The Carpe Diem

SEIZE THE SEMESTER

The Carpe Diem Cell Structure — Question Bank

KNUST — College of Health Sciences · HESA

Cell Structure · BIOL 151 · slides 1 to 562

1,120 questions · 6 modules · 96 sections · Easy / Medium / Hard / Devil

Format 1 · Answer after every question

Module 1 — What is a cell? → Putting the organelles together

slides 1 to 100 · 200 questions · 19 sections · bank: BIOL151_Question_Bank_Slides1-100.docx
Difficulty: 80 Easy · 81 Medium · 31 Hard · 8 Devil

What is a cell? · Q1–8

Q1 · Easy · *codex, slides 20 to 25*

What is an organism called if it consists of a single cell?

1. Multicellular, such as a human or an oak tree
2. Acellular, meaning it has no cells at all
3. Unicellular, such as an amoeba or a bacterium
4. Polycellular, meaning it has two or three cells

✓ **Answer: C** — An organism made of one cell is unicellular.

A: Multicellular organisms contain many cells organised into complex structures.
B: Acellular means without cells, which does not describe a single-celled organism.
C: An organism made of one cell is unicellular.
D: Polycellular is not the standard term; one-celled organisms are unicellular.

Q2 · Easy · *codex, slide 25*

Which description best defines a cell?

1. The smallest structure that always has a membrane-bound nucleus
2. The smallest unit able to perform life functions on its own
3. A group of different tissues cooperating to perform one task
4. A structure found only in organisms made of many cells

✓ **Answer: B** — A cell is the smallest unit able to perform life functions independently, which is why it is the basic unit of life.

A: Many cells, such as bacteria, have no membrane-bound nucleus, so this wording wrongly excludes prokaryotic cells.
B: A cell is the smallest unit able to perform life functions independently, which is why it is the basic unit of life.
C: That describes an organ, which is built from many cells and sits above the cell in organisation.
D: Unicellular organisms such as amoebae and bacteria are complete organisms made of a single cell.

Q3 · Easy · *codex, slide 21*

Which of these is among the abilities that define life in a cell?

1. Possessing a rigid cell wall of cellulose
2. Responding to stimuli in its surroundings
3. Containing a membrane-bound nucleus at all times
4. Measuring more than 200 micrometres across

✓ **Answer: B** — Responding to stimuli is one of the abilities, along with growth, reproduction, processing information and chemical reactions.

A: Animal cells show every property of life without a cellulose wall, so it is not a defining ability.
B: Responding to stimuli is one of the abilities, along with growth, reproduction, processing information and chemical reactions.
C: Bacteria are living cells with no membrane-bound nucleus, so this is not a defining ability.
D: Size is not a property of life; most living cells are far smaller than that.

Q4 · Medium · *codex, slides 20 to 25*

Which statement about multicellular organisms such as humans is correct?

1. They consist of one very large cell with many nuclei
2. They contain billions of cells in complex structures
3. They contain only a few hundred cells that work independently
4. They contain no cells that are able to reproduce

✓ **Answer: B** — Humans and other multicellular organisms are built from vast numbers of cells in complex structures.

A: Multicellular organisms are made of many separate cells, not one large cell.
B: Humans and other multicellular organisms are built from vast numbers of cells in complex structures.
C: The numbers run to billions or trillions, and cells cooperate in structures.
D: Cells can reproduce, which is one of the abilities that define life.

Q5 · Medium · *codex, slides 20 to 25*

Which of the following is NOT listed among the abilities that define life in cells?

1. Photosynthesising in sunlight
2. Growing and reproducing
3. Processing information
4. Carrying out chemical reactions

✓ **Answer: A** — Correct choice.

A: Correct choice. Photosynthesis occurs only in some cells and is not in the list of defining abilities.
B: Growth and reproduction are listed among the defining abilities of cells.
C: Processing information is listed among the abilities that define life.
D: An array of chemical reactions is listed among the defining abilities.

Q6 · Medium · *codex, slides 20 to 25*

A bacterium swims toward a nutrient-rich region. Which defining property of life does this show?

1. Reproducing by cell division
2. Responding to stimuli
3. Growing in overall size
4. Carrying out chemical reactions

✓ **Answer: B** — Moving toward nutrients is a response to a stimulus in the environment.

A: Swimming toward nutrients is a response, not reproduction.
B: Moving toward nutrients is a response to a stimulus in the environment.
C: Growth is an increase in size and does not describe directed movement.
D: Chemical reactions occur inside the cell and do not by themselves explain directed movement.

Q7 · Hard · *codex, slides 20 to 25*

A student argues that a mitochondrion is a cell because it contains DNA and makes ATP. Which part of the definition of a cell shows she is wrong?

1. A cell must perform life functions on its own, and a mitochondrion cannot outside its host
2. A cell must be larger than 200 micrometres, and mitochondria are much smaller than that
3. A cell must contain a nucleus, and mitochondria have none of their own
4. A cell must be multicellular, and a mitochondrion is a single unit

> ✓ **Answer: A** — A cell is the smallest unit able to perform life functions independently.

A: A cell is the smallest unit able to perform life functions independently.
B: Many cells, such as bacteria, are far smaller than 200 micrometres, so size is not the test.
C: Bacteria are cells without a nucleus, so having a nucleus is not the test.
D: Unicellular organisms are cells, so being multicellular is not required.

Q8 · Hard · *codex, slide 22*

Which observation best supports the idea that the cell is the fundamental unit of life?

1. Multicellular organisms contain trillions of cells arranged in complex structures
2. Even simple single-celled organisms show all the major properties of life
3. Cells can be seen under a light microscope using suitable preparation
4. All cells share exactly the same shape and size in every organism

> ✓ **Answer: B** — A single-celled organism shows every major property of life, so the cell is the fundamental unit.

A: This shows organisation in large organisms but does not show that one cell carries out all life functions.
B: A single-celled organism shows every major property of life, so the cell is the fundamental unit.
C: Visibility under a microscope says nothing about whether a cell is the basic unit of life.
D: Cells vary widely in size and shape, so this statement is false.

History of the cell · Q9–20

Q9 · Easy · *codex, slides 26 to 32*

In which year did Robert Hooke introduce the term cell?

1. 1595
2. 1674
3. 1665
4. 1855

> ✓ **Answer: C** — Hooke named the cell in 1665 after viewing cork.

A: Janssen is credited with the first compound microscope in 1595.
B: Leeuwenhoek described living cells in 1674.
C: Hooke named the cell in 1665 after viewing cork.
D: Virchow completed classical cell theory in 1855.

Q10 · Easy · *codex, slides 26 to 32*

Who was the first person to witness a live cell under a microscope?

1. Robert Hooke
2. Antony van Leeuwenhoek
3. Robert Brown
4. Rudolf Virchow

✓ **Answer: B** — Leeuwenhoek was the first to witness a live cell, in 1674.

A: Hooke saw only the dead cell walls of cork.
B: Leeuwenhoek was the first to witness a live cell, in 1674.
C: Brown described the nucleus in the 1830s, long after the first live cell was seen.
D: Virchow completed cell theory in 1855 and did not first see live cells.

Q11 · Easy · *codex, slide 26*

In 1665 Robert Hooke named the cell after comparing cork compartments to what?

1. The honey chambers of a beehive
2. Small rooms that monks lived in
3. Tiny beads strung along a thread
4. Seeds packed inside a fruit

✓ **Answer: B** — Hooke likened the cork compartments to the little rooms (cellulae) monks lived in, which gave us the word cell.

A: Beehive chambers are a familiar image, but Hooke's recorded comparison was to the rooms monks lived in.
B: Hooke likened the cork compartments to the little rooms (cellulae) monks lived in, which gave us the word cell.
C: Beads on a thread do not resemble the box-like compartments Hooke saw in cork.
D: Seeds inside a fruit are not what Hooke compared the cork compartments to.

Q12 · Easy · *codex, slide 26*

In which publication did Robert Hooke describe his cork observations?

1. Cellular Pathology, a book on cell origins
2. On the Origin of Species, a work on evolution
3. Micrographia, a book of microscope drawings
4. De Humani Corporis Fabrica, a text on anatomy

✓ **Answer: C** — Hooke published his cork observations and drawings in Micrographia.

A: Cellular Pathology is associated with Virchow, not Hooke's cork observations.
B: Darwin's book concerns evolution and has nothing to do with Hooke's microscope work.
C: Hooke published his cork observations and drawings in Micrographia.
D: Vesalius wrote this anatomy text long before Hooke, and it does not describe cork cells.

Q13 · Easy · *codex, slide 32*

Who is credited with building the first compound microscope in 1595?

1. Zacharias Janssen
2. Robert Hooke
3. Antonie van Leeuwenhoek
4. Ernst Ruska

✓ **Answer: A** — Janssen is credited with the first compound microscope in 1595.

A: Janssen is credited with the first compound microscope in 1595.
B: Hooke used a microscope to examine cork in 1665, long after the first compound microscope.
C: Leeuwenhoek observed living cells in 1674, well after the first compound microscope.
D: Ruska helped develop the electron microscope in 1931, not the 1595 compound microscope.

Q14 · Medium · *codex, slides 26 to 32*

What did Hooke actually see when he examined cork under his microscope?

1. The dead cell walls of plant cells
2. Living cells with visible nuclei
3. Bacteria swimming in a drop of water
4. Protozoa moving among algae

✓ **Answer: A** — Hooke saw the walls of dead plant cells, which looked like small rooms.

A: Hooke saw the walls of dead plant cells, which looked like small rooms.
B: The walls gave no indication of a nucleus or other organelles.
C: Bacteria were described later, by Leeuwenhoek.
D: Protozoa were observed by Leeuwenhoek in 1674, not by Hooke.

Q15 · Medium · *codex, slides 26 to 32*

Besides algae, what did Leeuwenhoek probably see through his microscope?

1. Mitochondria
2. Ribosomes
3. Chromosomes
4. Bacteria

✓ **Answer: D** — The lecture says Leeuwenhoek probably also saw bacteria.

A: Mitochondria are far too small for his simple microscope to show.
B: Ribosomes were described much later, with electron microscopy.
C: Chromosomes were not described from his observations.
D: The lecture says Leeuwenhoek probably also saw bacteria.

Q16 · Medium · *codex, slides 26 to 32*

Which person and year pairing is correct?

1. Janssen, 1665
2. Leeuwenhoek, 1595
3. Hooke, 1665
4. Brown, 1674

✓ **Answer: C** — Hooke introduced the term cell in 1665.

A: Janssen is credited with the first compound microscope in 1595.
B: Leeuwenhoek's observations date from 1674, not 1595.
C: Hooke introduced the term cell in 1665.
D: Brown described the nucleus between 1831 and 1833.

Q17 · Medium · *codex, slides 26 to 32*

How many years after Hooke named the cell (1665) did Leeuwenhoek describe the alga Spirogyra (1674)?

1. 19 years
2. 29 years
3. 90 years
4. 9 years

✓ **Answer: D** — 1674 minus 1665 is 9 years.

A: This slips by ten; the gap is 9 years.
B: This is a miscalculation; the gap is 9 years.
C: This is ten times too large.
D: 1674 minus 1665 is 9 years.

Q18 · Medium · *codex, slides 26 to 32*

Leeuwenhoek lived from 1632 to 1723. About how old was he when he described the alga Spirogyra in 1674?

1. 32 years old
2. 52 years old
3. 42 years old
4. 91 years old

✓ **Answer: C** — 1674 minus 1632 is 42.

A: This slips ten years; 1674 minus 1632 is 42.
B: This adds ten too many; the age is 42.
C: 1674 minus 1632 is 42.
D: This is the age at his death in 1723, not in 1674.

Q19 · Medium · *codex, slide 29*

Which organism did Leeuwenhoek describe in 1674 when he first saw living cells?

1. Thin slices of dead cork seen through a lens
2. The green alga Spirogyra under his lens
3. Orchid cells showing a clear central nucleus
4. Red cells drawn from a drop of human blood

✓ **Answer: B** — In 1674 Leeuwenhoek described the alga Spirogyra, the first living cells seen.

A: Cork slices were Hooke's subject in 1665, and the cells were dead.
B: In 1674 Leeuwenhoek described the alga Spirogyra, the first living cells seen.
C: Orchid cells and the nucleus belong to Robert Brown in the 1830s.
D: His 1674 description concerned the alga Spirogyra, not red blood cells.

Q20 · Hard · *codex, slide 32*

Which statement about early microscopists is supported by the lecture timeline?

1. Hooke described bacteria in 1665, before Leeuwenhoek's microscopes existed
2. Leeuwenhoek had described bacteria by 1683, after Hooke named cells in 1665
3. Janssen described bacteria in 1595 with the first compound microscope
4. Brown described bacteria in 1831 before he identified the nucleus

✓ **Answer: B** — Hooke named cells in 1665, and Leeuwenhoek had described bacteria by 1683.

A: Hooke observed cork and named cells in 1665; bacteria were described later by Leeuwenhoek.
B: Hooke named cells in 1665, and Leeuwenhoek had described bacteria by 1683.
C: Janssen is credited only with constructing the first compound microscope in 1595.
D: Brown described the nucleus in plant cells between 1831 and 1833, not bacteria.

Milestones in cell biology · Q21–34

Q21 · Easy · *codex, slides 33 to 35*

Who developed the polymerase chain reaction (PCR) in 1983?

1. Shinya Yamanaka
2. Ernst Ruska
3. Camillo Golgi
4. Kary Mullis

✓ **Answer: D** — Kary Mullis developed PCR in 1983.

A: Yamanaka generated iPSCs in 2006. The right answer is: Kary Mullis.
B: Ruska co-developed the first electron microscope in 1931.
C: Golgi identified the Golgi apparatus in 1898.
D: Kary Mullis developed PCR in 1983.

Q22 · Easy · *codex, slides 33 to 35*

Which genome-editing technology emerged in 2012?

1. Polymerase chain reaction
2. CRISPR-Cas9
3. Super-resolution microscopy
4. The electron microscope

✓ **Answer: B** — CRISPR-Cas9 emerged in 2012 as a powerful genome-editing technology.

A: PCR amplifies DNA and was developed in 1983.
B: CRISPR-Cas9 emerged in 2012 as a powerful genome-editing technology.
C: Super-resolution microscopy broke the diffraction limit in 2014.
D: The first electron microscope came in 1931.

Q23 · Easy · *codex, slides 33 to 35*

Who generated induced pluripotent stem cells (iPSCs) in 2006?

1. Kary Mullis
2. Shinya Yamanaka
3. Friedrich Miescher
4. Max Knoll

✓ **Answer: B** — Yamanaka generated iPSCs in 2006.

A: Mullis developed PCR in 1983. The right answer is: Shinya Yamanaka.
B: Yamanaka generated iPSCs in 2006.
C: Miescher isolated nuclein in 1869. The right answer is: Shinya Yamanaka.
D: Knoll co-developed the first electron microscope in 1931.

Q24 · Easy · *codex, slides 33 to 35*

What did Singer and Nicolson propose in 1972?

1. The chromosome theory of inheritance
2. The double helix structure of DNA
3. The existence of introns in genes
4. The fluid mosaic model of the cell membrane

✓ **Answer: D** — In 1972 they proposed the fluid mosaic model.

A: Sutton and Boveri proposed this in 1902 to 1903.
B: Watson and Crick described this in 1953.
C: Introns and RNA splicing were discovered in 1977.
D: In 1972 they proposed the fluid mosaic model.

Q25 · Easy · *codex, slides 33 to 35*

Which structure did Watson and Crick describe in 1953?

1. The double helix of DNA
2. The fluid mosaic membrane
3. The Golgi apparatus
4. The nucleus of orchid cells

✓ **Answer: A** — Watson and Crick described the double helix, with contributions from Franklin and Wilkins.

A: Watson and Crick described the double helix, with contributions from Franklin and Wilkins.
B: That model came from Singer and Nicolson in 1972.
C: Golgi identified his apparatus in 1898.
D: Brown described the nucleus in the 1830s.

Q26 · Medium · *codex, slide 32*

Which structure did Robert Brown describe in orchid cells between 1831 and 1833?

1. The Golgi apparatus
2. The ribosome
3. The cell nucleus
4. The cork cell wall

✓ **Answer: C** — Brown identified and described the nucleus in plant (orchid) cells.

A: Camillo Golgi identified this structure much later, in 1898.
B: Ribosomes were described with electron microscopy in the 1940s and 1950s.
C: Brown identified and described the nucleus in plant (orchid) cells.
D: Hooke observed cork walls back in 1665, long before Brown.

Q27 · Medium · *codex, slide 33*

In 1869 Friedrich Miescher isolated nuclein from cell nuclei. What molecule is this material?

1. Messenger RNA from active genes
2. Deoxyribonucleic acid (DNA)
3. Ribosomal protein from the cytoplasm
4. Glycogen stored in the nucleus

✓ **Answer: B** — Miescher's nuclein, isolated from nuclei in 1869, was DNA.

A: Messenger RNA was not what Miescher isolated; nuclein was identified as DNA.
B: Miescher's nuclein, isolated from nuclei in 1869, was DNA.
C: Nuclein came from nuclei, and ribosomes were described only in the 1940s and 1950s.
D: Glycogen is a carbohydrate energy store, not the nuclear material Miescher isolated.

Q28 · Medium · *codex, slide 33*

Which cell structure did Camillo Golgi identify in 1898?

1. The Golgi apparatus
2. The endoplasmic reticulum
3. The ribosomes
4. The chromosomes

✓ **Answer: A** — Golgi identified the structure that now bears his name in 1898.

A: Golgi identified the structure that now bears his name in 1898.
B: The ER was described later, with electron microscopy in the 1940s and 1950s.
C: Ribosomes were also described by electron microscopy in the 1940s and 1950s.
D: Sutton and Boveri linked chromosomes to inheritance in 1902 to 1903, not Golgi.

Q29 · Medium · *codex, slide 33*

What did Sutton and Boveri propose in 1902 and 1903?

1. That nuclein is made of a double helix of DNA strands
2. That membranes are a fluid mosaic of lipids and proteins
3. That cells arise only from pre-existing cells
4. That chromosomes carry inherited information

✓ **Answer: D** — Their chromosome theory of inheritance tied heredity to chromosomes.

A: The double helix was described by Watson and Crick in 1953.
B: The fluid mosaic model came from Singer and Nicolson in 1972.
C: Virchow stated this principle in 1855, decades earlier.
D: Their chromosome theory of inheritance tied heredity to chromosomes.

Q30 · Medium · *codex, slide 34*

Which scientists made key contributions alongside Watson and Crick to the 1953 double helix model?

1. Friedrich Miescher and Camillo Golgi
2. Kary Mullis and Shinya Yamanaka
3. Rosalind Franklin and Maurice Wilkins
4. Singer and Nicolson in membrane research

✓ **Answer: C** — Franklin and Wilkins made key contributions to the 1953 double helix model.

A: Miescher isolated nuclein in 1869 and Golgi identified his apparatus in 1898.
B: Mullis developed PCR in 1983 and Yamanaka generated iPSCs in 2006.
C: Franklin and Wilkins made key contributions to the 1953 double helix model.
D: Singer and Nicolson proposed the fluid mosaic model in 1972, not the double helix.

Q31 · Medium · *codex, slide 34*

Which gene structure discovery was made in 1977?

1. The deciphered genetic code
2. The double helix of DNA
3. Introns and RNA splicing
4. The polymerase chain reaction

✓ **Answer: C** — Introns and RNA splicing were discovered in 1977.

A: The genetic code was deciphered between 1961 and 1966.
B: The double helix was described in 1953.
C: Introns and RNA splicing were discovered in 1977.
D: Mullis developed PCR in 1983, a technique rather than a gene structure finding.

Q32 · Hard · *codex, slide 35*

A lab must amplify pathogen DNA from a patient sample, reprogramme adult cells into pluripotent cells, and edit a gene. Which technologies fit these tasks, in that order?

1. CRISPR-Cas9, PCR, induced pluripotent stem cells
2. Induced pluripotent stem cells, CRISPR-Cas9, PCR
3. PCR, induced pluripotent stem cells, CRISPR-Cas9
4. PCR, CRISPR-Cas9, induced pluripotent stem cells

✓ **Answer: C** — PCR amplifies DNA, iPSC technology reprogrammes cells, and CRISPR-Cas9 edits genes.

A: CRISPR-Cas9 does not amplify DNA samples, so the first match is wrong.
B: iPSC technology reprogrammes cells and cannot amplify pathogen DNA, so the first match is wrong.
C: PCR amplifies DNA, iPSC technology reprogrammes cells, and CRISPR-Cas9 edits genes.
D: PCR is right first, but CRISPR-Cas9 does not reprogramme adult cells into pluripotent cells.

Q33 · Hard · *codex, slides 32 to 35*

Which scientist and discovery pairing is INCORRECT?

1. Miescher: the double helix structure of DNA
2. Mullis: the polymerase chain reaction (PCR)
3. Sutton and Boveri: the chromosome theory of inheritance
4. Singer and Nicolson: the fluid mosaic model of the membrane

✓ **Answer: A** — Correct choice.

A: Correct choice. This pairing is wrong: Miescher isolated nuclein in 1869, while Watson and Crick described the double helix in 1953.
B: This pairing is accurate; Kary Mullis developed PCR in 1983, so it is not the incorrect one.
C: This pairing is accurate; Sutton and Boveri proposed the chromosome theory of inheritance in 1902 to 1903.
D: This pairing is accurate; Singer and Nicolson proposed the fluid mosaic model in 1972.

Q34 · Devil · *codex, slides 33, 35*

Which advance is correctly matched to what it made possible?

1. PCR (1983): revealing the double helix structure of DNA through amplification of samples
2. iPSC generation (2006): leading to the discovery of introns and RNA splicing in genes
3. Electron microscope (1931): showing ultrastructure, leading to descriptions of the ER and ribosomes
4. CRISPR-Cas9 (2012): enabling the first isolation of nuclein from nuclei of human cells

✓ **Answer: C** — The 1931 electron microscope revealed ultrastructure, and the ER and ribosomes were described by electron microscopy in the 1940s and 1950s.

A: PCR amplifies DNA; the double helix was described in 1953, before PCR existed.
B: iPSCs came from reprogramming cells in 2006; introns and splicing were discovered in 1977.
C: The 1931 electron microscope revealed ultrastructure, and the ER and ribosomes were described by electron microscopy in the 1940s and 1950s.
D: CRISPR-Cas9 is a genome-editing tool from 2012; nuclein was isolated in 1869, long before.

Cell theory · Q35–50

Q35 · Easy · *codex, slides 36 to 39*

According to the classical tenets, all living things are made up of what?

1. Organs
2. Tissues
3. Organelles
4. Cells

✓ **Answer: D** — The first tenet says all living things are made up of cells.

A: Organs are made of cells and are not the unit named in the tenet.
B: Tissues are made of cells and are not the unit named in the tenet.
C: Organelles are parts of cells and are not the unit named in the tenet.
D: The first tenet says all living things are made up of cells.

Q36 · Easy · *codex, slides 36 to 39*

Who completed the classical cell theory in 1855?

1. Theodor Schwann
2. Matthias Schleiden
3. Rudolf Virchow
4. Robert Brown

✓ **Answer: C** — Virchow concluded in 1855 that all cells come from pre-existing cells.

A: Schwann extended the idea to animals in 1839.
B: Schleiden proposed in 1838 that plants are made of cells.
C: Virchow concluded in 1855 that all cells come from pre-existing cells.
D: Brown described the nucleus in the 1830s.

Q37 · Easy · *codex, slides 36 to 39*

Who proposed in 1838 that all plants are composed of cells?

1. Theodor Schwann
2. Rudolf Virchow
3. Matthias Schleiden
4. Robert Hooke

✓ **Answer: C** — Schleiden proposed this in 1838.

A: Schwann extended the proposal to animals in 1839.
B: Virchow's contribution came in 1855. The right answer is: Matthias Schleiden.
C: Schleiden proposed this in 1838.
D: Hooke named the cell in 1665.

Q38 · Easy · *codex, slides 36 to 39*

Who extended the idea that organisms are made of cells to animals in 1839?

1. Matthias Schleiden
2. Rudolf Virchow
3. Antony van Leeuwenhoek
4. Theodor Schwann

✓ **Answer: D** — Schwann extended Schleiden's idea to animals in 1839.

A: Schleiden's work in 1838 concerned plants.
B: Virchow completed the theory in 1855.
C: Leeuwenhoek described live cells in 1674.
D: Schwann extended Schleiden's idea to animals in 1839.

Q39 · Easy · *codex, slides 36 to 39*

What name did Schleiden give to his proposed process of spontaneous crystallization?

1. Free cell formation
2. Binary fission
3. Cell differentiation
4. Cell fusion

✓ **Answer: A** — Schleiden called it free cell formation, and it differs from modern theory.

A: Schleiden called it free cell formation, and it differs from modern theory.
B: Binary fission is division of an existing cell, not spontaneous crystallization.
C: Differentiation is specialization of cells and is a different idea.
D: Cell fusion joins cells, which is not what Schleiden proposed.

Q40 · Easy · *codex, slides 36 to 39*

The classical tenets say cells are the smallest what of all living things?

1. Storage units
2. Working units
3. Genetic units
4. Chemical units

✓ **Answer: B** — Cells are the smallest working units of all living things.

A: The tenet speaks of working units, not storage units.
B: Cells are the smallest working units of all living things.
C: Genes and DNA are not named as the unit in this tenet.
D: The tenet names working units, not chemical units.

Q41 · Medium · *codex, slides 36 to 39*

Which scientist had already proposed that all cells come from pre-existing cells before Virchow?

1. Robert Remak
2. Matthias Schleiden
3. Theodor Schwann
4. Robert Brown

✓ **Answer: A** — Remak had proposed it, and it has been suggested Virchow plagiarized him.

A: Remak had proposed it, and it has been suggested Virchow plagiarized him.
B: Schleiden proposed free cell formation, which is the opposite idea.
C: Schwann extended the theory to animals but did not state this idea.
D: Brown described the nucleus, not cell origin.

Q42 · Medium · *codex, slides 36 to 39*

Which statement is part of the modern cell theory?

1. Energy flow (metabolism) occurs within cells
2. Cells arise by spontaneous crystallization
3. Only plants are composed of cells
4. Cells are not the smallest working units

✓ **Answer: A** — Modern theory places metabolism within cells.

A: Modern theory places metabolism within cells.
B: This is Schleiden's free cell formation, which was replaced.
C: Both plants and animals are composed of cells.
D: Cells are the smallest working units of living things.

Q43 · Medium · *codex, slides 36 to 39*

Modern cell theory says hereditary information is passed from cell to cell during which process?

1. Photosynthesis
2. Protein synthesis
3. Phagocytosis
4. Cell division

✓ **Answer: D** — DNA is passed from cell to cell during cell division.

A: Photosynthesis makes sugars and does not pass on hereditary information.
B: Protein synthesis uses genetic information but does not pass it between cells.
C: Phagocytosis is engulfment of material and does not pass on DNA.
D: DNA is passed from cell to cell during cell division.

Q44 · Medium · *codex, slides 36 to 39*

In 1839, Schwann and Schleiden suggested what about cells?

1. That all cells come from pre-existing cells
2. That cells contain hereditary DNA
3. That cells are the basic unit of life
4. That energy flow occurs outside cells

✓ **Answer: C** — They suggested that cells were the basic unit of life.

A: Virchow completed that idea in 1855.
B: DNA-based heredity belongs to the modern cell theory.
C: They suggested that cells were the basic unit of life.
D: Modern theory places metabolism within cells.

Q45 · Medium · *codex, slides 36 to 39*

How many classical tenets of cell theory are listed in the lecture?

1. Two
2. Four
3. Three
4. Five

✓ **Answer: C** — The lecture lists three classical tenets.

A: Two is too few; three tenets are listed.
B: Four is too many; three tenets are listed.
C: The lecture lists three classical tenets.
D: Five is too many; three tenets are listed.

Q46 · Medium · *codex, slides 32, 37*

A pathologist explains that a tumour enlarges because its cells keep dividing. Which principle, stated by Virchow in 1855, does this illustrate?

1. Cells form spontaneously by crystallising out of fluid
2. Every cell must contain a prominent nucleus
3. All plants are composed of cells
4. All cells arise from pre-existing cells

✓ **Answer: D** — Virchow's omnis cellula e cellula says new cells come from division of existing cells, as in tumour growth.

A: That is Schleiden's free cell formation, which Virchow's principle replaced.
B: Red blood cells lack nuclei, so this is not a rule of cell theory.
C: That was Schleiden's 1838 proposal, and it says nothing about where new cells come from.
D: Virchow's omnis cellula e cellula says new cells come from division of existing cells, as in tumour growth.

Q47 · Hard · *codex, slides 38, 39*

Modern cell theory adds statements to the classical version. Which of these are additions rather than classical tenets? 1. Metabolism takes place within cells. 2. Cells carry hereditary DNA that is passed on during division. 3. All living things are made of cells. 4. All cells come from pre-existing cells.

1. 1 and 2 only
2. 1, 2 and 3 only
3. 3 and 4 only
4. 2, 3 and 4 only

✓ **Answer: A** — Metabolism inside cells and DNA-based heredity are the modern additions; statements 3 and 4 are classical tenets.

A: Metabolism inside cells and DNA-based heredity are the modern additions; statements 3 and 4 are classical tenets.
B: Statement 3, that all living things are made of cells, is already a classical tenet, so it is not an addition.
C: Statements 3 and 4 are the classical tenets, so this choice picks the original statements and misses both additions.
D: Statements 3 and 4 are classical, and this option also leaves out statement 1, which is a modern addition.

Q48 · Hard · *codex, slides 36, 37*

Which point shows that the 1839 Schwann and Schleiden theory was still incomplete?

1. It lacked the idea that cells arise from existing cells, and Schleiden proposed spontaneous free cell formation
2. It rejected the idea of cells as the basic unit of life and treated whole tissues as the fundamental unit
3. It applied only to plants, because Schwann had not yet shown that animal tissues are also made of cells
4. It required every cell to contain a nucleus, a condition that red blood cells later showed to be false

✓ **Answer: A** — Cell origin from existing cells was missing, and Schleiden's free cell formation was later replaced by Virchow's principle.

A: Cell origin from existing cells was missing, and Schleiden's free cell formation was later replaced by Virchow's principle.
B: Schwann and Schleiden did accept that cells are the basic unit of life, so this is not the gap.
C: Schwann extended the theory to animals in 1839, so it was not limited to plants.
D: Neither scientist made nuclei a requirement; the real gap concerned where cells come from.

Q49 · Hard · *codex, slides 32, 36, 37*

Which statement correctly gives who proposed classical cell theory and when it was completed?

1. Schwann and Virchow proposed it by 1839, and Schleiden completed it in 1855
2. Hooke and Brown proposed it by 1665, and Virchow completed it in 1831
3. Schleiden and Schwann proposed it by 1839, and Virchow completed it in 1855
4. Schleiden and Schwann proposed it by 1855, and Virchow completed it in 1839

✓ **Answer: C** — Schleiden (1838) and Schwann (1839) established it, and Virchow completed it in 1855.

A: Virchow's contribution came in 1855, and Schleiden was part of the 1839 proposal.
B: Hooke named cells in 1665, but he and Brown did not propose cell theory.
C: Schleiden (1838) and Schwann (1839) established it, and Virchow completed it in 1855.
D: The dates are reversed; the theory began in 1839 and was completed in 1855.

Q50 · Devil · *codex, slide 39*

Which statement would a supporter of modern cell theory reject?

1. An organism's activity reflects the total activity of its cells
2. Metabolism occurs mainly in body fluid outside all cells
3. DNA carried in cells is passed on during cell division
4. Cells of similar species share basic chemical composition

✓ **Answer: B** — Correct choice.

A: This matches modern cell theory, which says an organism's activity depends on the total activity of its cells.
B: Correct choice. Modern cell theory places energy flow (metabolism) inside cells, so this statement contradicts it.
C: This matches modern cell theory: hereditary DNA is passed from cell to cell during division.
D: This matches modern cell theory, which says such cells are basically the same in chemical composition.

Diversity of cells · Q51–68

Q51 · Easy · *codex, slides 41 to 49*

Which blood cells are part of the immune system?

1. White blood cells
2. Red blood cells
3. Platelets
4. Osteocytes

✓ **Answer: A** — White blood cells are part of the immune system.

A: White blood cells are part of the immune system.
B: Red blood cells carry oxygen. The right answer is: White blood cells.
C: Platelets provide substances that enable blood to clot.
D: Osteocytes are bone cells, not blood cells.

Q52 · Easy · *codex, slides 41 to 49*

Gametes are haploid. What do they form when they fuse?

1. A stem cell line
2. A muscle fibre
3. A red blood cell
4. A zygote

✓ **Answer: D** — Gametes fuse to form a zygote.

A: Stem cells are undifferentiated cells and are not the result of gamete fusion.
B: A muscle fibre is a specialised cell made later in development.
C: Red blood cells lack nuclei and are not formed by fusion of gametes.
D: Gametes fuse to form a zygote.

Q53 · Easy · *codex, slides 41 to 49*

What are stem cells capable of?

1. Self-renewal and specialization
2. Only carrying oxygen in the blood
3. Only transmitting signals along axons
4. Only contracting to cause movement

✓ **Answer: A** — Stem cells are undifferentiated and can self-renew and specialise.

A: Stem cells are undifferentiated and can self-renew and specialise.
B: That describes red blood cells. The right answer is: Self-renewal and specialization.
C: That describes neurons. The right answer is: Self-renewal and specialization.
D: That describes muscle cells packed with contractile proteins.

Q54 · Easy · *codex, slides 41 to 49*

Roughly how many distinct cell types does the human body contain?

1. About 20
2. Over 200
3. About 50
4. Over 2,000

✓ **Answer: B** — The human body has over 200 distinct cell types.

A: This is far too few; there are over 200.
B: The human body has over 200 distinct cell types.
C: This is too few; there are over 200.
D: This is ten times too many.

Q55 · Easy · *codex, slide 44*

Which feature distinguishes a mature human red blood cell from most other human cells?

1. It contains two nuclei and divides quickly to repair tissue
2. It lacks a nucleus and is specialised to carry oxygen
3. It sits in lacunae and maintains the bone matrix
4. It is haploid and fuses with another cell to form a zygote

✓ **Answer: B** — Red blood cells have no nucleus, which suits their job of transporting oxygen.

A: Red blood cells have no nucleus at all, so having two is wrong.
B: Red blood cells have no nucleus, which suits their job of transporting oxygen.
C: That describes osteocytes, the bone cells, not red blood cells.
D: That describes gametes such as sperm and egg, not red blood cells.

Q56 · Easy · *codex, slide 43*

Which cell type extends axons and dendrites to transmit signals?

1. Osteocytes of bone tissue
2. Red blood cells of the circulation
3. Neurons of the nervous system
4. Gametes such as sperm and egg

✓ **Answer: C** — Neurons extend axons and dendrites to transmit signals.

A: Osteocytes sit in lacunae and maintain bone matrix, rather than transmitting signals.
B: Red blood cells carry oxygen and have no nucleus; they do not extend axons or dendrites.
C: Neurons extend axons and dendrites to transmit signals.
D: Gametes are haploid cells that fuse to form a zygote, not signal-transmitting cells.

Q57 · Easy · *codex, slide 44*

Which cell type is packed with contractile proteins?

1. Red blood cells that carry oxygen
2. Osteocytes that maintain bone matrix
3. Muscle cells that generate movement
4. Neurons that transmit electrical signals

✓ **Answer: C** — Muscle cells are packed with contractile proteins that generate movement.

A: Red blood cells lack nuclei and carry oxygen; contractile proteins define muscle cells.
B: Osteocytes reside in lacunae and maintain bone matrix, rather than contracting.
C: Muscle cells are packed with contractile proteins that generate movement.
D: Neurons transmit signals through axons and dendrites and are not defined by contractile proteins.

Q58 · Medium · *codex, slides 41 to 49*

Which statement about oxygen and cells is supported?

1. Oxygen is essential for every cell of every organism
2. Oxygen kills every cell that is exposed to it
3. Oxygen has no effect on any cell at all
4. Oxygen kills some cells but is essential for others

✓ **Answer: D** — Cells vary in their need for oxygen.

A: Some cells are killed by oxygen.
B: Many cells need oxygen. The right answer is: Oxygen kills some cells but is essential for others.
C: Oxygen kills some cells and is essential to others.
D: Cells vary in their need for oxygen.

Q59 · Medium · *codex, slides 41 to 49*

Which example shows a unicellular organism living in close association with another organism?

1. A lone amoeba living freely in a drop of pond water
2. Bacteria that help plants extract nitrogen from the air
3. A neuron forming connections in the cerebellum
4. A red blood cell carrying oxygen through the blood

✓ **Answer: B** — Such bacteria live in association with plants.

A: This is a unicellular organism living in isolation.
B: Such bacteria live in association with plants.
C: A neuron is a cell within a multicellular organism, not an associated unicellular organism.
D: A red blood cell is part of a multicellular body.

Q60 · Medium · *codex, slides 41 to 49*

About how large is the human egg cell?

1. About 2 micrometres
2. About 200 micrometres
3. About 20 micrometres
4. About 2 millimetres

✓ **Answer: B** — The human egg is about 200 micrometres.

A: This is the size of a small bacterium.
B: The human egg is about 200 micrometres.
C: This is too small; the egg is about 200 micrometres.
D: This is ten times too large.

Q61 · Medium · *codex, slides 41 to 49*

Where do osteocytes reside, and what do they do?

1. They float in the blood and carry oxygen
2. They sit in the cerebellum and form synapses
3. They line the muscles and contain contractile proteins
4. They reside in lacunae and maintain the bone matrix

✓ **Answer: D** — Osteocytes sit in lacunae and maintain bone matrix.

A: That describes red blood cells. The right answer is: They reside in lacunae and maintain the bone matrix.
B: That describes neurons such as Purkinje cells.
C: That describes muscle cells. The right answer is: They reside in lacunae and maintain the bone matrix.
D: Osteocytes sit in lacunae and maintain bone matrix.

Q62 · Medium · *codex, slides 41 to 49*

Which statements about unicellular organisms are correct? 1. Some live in isolation. 2. Others form colonies. 3. All of them lack DNA. 4. None of them respond to stimuli.

1. 1 and 2 only
2. 1, 2 and 3 only
3. 2 and 4 only
4. 3 and 4 only

✓ **Answer: A** — Some unicellular organisms live in isolation, and others form colonies or live in association.

A: Some unicellular organisms live in isolation, and others form colonies or live in association.
B: Statement 3 is false; unicellular organisms contain DNA.
C: Statement 4 is false; they respond to stimuli, and this option omits statement 1.
D: Statements 3 and 4 are both false.

Q63 · Medium · *codex, slides 41 to 49*

Which statement about the human egg and sperm cells is correct?

1. Both are multicellular structures that divide before fusing
2. Both are single cells, and their union starts the development of the body
3. Only the egg is a cell, and sperm is a non-living particle
4. Both are diploid cells that contain 92 chromosomes each

✓ **Answer: B** — The egg and sperm are single cells whose union begins development.

A: Each is a single cell. The right answer is: Both are single cells, and their union starts the development of the body.
B: The egg and sperm are single cells whose union begins development.
C: Sperm cells are single cells too.
D: Gametes are haploid. The right answer is: Both are single cells, and their union starts the development of the body.

Q64 · Medium · *codex, slide 48*

Which blood element provides substances that let blood clot at a wound?

1. The platelets circulating in blood
2. The red cells circulating in blood
3. The white cells circulating in blood
4. The osteocytes embedded in bone

> ✓ **Answer: A** — Platelets provide the substances that allow blood to clot at a wound.

A: Platelets provide the substances that allow blood to clot at a wound.
B: Red blood cells carry oxygen rather than driving clotting.
C: White blood cells are part of the immune system, not the clotting response.
D: Osteocytes maintain bone matrix and are not found circulating in blood.

Q65 · Hard · *codex, slide 47*

A microbiologist finds a microbe in cattle rumen that converts carbon dioxide and water into methane, around 150 litres of gas a day per animal. Which group does it belong to?

1. Archaebacteria such as Methanosarcina
2. Filamentous algae such as Spirogyra
3. Rotifers that move rapidly in water
4. Bacteria that help plants obtain nitrogen

> ✓ **Answer: A** — Methanosarcina is an archaebacterium that makes methane from CO_2 and water, and some live in cattle rumen.

A: Methanosarcina is an archaebacterium that makes methane from CO_2 and water, and some live in cattle rumen.
B: Spirogyra is an alga that Leeuwenhoek observed; it does not produce methane in the rumen.
C: Rotifers are cited as fast-moving organisms, not as methane producers.
D: Nitrogen-helping bacteria assist plants and do not generate methane in cattle.

Q66 · Hard · *codex, slides 42, 49*

A Purkinje neuron in the cerebellum can form over 100,000 connections through its dendrites. Which idea about cells does this best illustrate?

1. All human cell types share one identical structure
2. Cells with more connections must contain several nuclei
3. Nerve cells are not true cells but extensions of tissue
4. Cell shape and structure are specialised for function

> ✓ **Answer: D** — A cell's shape and structure reflect its specialised role, as a neuron's extensive dendrites show.

A: Human cells vary widely in size, shape and structure, so they are not identical.
B: Connections come from dendrite branching, not extra nuclei; a neuron has one nucleus.
C: Neurons are true cells, specialised to transmit signals with axons and dendrites.
D: A cell's shape and structure reflect its specialised role, as a neuron's extensive dendrites show.

Q67 · Hard · *codex, slide 41*

A lecture lists amoebae and rotifers as organisms that move rapidly, while others stay largely stationary. Which idea about living things does this illustrate?

1. Movement is what separates living cells from non-living material
2. Rapid movement is required before an organism counts as single-celled
3. Cells that stay in place cannot reproduce or respond to stimuli
4. Cells and organisms show great diversity, including differences in movement

✓ **Answer: D** — The examples illustrate the variety of living things, including differences in movement.

A: Plants stay largely stationary yet are alive, so movement cannot be the dividing line.
B: Single-celled organisms need not move rapidly, so this is not a requirement.
C: Stationary cells can still reproduce and respond to stimuli, so this is false.
D: The examples illustrate the variety of living things, including differences in movement.

Q68 · Devil · *codex, slide 43*

Which statement correctly distinguishes human gametes from stem cells?

1. Gametes can self-renew and specialise, while stem cells are haploid and fuse to form a zygote
2. Both cell types are haploid, but only stem cells can fuse with another cell to form a zygote
3. Gametes are haploid and fuse to form a zygote, while stem cells can self-renew and specialise
4. Both self-renew without limit, but only gametes can specialise into different kinds of tissue

✓ **Answer: C** — Gametes are haploid and fuse into a zygote; stem cells are undifferentiated and can renew themselves and specialise.

A: This swaps the two cell types; gametes do not self-renew, and stem cells are not gametes.
B: Stem cells are not described as haploid and do not fuse to form a zygote; gametes do.
C: Gametes are haploid and fuse into a zygote; stem cells are undifferentiated and can renew themselves and specialise.
D: Gametes do not specialise into tissues; stem cells self-renew and specialise, so this reverses the facts.

The nucleus: envelope and pores · Q69–82

Q69 · Easy · *codex, slides 54 to 62*

What is the gap between the two membranes of the nuclear envelope called?

1. The perinuclear space
2. The nucleoplasm
3. The cytosol
4. The annulus

✓ **Answer: A** — The two membranes are separated by the perinuclear space.

A: The two membranes are separated by the perinuclear space.
B: The nucleoplasm is the material inside the nucleus.
C: The cytosol lies outside the nucleus.
D: The annulus is the ring of protein granules around a pore.

Q70 · Easy · *codex, slides 54 to 62*

How many protein granules surround each nuclear pore?

1. Four
2. Six
3. Twelve
4. Eight

✓ **Answer: D** — Eight protein granules are arranged symmetrically around each pore.

A: Four is too few; the annulus has eight granules.
B: Six is too few; the annulus has eight granules.
C: Twelve is too many; the annulus has eight granules.
D: Eight protein granules are arranged symmetrically around each pore.

Q71 · Easy · *codex, slides 54 to 62*

Where are nuclear pores found?

1. Where the outer and inner membranes fuse
2. Only on the surface of the nucleolus
3. On the inner membrane alone
4. Where the envelope meets the Golgi

✓ **Answer: A** — Pores sit at regions where the two membranes fuse.

A: Pores sit at regions where the two membranes fuse.
B: The nucleolus has no membrane and no pores.
C: Pores form where both membranes fuse, not on one membrane alone.
D: The outer membrane is continuous with rough ER, not with the Golgi.

Q72 · Easy · *codex, slides 54 to 62*

The nuclear pores are described as being filled with what?

1. Lipid
2. Water
3. DNA
4. Glycogen

✓ **Answer: B** — The nuclear pores are water-filled.

A: Lipid forms membranes, not the contents of the pores.
B: The nuclear pores are water-filled.
C: DNA is held within the nucleus, not in the pores.
D: Glycogen is a carbohydrate store and does not fill the pores.

Q73 · Easy · *codex, slide 59*

Which organelle is described as the control centre of the cell and holds its DNA?

1. The ribosome, built from rRNA and protein
2. The lysosome, filled with hydrolytic enzymes
3. The Golgi apparatus, a stack of flattened sacs
4. The nucleus, enclosed by a double membrane

✓ **Answer: D** — The nucleus is the control centre of the cell and contains its DNA.

A: Ribosomes make proteins; they are not the control centre that holds the DNA.
B: Lysosomes carry out intracellular digestion and do not hold the DNA.
C: The Golgi apparatus modifies and packages materials for transport, not for storing DNA.
D: The nucleus is the control centre of the cell and contains its DNA.

Q74 · Easy · *codex, slides 54, 61*

How many membranes surround the nucleus?

1. One membrane, forming a single boundary layer
2. Two membranes, together forming the nuclear envelope
3. None, because the nucleus is only a free region
4. Three, with an extra membrane around the nucleolus

✓ **Answer: B** — The nuclear envelope is a double membrane separated by the perinuclear space.

A: The nucleus has a double membrane, so one layer is not enough.
B: The nuclear envelope is a double membrane separated by the perinuclear space.
C: The nucleus is a membrane-bound organelle with a double-membrane envelope.
D: The nucleolus has no membrane, so there is no third layer.

Q75 · Medium · *codex, slides 54 to 62*

What kind of symmetry does the annulus around a nuclear pore show?

1. Fourfold (square) symmetry
2. Sixfold (hexagonal) symmetry
3. Eightfold (octagonal) symmetry
4. No symmetry at all

✓ **Answer: C** — Eight protein subunits give octagonal symmetry.

A: The annulus has eight subunits, not four.
B: The annulus has eight subunits, not six.
C: Eight protein subunits give octagonal symmetry.
D: The annulus is highly organised and symmetrical.

Q76 · Medium · *codex, slides 54 to 62*

The proteins that assemble the nuclear pore complex are mainly called what?

1. Nucleoporins
2. Histones
3. Tubulins
4. Lamins

> ✓ **Answer: A** — Nucleoporins assemble into the nuclear pore complex.

A: Nucleoporins assemble into the nuclear pore complex.
B: Histones are chromatin proteins that associate with DNA.
C: Tubulins form microtubules in the cytoskeleton.
D: Lamins form the nuclear lamina and are not the main pore proteins.

Q77 · Medium · *codex, slides 54 to 62*

Which statement about the nuclear pore complex is correct?

1. It synthesises ribosomal RNA for the nucleolus
2. It condenses chromosomes before cell division
3. It regulates transport of RNA and proteins
4. It stores calcium ions for the cell

> ✓ **Answer: C** — The complex regulates transport between nucleus and cytoplasm.

A: rRNA is made in the nucleolus, not by the pore complex.
B: Chromosome condensation involves the DNA and its proteins, not the pore complex.
C: The complex regulates transport between nucleus and cytoplasm.
D: Calcium storage is a function of the smooth ER.

Q78 · Medium · *codex, slides 54 to 62*

All of the following are true of the nuclear envelope EXCEPT which one?

1. It is a double membrane with a gap between
2. It is perforated by water-filled nuclear pores
3. Its outer membrane is continuous with the rough ER
4. Its inner membrane is continuous with the rough ER

> ✓ **Answer: D** — Correct choice.

A: This is true; it has two membranes.
B: This is true; pores perforate the envelope.
C: This is true; the outer membrane joins the rough ER.
D: Correct choice. The outer membrane, not the inner one, is continuous with the rough ER.

Q79 · Medium · *codex, slides 54, 85*

Which feature links the nuclear envelope to the endomembrane system?

1. Its inner membrane is continuous with the Golgi apparatus
2. Its outer membrane is continuous with the rough ER
3. Its pores fuse directly with the lysosome membrane
4. Its perinuclear space is shared with the plasma membrane

✓ **Answer: B** — The outer nuclear membrane is continuous with the rough ER.

A: The Golgi apparatus is not continuous with the nuclear envelope; the outer membrane joins the rough ER.
B: The outer nuclear membrane is continuous with the rough ER.
C: Nuclear pores regulate nucleus and cytoplasm traffic and do not fuse with lysosomes.
D: The perinuclear space lies between the two nuclear membranes only.

Q80 · Hard · *codex, slides 61, 62*

Which description of the nuclear pore complex is accurate?

1. Six histone subunits in hexagonal symmetry regulate transport of RNA and proteins into the nucleus
2. Eight protein subunits in octagonal symmetry, mainly nucleoporins, regulate transport of RNA and proteins
3. Eight protein subunits in octagonal symmetry form a fixed open hole that lets all molecules pass
4. Four nucleoporin subunits in square symmetry, found only on the inner membrane, move DNA out

✓ **Answer: B** — The annulus has eightfold symmetry and is built mainly of nucleoporins that regulate transport.

A: The annulus has eight subunits made mainly of nucleoporins, not six histone subunits.
B: The annulus has eightfold symmetry and is built mainly of nucleoporins that regulate transport.
C: The pore complex regulates transport and does not let all molecules pass.
D: Pores lie where the membranes fuse, have eight subunits and do not move DNA out.

Q81 · Hard · *codex, slide 61*

On an electron micrograph the two nuclear membranes are separated by a gap but meet at certain points. What are the gap and the meeting points?

1. The perinuclear space, and sites where pores form
2. The nucleoplasm, and sites where nucleoli attach
3. The perinuclear space, and sites where ribosomes dock
4. The annulus, and sites where histones bind

✓ **Answer: A** — The gap is the perinuclear space, and pores form where the membranes fuse.

A: The gap is the perinuclear space, and pores form where the membranes fuse.
B: The nucleoplasm is inside the nucleus, and nucleoli lie within it, not on the envelope.
C: The gap is correct, but pores, not ribosome docking sites, form where the membranes meet.
D: The annulus surrounds pores and is not the gap; histones bind DNA inside the nucleus.

Q82 · Devil · *codex, slides 54, 58*

Which statement correctly contrasts the nucleus with the nucleolus?

1. The nucleus has a double membrane envelope, whereas the nucleolus has no membrane and assembles ribosomal subunits
2. The nucleolus has a double membrane envelope, whereas the nucleus has none and assembles ribosomal subunits
3. Both have a double membrane envelope, but only the nucleolus is involved in assembling ribosomal subunits
4. Both lack a surrounding membrane, but only the nucleus contains DNA and is perforated by nuclear pores

✓ **Answer: A** — The nucleus has a double membrane envelope, while the nucleolus lacks a membrane and assembles ribosomal subunits.

A: The nucleus has a double membrane envelope, while the nucleolus lacks a membrane and assembles ribosomal subunits.
B: This swaps the two structures; the nucleus is the one with the envelope.
C: The nucleolus has no membrane, so it does not have a double membrane envelope.
D: The nucleus has a double membrane envelope, so it does not lack a surrounding membrane.

Nuclear transport and contents · Q83–90

Q83 · Easy · *codex, slides 62 to 71*

Where are nuclear proteins produced?

1. Inside the nucleolus
2. In the perinuclear space
3. In the nuclear pores
4. In the cytosol

✓ **Answer: D** — Nuclear proteins, like all proteins, are produced in the cytosol.

A: The nucleolus makes ribosomal subunits, not nuclear proteins.
B: The perinuclear space is a gap between membranes, not a synthesis site.
C: The pores are channels and do not make proteins.
D: Nuclear proteins, like all proteins, are produced in the cytosol.

Q84 · Easy · *codex, slides 62 to 71*

What do the nuclear pores regulate?

1. The folding of chromatin into nucleosomes inside the nucleus
2. The assembly of ribosomal subunits in the nucleolus
3. The passage of molecules between the nucleus and cytoplasm
4. The doubling of DNA before the cell divides

✓ **Answer: C** — The pores permit some molecules to pass and block others.

A: Nucleosome formation involves DNA and histones.
B: Subunit assembly happens in the nucleolus.
C: The pores permit some molecules to pass and block others.
D: DNA copying is not a pore function.

Q85 · Easy · *codex, slides 62 to 71*

Glycoproteins at the nuclear pore appear to regulate what?

1. The transcription of rRNA in the nucleolus
2. The doubling of DNA before cell division
3. The entry of material into the nucleus
4. The size of the nucleolus in the nucleus

✓ **Answer: C** — Glycoproteins appear to regulate entry into the nucleus.

A: Transcription of rRNA occurs in the nucleolus.
B: DNA doubling is not controlled by pore glycoproteins.
C: Glycoproteins appear to regulate entry into the nucleus.
D: Pore glycoproteins are not linked to nucleolus size.

Q86 · Medium · *codex, slides 62 to 71*

Some molecules much bigger than nuclear pores pass freely, while some far smaller are blocked. What does this show about nuclear entry?

1. It depends only on the size of the molecule
2. It is selective and does not depend on size alone
3. It is completely random
4. It depends only on whether a molecule is charged

✓ **Answer: B** — Entry is regulated and selective, not purely a size filter.

A: The observations contradict a size-only rule.
B: Entry is regulated and selective, not purely a size filter.
C: Entry is regulated, not random. The right answer is: It is selective and does not depend on size alone.
D: The lecture does not state that charge alone decides entry.

Q87 · Medium · *codex, slides 62 to 71*

Which materials are allowed into the nucleus to build DNA and RNA?

1. Fully assembled lysosomes from the cytoplasm
2. Building blocks and molecules that provide energy
3. Complete finished chromosomes from the cytoplasm
4. Intact mitochondria from the cytoplasm

✓ **Answer: B** — Building blocks for DNA and RNA and energy molecules are allowed in.

A: Lysosomes are far too large and are not imported.
B: Building blocks for DNA and RNA and energy molecules are allowed in.
C: Chromosomes are made inside the nucleus.
D: Mitochondria are far too large to pass through pores.

Q88 · Medium · *codex, slides 62 to 71*

Chromatin material embedded in the nucleoplasm is the precursor of what?

1. Ribosomes
2. Lysosomes
3. Chromosomes
4. Nuclear pores

✓ **Answer: C** — Chromatin is the precursor of chromosomes.

A: Ribosomes are assembled from rRNA and proteins in the nucleolus.
B: Lysosomes are produced by the Golgi apparatus.
C: Chromatin is the precursor of chromosomes.
D: Pores are built from nucleoporins at membrane fusion sites.

Q89 · Medium · *codex, slides 62 to 71*

Which two structures are contained within the nucleus?

1. The nucleolus and the nucleoplasm
2. The Golgi cisternae and the nucleolus
3. The cristae and the nucleoplasm
4. The thylakoids and the nucleolus

✓ **Answer: A** — The nucleus contains the nucleolus and the nucleoplasm.

A: The nucleus contains the nucleolus and the nucleoplasm.
B: Golgi cisternae are outside the nucleus.
C: Cristae are folds inside mitochondria. The right answer is: The nucleolus and the nucleoplasm.
D: Thylakoids are found in chloroplasts. The right answer is: The nucleolus and the nucleoplasm.

Q90 · Hard · *codex, slide 66*

Nuclear proteins are made on ribosomes in the cytosol. Which feature lets them accumulate selectively in the nucleus?

1. Their synthesis on ribosomes located inside the nucleolus
2. Their small size, which lets only nuclear proteins slip through pores
3. Packaging into lysosomes that deliver them across the envelope
4. Amino acid sequences that act as signals directing them to the nucleus

✓ **Answer: D** — Signal sequences of amino acids concentrate these proteins in the nucleus.

A: Nuclear proteins are made in the cytosol, so this location is wrong.
B: Size alone does not decide entry; signals do, and some small molecules are excluded.
C: Lysosomes digest materials and do not deliver proteins into the nucleus.
D: Signal sequences of amino acids concentrate these proteins in the nucleus.

Chromatin and chromosomes · Q91–102

Q91 · Easy · *codex, slides 64 to 69*

What is the complex of DNA and protein in chromosomes called?

1. Chromatin
2. Cytosol
3. Nucleoid
4. Cytoskeleton

✓ **Answer: A** — The nucleoprotein complex of DNA and protein is chromatin.

A: The nucleoprotein complex of DNA and protein is chromatin.
B: The cytosol is the fluid of the cytoplasm.
C: The nucleoid is the DNA region of a prokaryotic cell.
D: The cytoskeleton is a network of protein filaments.

Q92 · Easy · *codex, slides 64 to 69*

Chromatin is made up of repeating structural units called what?

1. Nucleosomes
2. Nucleoporins
3. Cisternae
4. Cristae

✓ **Answer: A** — Chromatin is made up of repeating nucleosomes.

A: Chromatin is made up of repeating nucleosomes.
B: Nucleoporins are proteins of the nuclear pore complex.
C: Cisternae are the flattened sacs of the Golgi apparatus.
D: Cristae are folds of the inner mitochondrial membrane.

Q93 · Easy · *codex, slides 64 to 69*

On which structures are genes found?

1. Ribosomes
2. Nucleoli
3. Lysosomes
4. Chromosomes

✓ **Answer: D** — Genes are found on chromosomes.

A: Ribosomes make proteins and do not carry the genes.
B: Nucleoli make ribosomal subunits. The right answer is: Chromosomes.
C: Lysosomes digest materials. The right answer is: Chromosomes.
D: Genes are found on chromosomes.

Q94 · Easy · *codex, slides 64 to 69*

What does each gene direct the synthesis of?

1. A specific lipid
2. A specific ribosome
3. A specific organelle
4. A specific protein

✓ **Answer: D** — Each gene directs the synthesis of a specific protein.

A: Lipids are not directly encoded by single genes.
B: Ribosomes are assembled from many components.
C: An organelle is built from many molecules.
D: Each gene directs the synthesis of a specific protein.

Q95 · Easy · *codex, slide 64*

How many DNA chromosomes does a human cell contain?

1. 23 chromosomes
2. 48 chromosomes
3. 46 chromosomes
4. 92 chromosomes

✓ **Answer: C** — A human cell contains 46 chromosomes.

A: This is the number in a haploid gamete, not in a typical human cell.
B: This figure is wrong for humans, who have 46.
C: A human cell contains 46 chromosomes.
D: This is double the human number and would be seen only after DNA doubling.

Q96 · Medium · *codex, slides 64 to 69*

What form do the chromosomes take in dividing cells?

1. Loosely dispersed chromatin
2. Free RNA strands
3. Tightly packed DNA
4. Membrane-bound vesicles

✓ **Answer: C** — Chromosomes in dividing cells are tightly packed DNA.

A: Loose chromatin is typical of non-dividing cells.
B: Chromosomes contain DNA. The right answer is: Tightly packed DNA.
C: Chromosomes in dividing cells are tightly packed DNA.
D: Chromosomes are not enclosed in vesicles.

Q97 · Medium · *codex, slides 64 to 69*

A nucleoprotein is best described as what?

1. A protein made entirely of histones
2. A complex of nucleic acid and protein
3. A lipid bound to DNA in the nucleus
4. A carbohydrate bound to RNA in the cytosol

✓ **Answer: B** — Chromatin is a nucleoprotein, a complex of DNA and protein.

A: Histones form only part of chromatin and need DNA.
B: Chromatin is a nucleoprotein, a complex of DNA and protein.
C: A nucleoprotein is DNA with protein, not lipid.
D: A nucleoprotein contains protein. The right answer is: A complex of nucleic acid and protein.

Q98 · Medium · *codex, slides 64 to 69*

By mass, which component makes up about two-thirds of a eukaryotic chromosome?

1. Protein
2. DNA
3. RNA
4. Lipid

✓ **Answer: A** — Chromosomes are about one-third DNA and two-thirds protein.

A: Chromosomes are about one-third DNA and two-thirds protein.
B: DNA makes up only about one-third.
C: RNA is not the main component of chromosomes.
D: Lipid is not a major component of chromosomes.

Q99 · Medium · *codex, slides 64 to 69*

All of the following describe chromatin EXCEPT which one?

1. It is a complex of DNA and protein
2. It makes up chromosomes
3. It is built from repeating nucleosomes
4. It is enclosed by its own double membrane

✓ **Answer: D** — Correct choice.

A: This is true; chromatin is a nucleoprotein.
B: This is true; chromatin forms chromosomes.
C: This is true; nucleosomes are its repeating units.
D: Correct choice. Chromatin is not enclosed by its own membrane; the nucleus is.

Q100 · Medium · *codex, slide 69*

By mass, how is a eukaryotic chromosome divided between DNA and protein?

1. About one-third DNA and two-thirds protein
2. About two-thirds DNA and one-third protein
3. About equal parts DNA and protein by mass
4. Almost entirely DNA, with only traces of protein

✓ **Answer: A** — Eukaryotic chromosomes are about one-third DNA and two-thirds protein.

A: Eukaryotic chromosomes are about one-third DNA and two-thirds protein.
B: This reverses the ratio; protein is the larger share.
C: Protein makes up about twice as much as DNA, not an equal share.
D: Chromosomes are a nucleoprotein, with protein making up most of the mass.

Q101 · Medium · *codex, slide 69*

Histones, the main proteins of chromatin, are best described as what?

1. Small, basic proteins that associate with DNA
2. Large, acidic enzymes that copy DNA
3. Lipid molecules that form the nuclear envelope
4. RNA molecules that assemble ribosomal subunits

✓ **Answer: A** — Histones are small, basic proteins that form chromatin with DNA.

A: Histones are small, basic proteins that form chromatin with DNA.
B: Histones are small and basic, and they are structural proteins rather than copying enzymes.
C: Histones are proteins, not lipids, and are part of chromatin.
D: Histones are proteins; rRNA is what helps form ribosomal subunits.

Q102 · Hard · *codex, slide 64*

A human cell is about to divide. Which sequence of events for its chromosomal DNA is correct?

1. The chromosomes condense first, then the DNA doubles itself in packed form
2. The DNA doubles itself, then the chromosomes condense into tightly packed forms
3. The DNA doubles itself, then it leaves the nucleus through the pores
4. The DNA is degraded, then rebuilt from histone proteins alone

✓ **Answer: B** — DNA doubles itself before it condenses into tightly packed chromosomes.

A: The slide gives the reverse order: the DNA doubles before it condenses.
B: DNA doubles itself before it condenses into tightly packed chromosomes.
C: Dividing cells carry packed chromosomes; DNA does not exit through the pores.
D: DNA is copied, not degraded, and histones alone cannot rebuild it.

Ribosomes and protein synthesis · Q103–118

Q103 · Easy · *codex, slides 72 to 79*

What is the function of ribosomes?

1. Lipid synthesis
2. ATP production
3. Photosynthesis
4. Protein synthesis

> ✓ **Answer: D** — Ribosomes make proteins.

A: Lipid synthesis is a function of the smooth ER.
B: ATP production happens mainly in mitochondria.
C: Photosynthesis occurs in chloroplasts. The right answer is: Protein synthesis.
D: Ribosomes make proteins. It matches what the lecture slides state.

Q104 · Easy · *codex, slides 72 to 79*

Where do free ribosomes float?

1. Inside the nucleolus
2. In the cytosol
3. In the perinuclear space
4. Inside the thylakoids

> ✓ **Answer: B** — Free ribosomes float in the cytosol.

A: The nucleolus assembles subunits; free ribosomes float in the cytosol.
B: Free ribosomes float in the cytosol.
C: The perinuclear space is between the two nuclear membranes.
D: Thylakoids belong to chloroplasts. The right answer is: In the cytosol.

Q105 · Easy · *codex, slides 72 to 79*

What carries the instructions for making a protein from DNA?

1. A ribosomal protein
2. Messenger RNA
3. A phospholipid
4. Glycogen

> ✓ **Answer: B** — DNA is transcribed onto a messenger RNA molecule.

A: Ribosomal proteins are components of ribosomes.
B: DNA is transcribed onto a messenger RNA molecule.
C: Phospholipids form membranes. The right answer is: Messenger RNA.
D: Glycogen is a carbohydrate store. The right answer is: Messenger RNA.

Q106 · Easy · *codex, slides 72 to 79*

What are the two subunits of a ribosome called?

1. The cis subunit and the trans subunit
2. The inner subunit and the outer subunit
3. The large subunit and the small subunit
4. The alpha subunit and the beta subunit

✓ **Answer: C** — A ribosome has a large and a small subunit.

A: Cis and trans are faces of the Golgi apparatus.
B: Inner and outer describe mitochondrial membranes.
C: A ribosome has a large and a small subunit.
D: Alpha and beta describe tubulins, which are not ribosome subunits.

Q107 · Easy · *codex, slides 72 to 79*

What does the nucleolus make?

1. Ribosomal subunits
2. Lysosomal enzymes
3. Chlorophyll for the chloroplast
4. Cell wall cellulose

✓ **Answer: A** — The nucleolus makes ribosomal subunits from rRNA and proteins.

A: The nucleolus makes ribosomal subunits from rRNA and proteins.
B: Lysosomes are produced by the Golgi apparatus.
C: Chlorophyll is a pigment found in chloroplasts.
D: Cellulose forms the plant cell wall and is not made by the nucleolus.

Q108 · Easy · *codex, slide 79*

Ribosomes are composed of which two components?

1. DNA and histone protein
2. Ribosomal RNA and protein
3. Phospholipid and cholesterol
4. Messenger RNA and glycogen

✓ **Answer: B** — Ribosomes are built from rRNA and protein, arranged as a large and a small subunit.

A: That describes chromatin, the material of chromosomes, not ribosomes.
B: Ribosomes are built from rRNA and protein, arranged as a large and a small subunit.
C: These make up membranes, whereas ribosomes have no membrane.
D: Messenger RNA is a template read by ribosomes, and glycogen is not a ribosome component.

Q109 · Medium · *codex, slides 72 to 79*

Which proteins do free ribosomes produce?

1. Proteins exported from the cell
2. Only membrane lipids
3. Proteins used within the cell
4. Only DNA polymerase

> ✓ **Answer: C** — Free ribosomes make proteins used within the cell.

A: Bound ribosomes make proteins for export.
B: Ribosomes make proteins, not lipids. The right answer is: Proteins used within the cell.
C: Free ribosomes make proteins used within the cell.
D: Free ribosomes make many proteins, not a single enzyme.

Q110 · Medium · *codex, slides 72 to 79*

Which proteins are made by ribosomes attached to the ER?

1. Proteins used only in the cytosol
2. Ribosomal RNA for new subunits
3. Proteins for export from the cell
4. Chlorophyll for the chloroplast

> ✓ **Answer: C** — Bound ribosomes attached to the ER make proteins for export.

A: Free ribosomes make proteins used within the cell.
B: rRNA is made in the nucleolus, not by ribosomes.
C: Bound ribosomes attached to the ER make proteins for export.
D: Chlorophyll is a pigment, not a protein made by ribosomes.

Q111 · Medium · *codex, slides 72 to 79*

What happens during translation?

1. DNA is copied onto messenger RNA in the nucleus
2. Ribosomal subunits are assembled in the nucleolus
3. The message is translated into a sequence of amino acids
4. Chromosomes condense before the cell divides

> ✓ **Answer: C** — Translation builds a protein from the mRNA message.

A: That is transcription. The right answer is: The message is translated into a sequence of amino acids.
B: Assembly of subunits takes place in the nucleolus.
C: Translation builds a protein from the mRNA message.
D: Chromosome condensation precedes cell division. The right answer is: The message is translated into a sequence of amino acids.

Q112 · Medium · *codex, slides 72 to 79*

What happens during transcription?

1. DNA information is copied onto a messenger RNA
2. The mRNA message is turned into amino acids
3. Ribosomal proteins are made in the nucleolus
4. DNA is degraded and then rebuilt from histones

✓ **Answer: A** — Transcription copies a gene's instructions onto mRNA.

A: Transcription copies a gene's instructions onto mRNA.
B: That is translation. The right answer is: DNA information is copied onto a messenger RNA.
C: Ribosomal proteins are produced in the cytoplasm.
D: Transcription copies information and does not degrade DNA.

Q113 · Medium · *codex, slides 72 to 79*

Where are rRNA molecules synthesised?

1. In the rough ER
2. In the nucleolus
3. In the Golgi cisternae
4. In the perinuclear space

✓ **Answer: B** — Nucleoli are sites of synthesis of rRNA molecules.

A: The rough ER carries ribosomes but does not make rRNA.
B: Nucleoli are sites of synthesis of rRNA molecules.
C: The Golgi packages materials and does not make rRNA.
D: The perinuclear space is a gap between nuclear membranes.

Q114 · Medium · *codex, slides 54, 58*

Where are ribosomal subunits assembled?

1. In the perinuclear space of the envelope
2. In the lumen of the rough endoplasmic reticulum
3. In the cisternae of the Golgi apparatus
4. In the nucleolus, a region inside the nucleus

✓ **Answer: D** — The nucleolus is the site where rRNA and proteins form ribosomal subunits.

A: The perinuclear space lies between the two nuclear membranes and is not an assembly site.
B: Ribosomes work on the ER surface but are assembled in the nucleolus.
C: The Golgi packages materials for transport and does not assemble ribosomal subunits.
D: The nucleolus is the site where rRNA and proteins form ribosomal subunits.

Q115 · Hard · *codex, slide 72*

Which sequence correctly shows how a gene directs protein synthesis?

1. mRNA is translated into DNA, then DNA is transcribed into amino acids
2. Amino acids are transcribed into mRNA, then mRNA is translated into DNA
3. DNA is translated into amino acids, then amino acids are transcribed into mRNA
4. DNA is transcribed into mRNA, then mRNA is translated into amino acids

✓ **Answer: D** — DNA is transcribed to messenger RNA, which is translated into an amino acid sequence.

A: This reverses the flow; DNA is the source and mRNA is the message.
B: Proteins are the end product, not the template for mRNA or DNA.
C: Transcription makes mRNA from DNA first, and translation then builds the protein.
D: DNA is transcribed to messenger RNA, which is translated into an amino acid sequence.

Q116 · Hard · *codex, slide 75*

Which statement about assembly of ribosomal subunits in the nucleolus is correct?

1. rRNA made from ribosomal genes combines with ribosomal proteins that were produced in the cytoplasm
2. Ribosomal proteins are made inside the nucleolus, using the rRNA transcripts as their template
3. Messenger RNA and histone proteins assemble directly into the large and small subunits there
4. Complete ribosomes form in the cytosol and are then imported into the nucleolus for storage

✓ **Answer: A** — rRNA transcripts combine with ribosomal proteins made in the cytoplasm.

A: rRNA transcripts combine with ribosomal proteins made in the cytoplasm.
B: The ribosomal proteins are produced in the cytoplasm, and rRNA is not their template.
C: Subunits are made from rRNA and ribosomal proteins, not from mRNA and histones.
D: Subunits are assembled in the nucleolus and exported, not made in the cytosol first.

Q117 · Hard · *codex, slides 79, 85*

A pancreatic cell secretes digestive enzymes. Which ribosomes make those enzymes?

1. Free ribosomes floating throughout the cytosol only
2. Ribosomal subunits stored inside the nucleolus
3. Bound ribosomes attached to the endoplasmic reticulum
4. Ribosomes embedded in the nuclear pore annulus

✓ **Answer: C** — Bound ribosomes on the ER make proteins for export from the cell.

A: Free ribosomes make proteins used within the cell, not proteins for export.
B: The nucleolus assembles subunits; it does not make secreted proteins.
C: Bound ribosomes on the ER make proteins for export from the cell.
D: The annulus is built of nucleoporins and does not carry ribosomes that make secreted enzymes.

Q118 · Devil · *codex, slide 75*

A drug destroys the nucleoli in a cell. What is the ultimate effect on protein production?

1. No mRNA can be transcribed from any gene, so proteins stop at once
2. Free ribosomes convert into bound ribosomes, so secretion rises
3. Fewer ribosomal subunits form, so overall protein synthesis declines
4. DNA can no longer double, so chromosomes cannot condense before division

✓ **Answer: C** — Without nucleoli, ribosomal subunits cannot be made, so protein synthesis falls.

A: The nucleolus makes rRNA and subunits; mRNA transcription from genes is not stopped by this.
B: Ribosome type depends on location, and losing subunits does not raise secretion.
C: Without nucleoli, ribosomal subunits cannot be made, so protein synthesis falls.
D: Nucleoli are ribosome factories and are not needed for DNA doubling or condensing.

The endomembrane system · Q119–126

Q119 · Easy · *codex, slides 81 to 85*

What does the prefix endo mean in endomembrane?

1. Outside
2. Between
3. Within
4. Around

✓ **Answer: C** — Endo means within.

A: Outside would be exo. The right answer is: Within.
B: Between is not the meaning of endo.
C: Endo means within. It matches what the lecture slides state.
D: Around is not the meaning of endo.

Q120 · Easy · *codex, slides 81 to 85*

Which organelle is part of the endomembrane system?

1. Mitochondria
2. Chloroplasts
3. Ribosomes
4. Lysosomes

✓ **Answer: D** — Lysosomes are part of the endomembrane system.

A: Mitochondria are not listed in the endomembrane system.
B: Chloroplasts are not listed in the endomembrane system.
C: Ribosomes have no membrane, so they are not endomembrane organelles.
D: Lysosomes are part of the endomembrane system.

Q121 · Easy · *codex, slides 81 to 85*

Which pair belongs to the endomembrane system together with the nuclear envelope?

1. The mitochondria and the chloroplasts
2. The ribosomes and the centrioles
3. The nucleoli and the chromosomes
4. The ER and the Golgi apparatus

✓ **Answer: D** — The ER and Golgi are core endomembrane organelles.

A: These are not part of the endomembrane system.
B: Neither has an endomembrane role. The right answer is: The ER and the Golgi apparatus.
C: Nucleoli and chromosomes are not membranes.
D: The ER and Golgi are core endomembrane organelles.

Q122 · Medium · *codex, slides 81 to 85*

Why is the plasma membrane counted as part of the endomembrane system?

1. It produces ribosomal subunits for the other organelles of the system
2. It is continuous with the nuclear pores and the nucleolus
3. It carries out cellular respiration with its inner cristae
4. It interacts with other endomembrane organelles and exports secreted proteins

✓ **Answer: D** — It interacts with the other organelles and is the export site for secreted proteins.

A: Ribosomal subunits are made in the nucleolus.
B: The pores are in the nuclear envelope, not the plasma membrane.
C: Cristae belong to mitochondria. The right answer is: It interacts with other endomembrane organelles and exports secreted proteins.
D: It interacts with the other organelles and is the export site for secreted proteins.

Q123 · Medium · *codex, slides 81 to 85*

What does the endomembrane system regulate?

1. Light capture and carbon fixation
2. Protein traffic and metabolic functions
3. Storage of hereditary information
4. Construction of the cell wall

✓ **Answer: B** — The system regulates protein traffic and performs metabolic functions.

A: These are tasks of chloroplasts. The right answer is: Protein traffic and metabolic functions.
B: The system regulates protein traffic and performs metabolic functions.
C: Hereditary information is stored in DNA in the nucleus.
D: The wall is made outside the plasma membrane and is not the system's described role.

Q124 · Medium · *codex, slides 81 to 85*

Besides lysosomes, which membranes does the endomembrane system include?

1. Mitochondrial, chloroplast and peroxisome membranes only
2. Peroxisome, ribosome and centriole membranes only
3. Cell wall, extracellular matrix and cytoskeleton
4. Nuclear envelope, ER, Golgi apparatus and plasma membrane

✓ **Answer: D** — These are the membranes listed in the endomembrane system.

A: These organelles are not listed in the system.
B: Ribosomes have no membrane, and peroxisomes are not listed.
C: These are outside the cell and are not membranes of the system.
D: These are the membranes listed in the endomembrane system.

Q125 · Medium · *codex, slide 85*

Which statement best describes the shared job of the endomembrane system?

1. It generates ATP through oxidative reactions in cristae
2. It modifies, packages and transports lipids and proteins
3. It stores the genetic instructions in chromosomes
4. It anchors the cell to its neighbours and matrix

✓ **Answer: B** — Endomembrane organelles work together to modify, package and transport lipids and proteins.

A: ATP production in cristae belongs to mitochondria, which are not part of the endomembrane system.
B: Endomembrane organelles work together to modify, package and transport lipids and proteins.
C: The nucleus holds chromosomes; the endomembrane system handles lipids and proteins.
D: Cell junctions and the extracellular matrix, not the endomembrane system, do that.

Q126 · Hard · *codex, slides 81 to 85*

A secreted protein is made on bound ribosomes. Which sequence of structures does it pass through before export?

1. Golgi apparatus, then rough ER, then plasma membrane
2. Rough ER, then lysosome, then plasma membrane
3. Rough ER, then Golgi apparatus, then plasma membrane
4. Nucleolus, then Golgi apparatus, then plasma membrane

✓ **Answer: C** — Secreted proteins pass from rough ER to the Golgi and then to the plasma membrane.

A: The order is reversed; the rough ER comes first.
B: Lysosomes digest materials and are not on the export route.
C: Secreted proteins pass from rough ER to the Golgi and then to the plasma membrane.
D: The nucleolus assembles ribosomal subunits and is not on the route.

Endoplasmic reticulum · Q127–136

Q127 · Easy · *codex, slide 86*

Which type of ER has ribosomes on its surface?

1. Smooth ER
2. Neither type has ribosomes
3. Rough ER
4. Only the nuclear envelope

✓ **Answer: C** — Rough ER has ribosomes on its surface.

A: Smooth ER has no ribosomes on its surface.
B: Rough ER carries ribosomes. The right answer is: Rough ER.
C: Rough ER has ribosomes on its surface.
D: The ER itself can carry ribosomes; the outer nuclear membrane is continuous with it.

Q128 · Easy · *codex, slide 86*

Which type of ER synthesises lipids?

1. Rough ER
2. The Golgi cisternae
3. The nuclear pores
4. Smooth ER

✓ **Answer: D** — Smooth ER synthesises lipids.

A: Rough ER packages proteins for secretion.
B: The Golgi is a separate organelle.
C: Pores are channels and do not synthesise lipids.
D: Smooth ER synthesises lipids. It matches what the lecture slides state.

Q129 · Easy · *codex, slide 86*

Which ion is stored in the smooth ER?

1. Sodium (Na^{+})
2. Calcium (Ca^{2+})
3. Chloride (Cl^{-})
4. Iron (Fe^{2+})

✓ **Answer: B** — The smooth ER stores Ca^{2+}.

A: Sodium is not the ion stored in the smooth ER.
B: The smooth ER stores Ca^{2+}.
C: Chloride is not the ion stored in the smooth ER.
D: Iron is not the ion stored in the smooth ER.

Q130 · Easy · *codex, slide 86*

Where do transport vesicles from the rough ER go?

1. To the nucleolus
2. To the mitochondria
3. To the Golgi apparatus
4. Directly to the chloroplast

✓ **Answer: C** — The rough ER sends transport vesicles to the Golgi.

A: The nucleolus is inside the nucleus and receives no ER vesicles.
B: Mitochondria are not the destination of these vesicles.
C: The rough ER sends transport vesicles to the Golgi.
D: Chloroplasts are not the destination of these vesicles.

Q131 · Easy · *codex, slide 86*

The endoplasmic reticulum is best described as a network of what?

1. Protein filaments
2. Cellulose fibres
3. Membranes and sacs
4. Hydrolytic enzymes

✓ **Answer: C** — The ER is a network of membranes and sacs.

A: Protein filaments form the cytoskeleton. The right answer is: Membranes and sacs.
B: Cellulose forms the plant cell wall.
C: The ER is a network of membranes and sacs.
D: Hydrolytic enzymes are found in lysosomes.

Q132 · Medium · *codex, slide 86*

What does the rough ER do with proteins?

1. It digests them with hydrolytic enzymes
2. It decomposes them with catalase
3. It stores them as pigments
4. It packages them for secretion

✓ **Answer: D** — Rough ER packages proteins for secretion.

A: Digestion is a lysosome function. The right answer is: It packages them for secretion.
B: Catalase is found in peroxisomes. The right answer is: It packages them for secretion.
C: Storing pigments is a vacuole function.
D: Rough ER packages proteins for secretion.

Q133 · Medium · *codex, slide 86*

Liver cells exposed to the barbiturate phenobarbital expand which organelle to detoxify the drug?

1. Rough ER
2. Chloroplasts
3. Nucleoli
4. Smooth ER

✓ **Answer: D** — The smooth ER detoxifies drugs and poisons.

A: Rough ER packages proteins for secretion.
B: Chloroplasts are found in plant cells, not in liver cells.
C: Nucleoli assemble ribosomal subunits. The right answer is: Smooth ER.
D: The smooth ER detoxifies drugs and poisons.

Q134 · Medium · *codex, slide 86*

What else does the rough ER make besides packaging proteins?

1. Chlorophyll for the chloroplast
2. ATP in its cristae
3. Replacement membrane
4. Ribosomal RNA for new subunits

✓ **Answer: C** — Rough ER makes replacement membrane.

A: Chlorophyll is a pigment in chloroplasts.
B: Cristae belong to mitochondria. The right answer is: Replacement membrane.
C: Rough ER makes replacement membrane.
D: rRNA is made in the nucleolus.

Q135 · Medium · *codex, slide 86*

All of the following are functions of the smooth ER EXCEPT which one?

1. Synthesising lipids for new membranes
2. Packaging proteins into transport vesicles
3. Storing calcium ions inside the lumen
4. Detoxifying drugs and poisons in liver cells

✓ **Answer: B** — Correct choice.

A: This is a smooth ER function.
B: Correct choice. This is a function of the rough ER.
C: This is a smooth ER function.
D: This is a smooth ER function.

Q136 · Hard · *codex, slide 86*

Cell A stores calcium and detoxifies alcohol, while cell B secretes large amounts of antibody. Which ER type dominates in each?

1. A: rough ER; B: smooth ER
2. A: smooth ER; B: smooth ER
3. A: rough ER; B: rough ER
4. A: smooth ER; B: rough ER

✓ **Answer: D** — Smooth ER stores Ca^{2+} and detoxifies, while rough ER packages secreted proteins.

A: This reverses the two types. The right answer is: A: smooth ER; B: rough ER.
B: Antibody secretion needs rough ER for packaging secreted proteins.
C: Calcium storage and detoxification are smooth ER functions.
D: Smooth ER stores Ca^{2+} and detoxifies, while rough ER packages secreted proteins.

Golgi apparatus · Q137–144

Q137 · Easy · *codex, slides 88 to 90*

What are the flattened membrane sacs of the Golgi apparatus called?

1. Cristae
2. Cisternae
3. Thylakoids
4. Lacunae

✓ **Answer: B** — The Golgi is a series of flattened sacs called cisternae.

A: Cristae are folds of the inner mitochondrial membrane.
B: The Golgi is a series of flattened sacs called cisternae.
C: Thylakoids are disks inside chloroplasts. The right answer is: Cisternae.
D: Lacunae are spaces in bone that house osteocytes.

Q138 · Easy · *codex, slides 88 to 90*

Which face of the Golgi apparatus receives vesicles from the ER?

1. The cis face
2. The trans face
3. The outer face
4. The nuclear face

✓ **Answer: A** — The cis face receives vesicles.

A: The cis face receives vesicles.
B: The trans face ships vesicles. The right answer is: The cis face.
C: The Golgi faces are named cis and trans.
D: The Golgi faces are named cis and trans.

Q139 · Easy · *codex, slides 88 to 90*

From which face do vesicles leave the Golgi apparatus?

1. The cis face
2. The inner face
3. The matrix face
4. The trans face

✓ **Answer: D** — The trans face ships vesicles.

A: The cis face receives vesicles. The right answer is: The trans face.
B: The Golgi faces are named cis and trans.
C: The matrix belongs to mitochondria. The right answer is: The trans face.
D: The trans face ships vesicles.

Q140 · Easy · *codex, slides 88 to 90*

Which organelles does the Golgi apparatus produce?

1. Lysosomes
2. Mitochondria
3. Ribosomes
4. Chloroplasts

✓ **Answer: A** — The Golgi produces lysosomes.

A: The Golgi produces lysosomes. It matches what the lecture slides state.
B: Mitochondria divide independently within the cell.
C: Ribosomal subunits are assembled in the nucleolus.
D: Chloroplasts reproduce independently within the cell.

Q141 · Medium · *codex, slides 88 to 90*

What is the function of the Golgi apparatus?

1. Photosynthesis in its thylakoid disks
2. Packaging materials for transport in vesicles
3. Cellular respiration in its folded cristae
4. Storage of calcium ions in its lumen

✓ **Answer: B** — The Golgi synthesises and packages small molecules for transport.

A: Photosynthesis occurs in chloroplasts. The right answer is: Packaging materials for transport in vesicles.
B: The Golgi synthesises and packages small molecules for transport.
C: Respiration occurs in mitochondria. The right answer is: Packaging materials for transport in vesicles.
D: Calcium storage is a smooth ER function.

Q142 · Medium · *codex, slides 88 to 90*

Which statement describes vesicle traffic through the Golgi apparatus?

1. Vesicles arrive at the trans face and leave from the cis face
2. Vesicles arrive at the cis face and are shipped from the trans face
3. Vesicles arrive and leave only at the cis face
4. Vesicles pass through the nucleolus before the trans face

✓ **Answer: B** — The cis face receives and the trans face ships vesicles.

A: This reverses the faces. The right answer is: Vesicles arrive at the cis face and are shipped from the trans face.
B: The cis face receives and the trans face ships vesicles.
C: The trans face ships vesicles. The right answer is: Vesicles arrive at the cis face and are shipped from the trans face.
D: The nucleolus is not on the route.

Q143 · Medium · *codex, slides 88 to 90*

All of the following are functions of the Golgi apparatus EXCEPT which one?

1. Packaging materials in vesicles
2. Producing lysosomes
3. Assembling ribosomal subunits
4. Synthesising small molecules for transport

✓ **Answer: C** — Correct choice.

A: This is a Golgi function. The right answer is: Assembling ribosomal subunits.
B: This is a Golgi function. The right answer is: Assembling ribosomal subunits.
C: Correct choice. Ribosomal subunits are assembled in the nucleolus.
D: This is a Golgi function. The right answer is: Assembling ribosomal subunits.

Q144 · Hard · *codex, slides 88 to 90*

A vesicle carrying a secretory protein buds from the rough ER. Which statement describes its next steps?

1. It fuses at the cis face, and contents leave from the trans face
2. It fuses at the trans face, and contents leave from the cis face
3. It bypasses the Golgi and is exported directly by the nucleolus
4. It enters the nucleolus first and then the cis face

✓ **Answer: A** — Vesicles arrive at the cis face and are shipped from the trans face.

A: Vesicles arrive at the cis face and are shipped from the trans face.
B: This reverses the cis and trans faces.
C: The nucleolus has no role in export.
D: The nucleolus is inside the nucleus and not on the route.

Lysosomes and vacuoles · Q145–154

Q145 · Easy · *codex, slides 91 to 92*

Which type of enzymes do lysosomes contain?

1. Photosynthetic enzymes
2. Respiratory enzymes of the cristae
3. Hydrolytic enzymes
4. DNA polymerase enzymes

✓ **Answer: C** — Lysosomes contain hydrolytic enzymes.

A: These are associated with chloroplasts. The right answer is: Hydrolytic enzymes.
B: These belong to mitochondria. The right answer is: Hydrolytic enzymes.
C: Lysosomes contain hydrolytic enzymes. It matches what the lecture slides state.
D: These are not characteristic lysosome enzymes.

Q146 · Easy · *codex, slides 91 to 92*

Lysosomes carry out which process?

1. Photosynthesis
2. Protein synthesis
3. ATP production by cristae
4. Intracellular digestion

✓ **Answer: D** — Lysosomes carry out intracellular digestion.

A: Photosynthesis occurs in chloroplasts. The right answer is: Intracellular digestion of materials.
B: Protein synthesis occurs on ribosomes. The right answer is: Intracellular digestion of materials.
C: This occurs in mitochondria. The right answer is: Intracellular digestion of materials.
D: Lysosomes carry out intracellular digestion.

Q147 · Easy · *codex, slides 91 to 92*

What do vacuoles store?

1. Only chromosomes and ribosomal subunits
2. Food, water, minerals, pigments and poisons
3. Only ribosomal subunits and rRNA molecules
4. Only hydrogen peroxide and catalase

✓ **Answer: B** — Vacuoles store these materials.

A: Chromosomes are in the nucleus. The right answer is: Food, water, minerals, pigments and poisons.
B: Vacuoles store these materials. It matches what the lecture slides state.
C: Subunits are assembled in the nucleolus.
D: Hydrogen peroxide is dealt with in peroxisomes.

Q148 · Easy · *codex, slides 91 to 92*

Which vacuole stores water and ions in plant cells?

1. The large central vacuole
2. The food vacuole
3. The contractile vacuole
4. The peroxisome

✓ **Answer: A** — Plants have a large central vacuole that stores water and ions.

A: Plants have a large central vacuole that stores water and ions.
B: Food vacuoles store food in some cells.
C: This is a different type of vacuole.
D: A peroxisome is not a vacuole.

Q149 · Medium · *codex, slides 91 to 92*

Which process involving lysosomes is a form of programmed cell death?

1. Photosynthesis
2. Transcription
3. Cytokinesis
4. Apoptosis

✓ **Answer: D** — Lysosomes participate in programmed cell death (apoptosis).

A: Photosynthesis makes sugars and is not cell death.
B: Transcription copies DNA to RNA. The right answer is: Apoptosis.
C: Cytokinesis divides the cytoplasm, not programmed death.
D: Lysosomes participate in programmed cell death (apoptosis).

Q150 · Medium · *codex, slides 91 to 92*

Which pair are examples of vacuoles?

1. Cisternae of the Golgi and cristae
2. Thylakoids and grana of chloroplasts
3. Lacunae of bone and annuli of pores
4. Food vacuoles and contractile vacuoles

✓ **Answer: D** — These are the examples of vacuoles listed.

A: These are Golgi sacs and mitochondrial folds.
B: These are structures inside chloroplasts. The right answer is: Food vacuoles and contractile vacuoles.
C: Lacunae house osteocytes, and annuli surround nuclear pores.
D: These are the examples of vacuoles listed.

Q151 · Medium · *codex, slides 91 to 92*

Which organelle produces lysosomes?

1. The nucleolus
2. The mitochondrion
3. The chloroplast in leaf cells
4. The Golgi apparatus

✓ **Answer: D** — The Golgi apparatus produces lysosomes.

A: The nucleolus makes ribosomal subunits. The right answer is: The Golgi apparatus.
B: Mitochondria make ATP. The right answer is: The Golgi apparatus.
C: Chloroplasts carry out photosynthesis. The right answer is: The Golgi apparatus.
D: The Golgi apparatus produces lysosomes.

Q152 · Medium · *codex, slides 91 to 92*

Why are lysosomes described as recycling centres of the cell?

1. They convert light into chemical energy for reuse
2. They copy DNA so the cell can reuse its genes
3. Hydrolytic enzymes break down materials for reuse
4. They store water for reuse by the cell

✓ **Answer: C** — Hydrolytic enzymes digest materials, recycling the cell's components.

A: That describes photosynthesis in chloroplasts. The right answer is: Hydrolytic enzymes break down materials for reuse.
B: Lysosomes do not copy DNA. The right answer is: Hydrolytic enzymes break down materials for reuse.
C: Hydrolytic enzymes digest materials, recycling the cell's components.
D: Water storage is a vacuole role.

Q153 · Medium · *codex, slides 91 to 92*

All of the following are functions of lysosomes EXCEPT which one?

1. Decomposing hydrogen peroxide with catalase
2. Intracellular digestion of materials
3. Recycling the cell's worn-out materials
4. Programmed cell death (apoptosis)

✓ **Answer: A** — Correct choice.

A: Correct choice. Catalase and hydrogen peroxide breakdown are peroxisome functions.
B: This is a lysosome function. The right answer is: Decomposing hydrogen peroxide with catalase.
C: This is a lysosome function. The right answer is: Decomposing hydrogen peroxide with catalase.
D: This is a lysosome function. The right answer is: Decomposing hydrogen peroxide with catalase.

Q154 · Hard · *codex, slides 91 to 92*

A macrophage engulfs a bacterium. Which organelle supplies the enzymes to digest it?

1. A peroxisome, using catalase to digest it
2. The central vacuole, storing it as a pigment
3. The smooth ER, detoxifying it as a drug
4. A lysosome from the Golgi, using hydrolytic enzymes

✓ **Answer: D** — Lysosomes made by the Golgi digest engulfed material with hydrolytic enzymes.

A: Catalase decomposes hydrogen peroxide and does not digest bacteria.
B: Central vacuoles belong to plant cells and store materials.
C: Smooth ER detoxifies drugs and poisons and does not digest bacteria.
D: Lysosomes made by the Golgi digest engulfed material with hydrolytic enzymes.

Peroxisomes · Q155–162

Q155 · Easy · *codex, slides 89, 98*

Which enzyme in peroxisomes decomposes hydrogen peroxide?

1. Amylase
2. Catalase
3. Pepsin
4. DNA polymerase

✓ **Answer: B** — Peroxisomes contain catalase, which decomposes H_2O_2.

A: Amylase digests starch and is not the peroxisome enzyme named here.
B: Peroxisomes contain catalase, which decomposes H_2O_2.
C: Pepsin digests protein in the stomach.
D: DNA polymerase copies DNA. The right answer is: Catalase.

Q156 · Easy · *codex, slides 89, 98*

Peroxisomes take part in the breakdown of which pair of molecules?

1. Amino acids and fatty acids
2. Starch and cellulose
3. Nucleotides and ATP
4. Chlorophyll and phospholipids

✓ **Answer: A** — Peroxisomes help break down amino acids and fatty acids.

A: Peroxisomes help break down amino acids and fatty acids.
B: These are carbohydrates and are not named for peroxisomes.
C: These are not named as peroxisome substrates.
D: These are not named as peroxisome substrates.

Q157 · Easy · *codex, slides 89, 98*

How do peroxisomes form?

1. By division of pre-existing peroxisomes
2. By budding from the nuclear envelope
3. By budding from the plasma membrane
4. By fusion of several lysosomes

✓ **Answer: A** — Peroxisomes form by division of pre-existing peroxisomes.

A: Peroxisomes form by division of pre-existing peroxisomes.
B: They do not bud from the nucleus.
C: They do not form from the plasma membrane.
D: They do not form by fusion of lysosomes.

Q158 · Medium · *codex, slides 89, 98*

Which toxic substances do peroxisomes oxidise?

1. Glucose and glycogen
2. Alcohol and formaldehyde
3. Chlorophyll and cellulose
4. Calcium and sodium ions

✓ **Answer: B** — Peroxisomes oxidise alcohol and formaldehyde.

A: These are fuels and not toxic substances.
B: Peroxisomes oxidise alcohol and formaldehyde.
C: These are not oxidised toxins. The right answer is: Alcohol and formaldehyde.
D: Ions are not oxidised toxic substances.

Q159 · Medium · *codex, slides 89, 98*

How do peroxisomes compare in size with lysosomes?

1. They are larger than lysosomes
2. They are the same size as lysosomes
3. They are smaller than lysosomes
4. They are larger than mitochondria

✓ **Answer: C** — Peroxisomes are described as smaller than lysosomes.

A: They are smaller. The right answer is: They are smaller than lysosomes.
B: They are smaller. The right answer is: They are smaller than lysosomes.
C: Peroxisomes are described as smaller than lysosomes.
D: They are smaller than lysosomes. The right answer is: They are smaller than lysosomes.

Q160 · Medium · *codex, slides 89, 98*

Which toxic compound is produced during peroxisomal oxidation reactions?

1. Chlorophyll for the chloroplast
2. Glycogen
3. Lactic acid
4. Hydrogen peroxide (H_2O_2)

✓ **Answer: D** — Oxidation in peroxisomes produces hydrogen peroxide.

A: Chlorophyll is a pigment, not a by-product.
B: Glycogen is a carbohydrate store. The right answer is: Hydrogen peroxide (H_2O_2).
C: Lactic acid is not named as a peroxisome product.
D: Oxidation in peroxisomes produces hydrogen peroxide.

Q161 · Hard · *codex, slides 89, 98*

Why must peroxisomes contain catalase?

1. Oxidation produces toxic hydrogen peroxide, which catalase decomposes
2. Catalase makes the hydrogen peroxide that oxidises fatty acids
3. Catalase digests worn-out organelles so the cell can recycle them
4. Catalase builds new peroxisomes by dividing existing ones

✓ **Answer: A** — Catalase decomposes the hydrogen peroxide produced.

A: Catalase decomposes the hydrogen peroxide produced.
B: Catalase decomposes hydrogen peroxide; it does not make it.
C: That is a lysosome function. The right answer is: Oxidation produces toxic hydrogen peroxide, which catalase decomposes.
D: Peroxisomes divide on their own and catalase does not build them.

Q162 · Devil · *codex, slides 89, 98*

After heavy alcohol intake, which organelle oxidises alcohol in liver cells, and which enzyme then handles the toxic by-product?

1. Lysosomes oxidise it, and hydrolytic enzymes decompose the product
2. Peroxisomes oxidise it, and catalase decomposes the hydrogen peroxide produced
3. The Golgi apparatus oxidises it, and cisternae store the product
4. Chloroplasts oxidise it, and chlorophyll decomposes the product

✓ **Answer: B** — Peroxisomes oxidise alcohol and catalase decomposes hydrogen peroxide.

A: Lysosomes digest materials and do not oxidise alcohol.
B: Peroxisomes oxidise alcohol and catalase decomposes hydrogen peroxide.
C: The Golgi packages materials and does not oxidise alcohol.
D: Liver cells have no chloroplasts. The right answer is: Peroxisomes oxidise it, and catalase decomposes the hydrogen peroxide produced.

Plant and animal cells · Q163–170

Q163 · Easy · *codex, slides 93 to 96*

Which organelle is found in plant cells only?

1. Lysosomes
2. Centrioles
3. Desmosomes
4. Chloroplasts

✓ **Answer: D** — Chloroplasts are listed as plant cells only.

A: Lysosomes are listed as animal cells only.
B: Centrioles are listed as animal cells only.
C: Desmosomes are listed as animal cell structures.
D: Chloroplasts are listed as plant cells only.

Q164 · Easy · *codex, slides 93 to 96*

The cell wall of plant cells is made of what?

1. Peptidoglycan
2. Cellulose
3. Chitin
4. Collagen

✓ **Answer: B** — The plant cell wall is made of cellulose.

A: Peptidoglycan is the wall material of bacteria.
B: The plant cell wall is made of cellulose.
C: Chitin is not the wall material listed for plant cells.
D: Collagen is a component of the animal extracellular matrix.

Q165 · Easy · *codex, slides 93 to 96*

Which pair of structures is found in animal cells only?

1. Central vacuoles and chloroplasts
2. Cellulose walls and plasmodesmata
3. Mitochondria and ribosomes
4. Lysosomes and centrioles

✓ **Answer: D** — Lysosomes and centrioles are listed as animal cells only.

A: These are plant cells only. The right answer is: Lysosomes and centrioles.
B: These are plant cells only. The right answer is: Lysosomes and centrioles.
C: These are found in both plant and animal cells.
D: Lysosomes and centrioles are listed as animal cells only.

Q166 · Medium · *codex, slides 93 to 96*

Which structure connects neighbouring plant cells?

1. Desmosomes
2. Gap junctions
3. Tight junctions
4. Plasmodesmata

✓ **Answer: D** — Plasmodesmata are listed as plant cells only.

A: Desmosomes are animal cell junctions. The right answer is: Plasmodesmata.
B: Gap junctions are animal cell junctions.
C: Tight junctions are animal cell junctions.
D: Plasmodesmata are listed as plant cells only.

Q167 · Medium · *codex, slides 93 to 96*

Which structure is found in animal cells only?

1. The large central vacuole
2. The chloroplast in leaf cells
3. The extracellular matrix (ECM)
4. The cellulose cell wall

✓ **Answer: C** — The ECM is listed as animal cells only.

A: The central vacuole is plant only.
B: Chloroplasts are plant only. The right answer is: The extracellular matrix (ECM).
C: The ECM is listed as animal cells only.
D: The cellulose wall is plant only.

Q168 · Medium · *codex, slides 93 to 96*

All of the following are found in plant cells only EXCEPT which one?

1. Central vacuoles
2. Chloroplasts
3. Centrioles
4. Plasmodesmata

✓ **Answer: C** — Correct choice.

A: These are plant only. The right answer is: Centrioles.
B: These are plant only. The right answer is: Centrioles.
C: Correct choice. Centrioles are listed as animal cells only.
D: These are plant only. The right answer is: Centrioles.

Q169 · Hard · *codex, slides 93 to 96*

A student sees a cell with a large central vacuole, chloroplasts and a cellulose wall. Which features should she NOT expect to find in it?

1. Centrioles and desmosomes
2. Plasmodesmata and a cellulose wall
3. A central vacuole and chloroplasts
4. Mitochondria and ribosomes

✓ **Answer: A** — These are listed as animal cell features.

A: These are listed as animal cell features.
B: These are plant features and fit the cell.
C: These are plant features and fit the cell.
D: These are found in both plant and animal cells.

Q170 · Devil · *codex, slides 93 to 96*

Which structures are found in BOTH plant and animal cells? 1. Mitochondria 2. Central vacuole 3. Golgi apparatus 4. Lysosomes

1. 1, 2 and 3 only
2. 1 and 3 only
3. 2 and 4 only
4. 1, 3 and 4 only

✓ **Answer: B** — Mitochondria and the Golgi apparatus are in both; the central vacuole is plant only and lysosomes are listed as animal only.

A: The central vacuole is plant only, so statement 2 cannot be included.
B: Mitochondria and the Golgi apparatus are in both; the central vacuole is plant only and lysosomes are listed as animal only.
C: The central vacuole is plant only and lysosomes are animal only, and this option omits mitochondria.
D: Lysosomes are listed as animal cells only, so statement 4 cannot be included.

Mitochondria · Q171–178

Q171 · Easy · *codex, slide 97*

What is the function of mitochondria?

1. They are the site of cellular respiration
2. They are the site of photosynthesis
3. They are the site of protein export
4. They detoxify drugs and poisons

✓ **Answer: A** — Mitochondria are the site of cellular respiration.

A: Mitochondria are the site of cellular respiration.
B: Photosynthesis occurs in chloroplasts. The right answer is: They are the site of cellular respiration.
C: Protein export involves the ER, Golgi and plasma membrane.
D: Detoxification involves the smooth ER and peroxisomes.

Q172 · Easy · *codex, slide 97*

How many membranes surround a mitochondrion?

1. One, a single outer membrane
2. Three, including a thylakoid membrane
3. None, since they are free in the cytosol
4. Two, an outer and an inner membrane

✓ **Answer: D** — Mitochondria have an outer and an inner membrane.

A: Mitochondria have a double membrane. The right answer is: Two, an outer and an inner membrane.
B: Thylakoids belong to chloroplasts. The right answer is: Two, an outer and an inner membrane.
C: Mitochondria are membrane-bound organelles. The right answer is: Two, an outer and an inner membrane.
D: Mitochondria have an outer and an inner membrane.

Q173 · Easy · *codex, slide 97*

What are the folds of the inner mitochondrial membrane called?

1. Cisternae
2. Grana
3. Cristae
4. Lacunae

✓ **Answer: C** — Cristae are folds of the inner membrane.

A: Cisternae are Golgi sacs. The right answer is: Cristae.
B: Grana are stacks of thylakoids in chloroplasts.
C: Cristae are folds of the inner membrane.
D: Lacunae are bone cavities that house osteocytes.

Q174 · Medium · *codex, slide 97*

What is the mitochondrial matrix?

1. The folds of the inner membrane
2. The outer membrane of the organelle
3. The fluid-filled inner compartment
4. The stack of thylakoid disks

✓ **Answer: C** — The matrix is the fluid-filled inner compartment.

A: Those are the cristae. The right answer is: The fluid-filled inner compartment.
B: The matrix is inside the inner membrane.
C: The matrix is the fluid-filled inner compartment.
D: Thylakoid stacks belong to chloroplasts. The right answer is: The fluid-filled inner compartment.

Q175 · Medium · *codex, slide 97*

Why do cristae increase the ATP made by a mitochondrion?

1. They make the outer membrane thicker so ATP leaks out
2. They increase the surface area holding ATP enzymes
3. They store chlorophyll to capture sunlight
4. They divide the matrix into many separate cells

✓ **Answer: B** — Cristae contain enzymes for ATP production and increase surface area.

A: Thickness is not the reason. The right answer is: They increase the surface area holding ATP enzymes.
B: Cristae contain enzymes for ATP production and increase surface area.
C: Chlorophyll is found in chloroplasts. The right answer is: They increase the surface area holding ATP enzymes.
D: Cristae are folds, not separate cells.

Q176 · Medium · *codex, slide 97*

All of the following are true of mitochondria EXCEPT which one?

1. They capture sunlight using chlorophyll
2. They have a double membrane
3. Cristae are folds of the inner membrane
4. They are the site of cellular respiration

✓ **Answer: A** — Correct choice.

A: Correct choice. Chlorophyll captures sunlight in chloroplasts.
B: This is true. The right answer is: They capture sunlight using chlorophyll.
C: This is true. The right answer is: They capture sunlight using chlorophyll.
D: This is true. The right answer is: They capture sunlight using chlorophyll.

Q177 · Hard · *codex, slide 97*

A heart muscle cell needs large amounts of ATP. Which mitochondrial feature would you expect to be extensive?

1. Cristae, which enlarge the inner membrane surface
2. Thylakoid stacks, which capture sunlight energy
3. Cisternae, which package proteins for secretion
4. A single smooth membrane, which stores calcium

✓ **Answer: A** — More cristae mean more surface for ATP-producing enzymes.

A: More cristae mean more surface for ATP-producing enzymes.
B: Thylakoids belong to chloroplasts. The right answer is: Cristae, which enlarge the inner membrane surface.
C: Cisternae belong to the Golgi apparatus.
D: Calcium storage is a smooth ER function.

Q178 · Hard · *codex, slide 97*

Which description lists mitochondrial structure from the outside inwards?

1. Outer membrane, thylakoid disks, then stroma
2. Outer membrane, cristae-folded inner membrane, matrix
3. Matrix, cristae, then a single outer membrane
4. Cis face, cisternae of the stack, then trans face

✓ **Answer: B** — The organelle has outer and inner membranes with cristae, and the matrix inside.

A: This describes a chloroplast. The right answer is: Outer membrane, cristae-folded inner membrane, matrix.
B: The organelle has outer and inner membranes with cristae, and the matrix inside.
C: This places the matrix outside and omits the inner membrane.
D: This describes the Golgi apparatus. The right answer is: Outer membrane, cristae-folded inner membrane, matrix.

Chloroplasts · Q179–184

Q179 · Easy · *codex, slide 99*

Which process takes place in chloroplasts?

1. They are the site of photosynthesis
2. They are the site of cellular respiration
3. They are the site of protein secretion
4. They store calcium ions

✓ **Answer: A** — Chloroplasts are the site of photosynthesis.

A: Chloroplasts are the site of photosynthesis.
B: Respiration occurs in mitochondria. The right answer is: They are the site of photosynthesis.
C: Secretion involves the ER and Golgi.
D: Calcium storage is a smooth ER function.

Q180 · Easy · *codex, slide 99*

Which pigments capture sunlight in chloroplasts?

1. Chlorophylls
2. Catalase
3. Histones
4. Hydrolases

✓ **Answer: A** — Chloroplasts contain chlorophylls for capturing sunlight energy.

A: Chloroplasts contain chlorophylls for capturing sunlight energy.
B: Catalase is an enzyme in peroxisomes.
C: Histones are chromatin proteins. The right answer is: Chlorophylls.
D: Hydrolases are enzymes in lysosomes. The right answer is: Chlorophylls.

Q181 · Easy · *codex, slide 99*

How many membranes surround a chloroplast?

1. One
2. Three
3. None
4. Two

> ✓ **Answer: D** — Chloroplasts have a double membrane.

A: Chloroplasts have a double membrane. The right answer is: Two.
B: Chloroplasts have two membranes surrounding them.
C: Chloroplasts are membrane-bound organelles. The right answer is: Two.
D: Chloroplasts have a double membrane.

Q182 · Medium · *codex, slide 99*

What are the stacks of thylakoid disks in a chloroplast called?

1. Grana
2. Cristae
3. Cisternae
4. Lacunae

> ✓ **Answer: A** — Thylakoid disks are in stacks called grana.

A: Thylakoid disks are in stacks called grana.
B: Cristae are folds of the inner mitochondrial membrane.
C: Cisternae are Golgi sacs. The right answer is: Grana.
D: Lacunae are bone cavities. The right answer is: Grana.

Q183 · Medium · *codex, slide 99*

What is the fluid inside a chloroplast called?

1. The matrix
2. The nucleoplasm
3. The stroma
4. The cytosol

> ✓ **Answer: C** — The fluid of the chloroplast is the stroma.

A: The matrix is the inner compartment of the mitochondrion.
B: The nucleoplasm lies inside the nucleus.
C: The fluid of the chloroplast is the stroma.
D: The cytosol lies outside the organelles.

Q184 · Hard · *codex, slide 99*

A leaf cell loses its chlorophyll. Which process fails, and where is the pigment normally held?

1. Cellular respiration fails, and the pigment is in the cristae
2. Protein secretion fails, and the pigment is in the Golgi cisternae
3. Photosynthesis fails, and the pigment is in the thylakoid disks of the grana
4. DNA doubling fails, and the pigment is in the nucleolus

✓ **Answer: C** — Chlorophylls capture sunlight in the thylakoids of chloroplasts.

A: Cristae belong to mitochondria and hold no chlorophyll.
B: The Golgi does not hold chlorophyll.
C: Chlorophylls capture sunlight in the thylakoids of chloroplasts.
D: Chlorophyll is not found in the nucleolus.

Endosymbiont theory · Q185–190

Q185 · Easy · *codex, slide 100*

Which two organelles are thought to share a similar origin according to the endosymbiont theory?

1. Mitochondria and chloroplasts
2. Lysosomes and peroxisomes
3. Golgi and ER
4. Ribosomes and nucleoli

✓ **Answer: A** — Mitochondria and chloroplasts are thought to share a similar origin.

A: Mitochondria and chloroplasts are thought to share a similar origin.
B: These are not part of the endosymbiont theory.
C: These are endomembrane organelles, not endosymbionts.
D: These are not described as endosymbionts.

Q186 · Easy · *codex, slide 100*

According to the endosymbiont theory, what engulfed the prokaryotic cells?

1. Ancestors of viruses
2. Early lysosomes
3. Early peroxisomes
4. Ancestors of eukaryotic cells

✓ **Answer: D** — Prokaryotic cells were engulfed by ancestors of eukaryotic cells.

A: Viruses are not part of the theory.
B: Lysosomes are not described as the engulfers.
C: Peroxisomes are not described as the engulfers.
D: Prokaryotic cells were engulfed by ancestors of eukaryotic cells.

Q187 · Easy · *codex, slide 100*

Which structural feature of mitochondria and chloroplasts is evidence for the endosymbiont theory?

1. A single flat membrane
2. A double-membrane structure
3. A ring of nuclear pores
4. A cellulose wall

✓ **Answer: B** — A double membrane is listed as evidence.

A: They have double membranes. The right answer is: They have a double-membrane structure.
B: A double membrane is listed as evidence.
C: Nuclear pores belong to the nucleus.
D: A cellulose wall is not listed as evidence.

Q188 · Medium · *codex, slide 100*

Which other evidence supports the endosymbiont theory?

1. They have no DNA at all
2. They are produced by the Golgi apparatus
3. They are made of only protein
4. They have their own ribosomes and DNA

✓ **Answer: D** — Own ribosomes and DNA are listed as evidence.

A: They carry their own DNA. The right answer is: They have their own ribosomes and DNA.
B: Lysosomes, not these organelles, are produced by the Golgi.
C: They have membranes, ribosomes and DNA.
D: Own ribosomes and DNA are listed as evidence.

Q189 · Medium · *codex, slide 100*

Which behaviour of mitochondria and chloroplasts supports the endosymbiont theory?

1. They reproduce independently within the cell
2. They only form when the nucleus divides
3. They are assembled in the nucleolus
4. They are made by the rough ER

✓ **Answer: A** — Independent reproduction is listed as evidence.

A: Independent reproduction is listed as evidence.
B: They reproduce independently. The right answer is: They reproduce independently within the cell.
C: They are not assembled in the nucleolus.
D: They are not made by the rough ER.

Q190 · Hard · *codex, slide 100*

All of the following support the endosymbiont theory EXCEPT which one?

1. They have a double-membrane structure
2. They have a single membrane like the ER
3. They have their own ribosomes and DNA
4. They reproduce independently within the cell

> ✓ **Answer: B** — Correct choice.

A: This is evidence for the theory.
B: Correct choice. They have a double-membrane structure, which supports the theory.
C: This is evidence for the theory.
D: This is evidence for the theory.

Putting the organelles together · Q191–200

Q191 · Easy · *codex, slides 85 to 100*

Which organelle is the site of photosynthesis?

1. The mitochondrion
2. The lysosome
3. The peroxisome
4. The chloroplast in leaf cells

> ✓ **Answer: D** — Chloroplasts are the site of photosynthesis.

A: Mitochondria are the site of cellular respiration.
B: Lysosomes carry out intracellular digestion. The right answer is: The chloroplast in leaf cells.
C: Peroxisomes oxidise toxic substances and decompose hydrogen peroxide.
D: Chloroplasts are the site of photosynthesis.

Q192 · Easy · *codex, slides 85 to 100*

Which organelle carries out intracellular digestion?

1. The Golgi apparatus
2. The mitochondrion
3. The nucleolus
4. The lysosome

> ✓ **Answer: D** — Lysosomes carry out intracellular digestion.

A: The Golgi packages and ships materials.
B: Mitochondria carry out cellular respiration. The right answer is: The lysosome.
C: The nucleolus assembles ribosomal subunits. The right answer is: The lysosome.
D: Lysosomes carry out intracellular digestion.

Q193 · Easy · *codex, slides 89, 98*

Which organelle decomposes hydrogen peroxide using catalase?

1. The lysosome
2. The peroxisome
3. The mitochondrion
4. The Golgi apparatus

✓ **Answer: B** — Peroxisomes contain catalase, which decomposes hydrogen peroxide.

A: Lysosomes carry out intracellular digestion with hydrolytic enzymes.
B: Peroxisomes contain catalase, which decomposes hydrogen peroxide.
C: Mitochondria are the site of cellular respiration.
D: The Golgi packages materials for transport in vesicles.

Q194 · Medium · *codex, slides 85 to 100*

Which pairing of organelle and function is correct?

1. Rough ER: site of photosynthesis in leaf cells
2. Peroxisome: intracellular digestion with hydrolytic enzymes
3. Golgi apparatus: packaging materials for transport
4. Mitochondrion: assembly of ribosomal subunits

✓ **Answer: C** — The Golgi synthesises and packages materials for transport in vesicles.

A: Photosynthesis occurs in chloroplasts. The right answer is: Golgi apparatus: packaging materials for transport.
B: That describes the lysosome. The right answer is: Golgi apparatus: packaging materials for transport.
C: The Golgi synthesises and packages materials for transport in vesicles.
D: That occurs in the nucleolus. The right answer is: Golgi apparatus: packaging materials for transport.

Q195 · Medium · *codex, slides 85 to 100*

Which pair of organelles works together to prepare a secreted protein for export?

1. The nucleolus and the chloroplast
2. The mitochondrion and the peroxisome
3. The rough ER and the Golgi apparatus
4. The lysosome and the central vacuole

✓ **Answer: C** — The rough ER packages proteins and the Golgi ships them onward.

A: These have no role in secretion.
B: These do not prepare secreted proteins.
C: The rough ER packages proteins and the Golgi ships them onward.
D: These digest or store materials rather than prepare secretion.

Q196 · Medium · *codex, slides 85 to 100*

Pick the odd one out among these organelles.

1. The rough ER
2. The Golgi apparatus
3. The lysosome
4. The chloroplast in leaf cells

✓ **Answer: D** — Correct choice.

A: This is part of the endomembrane system.
B: This is part of the endomembrane system.
C: This is part of the endomembrane system.
D: Correct choice. The chloroplast is not part of the endomembrane system.

Q197 · Hard · *codex, slides 85 to 100*

Which sequence correctly traces a secreted protein from gene to export?

1. Gene in the nucleus, mRNA, bound ribosome on rough ER, Golgi apparatus, plasma membrane
2. Gene in the nucleus, mRNA, free ribosome in the cytosol, Golgi apparatus, plasma membrane
3. Gene in the nucleus, mRNA, bound ribosome on rough ER, lysosome, plasma membrane
4. Gene in the nucleolus, rRNA, bound ribosome on rough ER, Golgi apparatus, plasma membrane

✓ **Answer: A** — The gene is transcribed, and the protein is made on bound ribosomes, then passes to the Golgi and the plasma membrane.

A: The gene is transcribed, and the protein is made on bound ribosomes, then passes to the Golgi and the plasma membrane.
B: Secreted proteins are made on bound ribosomes, not free ribosomes.
C: The lysosome is not on the export route.
D: Genes for protein are transcribed to mRNA, not rRNA, in the nucleus.

Q198 · Hard · *codex, slides 85 to 100*

Which organelles contain their own DNA and ribosomes? I. Mitochondria II. Chloroplasts III. Lysosomes IV. Peroxisomes

1. I, II and III only
2. II and IV only
3. I and II only
4. I, III and IV only

✓ **Answer: C** — Mitochondria and chloroplasts have their own ribosomes and DNA, as the endosymbiont theory notes.

A: Lysosomes do not have their own DNA and ribosomes, so statement III is wrong.
B: This omits mitochondria and wrongly includes peroxisomes.
C: Mitochondria and chloroplasts have their own ribosomes and DNA, as the endosymbiont theory notes.
D: Lysosomes and peroxisomes do not have their own DNA and ribosomes.

Q199 · Hard · *codex, slides 85 to 100*

Which structure is NOT enclosed by a double membrane?

1. The nucleus
2. The lysosome
3. The mitochondrion
4. The chloroplast in leaf cells

✓ **Answer: B** — Correct choice.

A: The nucleus has a double-membrane envelope.
B: Correct choice. A lysosome has a single membrane.
C: Mitochondria have an outer and an inner membrane.
D: Chloroplasts have a double membrane. The right answer is: The lysosome.

Q200 · Devil · *codex, slide 85*

Which structure is NOT part of the endomembrane system as described in the lecture?

1. The mitochondrion, bounded by outer and inner membranes
2. The plasma membrane, where secreted proteins are exported
3. The nuclear envelope, continuous with the rough ER
4. The lysosome, which holds hydrolytic enzymes

✓ **Answer: A** — The lecture lists the nuclear envelope, ER, Golgi, lysosomes and plasma membrane; mitochondria are not included.

A: The lecture lists the nuclear envelope, ER, Golgi, lysosomes and plasma membrane; mitochondria are not included.
B: The plasma membrane is included in the endomembrane system and is where secreted proteins leave.
C: The nuclear envelope is listed as part of the endomembrane system.
D: Lysosomes are listed as part of the endomembrane system.

Module 2 — Microbodies → Intermediate filaments

slides 101 to 200 · 200 questions · 21 sections · bank: BIOL151_Question_Bank_Slides101-200.docx
Difficulty: 80 Easy · 80 Medium · 32 Hard · 8 Devil

Microbodies · Q201–208

Q201 · Easy · *codex, slides 101 to 102*

Which three organelles make up the microbodies?

1. Peroxisomes, glyoxysomes and hydrogenosomes
2. Lysosomes, ribosomes and central vacuoles
3. Mitochondria, chloroplasts and the nucleus
4. Golgi bodies, ER and transport vesicles

✓ **Answer: A** — Microbodies consist of peroxisomes, glyoxysomes and hydrogenosomes.

A: Microbodies consist of peroxisomes, glyoxysomes and hydrogenosomes.
B: These are not the three microbody types listed.
C: These are not microbodies. The right answer is: Peroxisomes, glyoxysomes and hydrogenosomes.
D: These belong to the endomembrane system, not the microbodies.

Q202 · Easy · *codex, slides 101 to 102*

How many membranes bound a microbody?

1. A single membrane
2. A double membrane
3. Three membranes
4. No membrane at all

✓ **Answer: A** — Microbodies are bounded by a single membrane.

A: Microbodies are bounded by a single membrane.
B: A double membrane surrounds mitochondria and chloroplasts.
C: No microbody has three membranes. The right answer is: A single membrane.
D: Microbodies are membrane-bounded vesicle-like organelles. The right answer is: A single membrane.

Q203 · Easy · *codex, slides 101 to 102*

Microbodies are concerned largely with which process?

1. Oxidation
2. Photosynthesis
3. Translation
4. DNA replication

✓ **Answer: A** — Microbodies are concerned largely with oxidation.

A: Microbodies are concerned largely with oxidation.
B: Photosynthesis occurs in chloroplasts. The right answer is: Oxidation.
C: Translation takes place on ribosomes. The right answer is: Oxidation.
D: DNA replication occurs in the nucleus.

Q204 · Medium · *codex, slides 101 to 102*

In which vertebrate organs are microbodies found?

1. The liver and kidneys
2. The skin and hair follicles
3. The bones and cartilage
4. The heart and lungs

> ✓ **Answer: A** — Microbodies are found in the liver and kidneys of vertebrates.

A: Microbodies are found in the liver and kidneys of vertebrates.
B: These are not named as microbody sites.
C: These are not named as microbody sites.
D: These are not named as microbody sites.

Q205 · Medium · *codex, slides 101 to 102*

Which description fits microbodies?

1. Large uniform organelles bounded by a double membrane
2. Small vesicle-like organelles bounded by a single membrane
3. Membraneless granules that assemble ribosomal subunits
4. Flattened sacs that package and ship proteins for secretion

> ✓ **Answer: B** — They are a heterogeneous group of small vesicle-like organelles with one membrane.

A: Microbodies are small, varied and single-membrane.
B: They are a heterogeneous group of small vesicle-like organelles with one membrane.
C: Microbodies have a membrane and do not assemble ribosomes.
D: That describes the Golgi apparatus. The right answer is: Small vesicle-like organelles bounded by a single membrane.

Q206 · Medium · *codex, slides 101 to 102*

Microbodies are found in all of the following EXCEPT which one?

1. The leaves and seeds of plants
2. The cell wall of bacteria
3. Protozoa and yeasts
4. The liver of vertebrates

> ✓ **Answer: B** — Correct choice.

A: They are found in plant leaves and seeds.
B: Correct choice. Microbodies are organelles and are not found in the bacterial cell wall.
C: They are found in protozoa, yeasts and other fungi.
D: They are found in the liver of vertebrates.

Q207 · Hard · *codex, slides 101 to 102*

Which feature distinguishes microbodies from mitochondria and chloroplasts?

1. They produce ATP by photosynthesis in light
2. They have a single bounding membrane
3. They contain cristae and a matrix inside
4. They are found only in bacteria and archaea

✓ **Answer: B** — Microbodies are single-membrane vesicle-like organelles.

A: Photosynthesis occurs in chloroplasts. The right answer is: They have a single bounding membrane.
B: Microbodies are single-membrane vesicle-like organelles.
C: Cristae and matrix are mitochondrial features.
D: Microbodies occur in eukaryotes such as plants, fungi and vertebrates.

Q208 · Hard · *codex, slides 101 to 102*

A cell biologist isolates small, oval, single-membrane vesicles from liver tissue that mainly carry out oxidation. Which group do they belong to?

1. Mitochondria
2. Microbodies
3. Chloroplasts
4. Golgi cisternae

✓ **Answer: B** — Microbodies are small oxidative vesicles found in liver and kidney.

A: Mitochondria have double membranes and carry out respiration.
B: Microbodies are small oxidative vesicles found in liver and kidney.
C: Chloroplasts occur in plants and have double membranes.
D: Golgi cisternae are flattened sacs that package materials.

Peroxisomes: enzymes and reactions · Q209–220

Q209 · Easy · *codex, slides 103 to 105*

About how many enzymes do peroxisomes contain, according to the lecture?

1. About 50
2. About 5
3. About 500
4. About 5,000

✓ **Answer: A** — The lecture says peroxisomes contain about 50 enzymes.

A: The lecture says peroxisomes contain about 50 enzymes.
B: This is far too few. The right answer is: About 50.
C: This is ten times too many.
D: This is far too many. The right answer is: About 50.

Q210 · Easy · *codex, slides 103 to 105*

Peroxisomes are morphologically similar to which other organelle?

1. Mitochondria
2. Lysosomes
3. Chloroplasts
4. The nucleus

✓ **Answer: B** — Peroxisomes look similar to lysosomes.

A: Mitochondria have double membranes and cristae.
B: Peroxisomes look similar to lysosomes.
C: Chloroplasts have thylakoids and double membranes.
D: The nucleus has a double envelope with pores.

Q211 · Easy · *codex, slides 103 to 105*

Which substrate is broken down by oxidative reactions in peroxisomes?

1. Uric acid
2. Starch
3. Cellulose
4. Chlorophyll

✓ **Answer: A** — Uric acid is among the substrates oxidised in peroxisomes.

A: Uric acid is among the substrates oxidised in peroxisomes.
B: Starch is not named as a peroxisome substrate.
C: Cellulose is not named as a peroxisome substrate.
D: Chlorophyll is a pigment and not a peroxisome substrate.

Q212 · Easy · *codex, slides 103 to 105*

Which enzyme converts urate into allantoin, CO_2 and H_2O_2?

1. Urate oxidase
2. Catalase
3. Pepsin
4. Amylase

✓ **Answer: A** — Urate oxidase catabolises urate to allantoin, CO_2 and H_2O_2.

A: Urate oxidase catabolises urate to allantoin, CO_2 and H_2O_2.
B: Catalase decomposes hydrogen peroxide. The right answer is: Urate oxidase.
C: Pepsin digests proteins in the stomach.
D: Amylase digests starch. The right answer is: Urate oxidase.

Q213 · Medium · *codex, slides 103 to 105*

Which three enzymes are named as peroxisome enzymes in the lecture?

1. Pepsin, amylase and lipase of the gut
2. DNA polymerase, helicase and DNA ligase
3. Urate oxidase, D-amino acid oxidase and catalase
4. ATP synthase, cytochrome c and NADH dehydrogenase

✓ **Answer: C** — These three enzymes are named in peroxisomes.

A: These are digestive enzymes of the gut.
B: These are DNA replication enzymes. The right answer is: Urate oxidase, D-amino acid oxidase and catalase.
C: These three enzymes are named in peroxisomes.
D: These are respiratory chain components of mitochondria.

Q214 · Medium · *codex, slides 103 to 105*

What can catalase convert hydrogen peroxide into?

1. Glucose
2. Methane
3. Hydrogen gas
4. Water

✓ **Answer: D** — Catalase converts hydrogen peroxide to water, or uses it to oxidise another compound.

A: Catalase does not make glucose. The right answer is: Water.
B: Catalase does not make methane. The right answer is: Water.
C: Catalase does not make hydrogen gas.
D: Catalase converts hydrogen peroxide to water, or uses it to oxidise another compound.

Q215 · Medium · *codex, slides 103 to 105*

Which peroxisomal process provides a major source of metabolic energy?

1. Photosynthesis in thylakoids
2. Digestion by hydrolases
3. Oxidation of fatty acids
4. Transcription of rRNA

✓ **Answer: C** — Fatty acid oxidation is a major source of metabolic energy.

A: Photosynthesis occurs in chloroplasts. The right answer is: Oxidation of fatty acids.
B: Hydrolytic digestion is a lysosome function.
C: Fatty acid oxidation is a major source of metabolic energy.
D: rRNA is made in the nucleolus.

Q216 · Medium · *codex, slides 103 to 105*

Where are fatty acids oxidised in animal cells?

1. Only in peroxisomes of the cell
2. In both peroxisomes and mitochondria
3. Only in the mitochondria of the cell
4. Only in lysosomes of the cell

✓ **Answer: B** — In animal cells fatty acids are oxidised in both organelles.

A: In animal cells mitochondria also oxidise fatty acids.
B: In animal cells fatty acids are oxidised in both organelles.
C: Peroxisomes also oxidise fatty acids in animal cells.
D: Lysosomes digest materials and do not oxidise fatty acids.

Q217 · Medium · *codex, slides 103 to 105*

In which organisms is fatty acid oxidation restricted to peroxisomes?

1. Humans and mice
2. Bacteria and archaea
3. Yeasts and plants
4. Birds and fish

✓ **Answer: C** — In yeasts and plants fatty acid oxidation is restricted to peroxisomes.

A: In animal cells both peroxisomes and mitochondria oxidise fatty acids.
B: Prokaryotes do not have peroxisomes. The right answer is: Yeasts and plants.
C: In yeasts and plants fatty acid oxidation is restricted to peroxisomes.
D: These are animals, where mitochondria also oxidise fatty acids.

Q218 · Medium · *codex, slides 103 to 105*

All of the following are substrates broken down by peroxisomal oxidation EXCEPT which one?

1. Uric acid from purine breakdown
2. Amino acids such as D-amino acids
3. Cellulose from plant cell walls
4. Fatty acids from stored lipids

✓ **Answer: C** — Correct choice.

A: Uric acid is a named substrate.
B: Amino acids are named substrates. The right answer is: Cellulose from plant cell walls.
C: Correct choice. Cellulose is not named as a peroxisomal substrate.
D: Fatty acids are named substrates. The right answer is: Cellulose from plant cell walls.

Q219 · Hard · *codex, slides 103 to 105*

Which statement correctly links each peroxisomal enzyme to its role?

1. Catalase breaks down urate, urate oxidase acts on amino acids, and D-amino acid oxidase disposes of hydrogen peroxide
2. D-amino acid oxidase breaks down urate, catalase acts on amino acids, and urate oxidase disposes of hydrogen peroxide
3. Urate oxidase disposes of hydrogen peroxide, catalase acts on amino acids, and D-amino acid oxidase breaks down urate
4. Urate oxidase breaks down urate, D-amino acid oxidase acts on amino acids, and catalase disposes of hydrogen peroxide

✓ **Answer: D** — Each enzyme has the role stated.

A: These roles are swapped. The right answer is: Urate oxidase breaks down urate, D-amino acid oxidase acts on amino acids, and catalase disposes of hydrogen peroxide.
B: These roles are swapped. The right answer is: Urate oxidase breaks down urate, D-amino acid oxidase acts on amino acids, and catalase disposes of hydrogen peroxide.
C: These roles are swapped. The right answer is: Urate oxidase breaks down urate, D-amino acid oxidase acts on amino acids, and catalase disposes of hydrogen peroxide.
D: Each enzyme has the role stated.

Q220 · Hard · *codex, slides 103 to 105*

A yeast cell with defective peroxisomes cannot grow on fatty acids as its only fuel. Why?

1. Yeasts oxidise fatty acids equally in mitochondria, so a defect would not matter
2. Fatty acids are digested only by lysosomes in yeasts
3. Fatty acid oxidation is restricted to peroxisomes in yeasts
4. Catalase is the only enzyme that can oxidise fatty acids

✓ **Answer: C** — Without peroxisomes the yeast cannot oxidise fatty acids.

A: In yeasts the oxidation is restricted to peroxisomes.
B: Lysosomes do not oxidise fatty acids.
C: Without peroxisomes the yeast cannot oxidise fatty acids.
D: Catalase decomposes hydrogen peroxide and does not oxidise fatty acids.

Glyoxysomes · Q221–228

Q221 · Easy · *codex, slides 106 to 107*

In which kind of cells are glyoxysomes found?

1. Human liver cells
2. Bacterial cells
3. Animal muscle cells
4. Some plant cells

✓ **Answer: D** — Glyoxysomes are found in some plant cells.

A: Glyoxysomes are plant microbodies. The right answer is: Some plant cells.
B: Bacteria do not have glyoxysomes. The right answer is: Some plant cells.
C: Glyoxysomes are plant microbodies. The right answer is: Some plant cells.
D: Glyoxysomes are found in some plant cells.

Q222 · Easy · *codex, slides 106 to 107*

A glyoxysome is a specialised form of which organelle?

1. Lysosome
2. Mitochondrion
3. Golgi apparatus
4. Peroxisome

✓ **Answer: D** — A glyoxysome is a specialised form of peroxisome.

A: Lysosomes are a different organelle. The right answer is: Peroxisome.
B: Mitochondria have a double membrane. The right answer is: Peroxisome.
C: The Golgi is a stack of cisternae.
D: A glyoxysome is a specialised form of peroxisome.

Q223 · Easy · *codex, slides 106 to 107*

Glyoxysomes are notably found in the cells of what?

1. Mature leaves
2. Germinating seeds
3. Root hairs
4. Dead cork tissue

✓ **Answer: B** — Glyoxysomes are notable in germinating seeds.

A: The lecture names germinating seeds. The right answer is: Germinating seeds.
B: Glyoxysomes are notable in germinating seeds.
C: The lecture names germinating seeds. The right answer is: Germinating seeds.
D: Cork consists of dead cell walls.

Q224 · Medium · *codex, slides 106 to 107*

Glyoxysomes contain the enzymes of which cycle?

1. The glyoxylate cycle
2. The Calvin cycle
3. The urea cycle
4. The cell cycle

✓ **Answer: A** — Glyoxysomes contain the enzymes of the glyoxylate cycle.

A: Glyoxysomes contain the enzymes of the glyoxylate cycle.
B: The Calvin cycle belongs to photosynthesis.
C: The urea cycle is not named for glyoxysomes.
D: The cell cycle describes cell division.

Q225 · Medium · *codex, slides 106 to 107*

The glyoxylate cycle is a variant of which cycle?

1. The Calvin cycle
2. The urea cycle
3. The cell cycle
4. The citric acid cycle

✓ **Answer: D** — It is a variant of the citric acid cycle.

A: The Calvin cycle is a separate pathway.
B: The urea cycle is a separate pathway.
C: The cell cycle is not a metabolic cycle.
D: It is a variant of the citric acid cycle.

Q226 · Medium · *codex, slides 106 to 107*

What does the glyoxylate cycle allow plants to convert?

1. Stored lipids into carbohydrates
2. Stored carbohydrates into lipids
3. Stored proteins into new DNA strands
4. Light energy into ATP in thylakoids

✓ **Answer: A** — Stored lipids are converted to carbohydrates.

A: Stored lipids are converted to carbohydrates.
B: This reverses the conversion. The right answer is: Stored lipids into carbohydrates.
C: This is not what the cycle does.
D: This describes photosynthesis. The right answer is: Stored lipids into carbohydrates.

Q227 · Hard · *codex, slides 106 to 107*

A germinating seed must move energy from fat reserves to growing tissues. How do glyoxysomes help?

1. They convert sugars into immobile fats for later storage
2. They digest the seed coat with hydrolytic enzymes
3. They convert immobile fat reserves into transportable sugars
4. They capture sunlight to make sugars inside the seed

✓ **Answer: C** — Fat reserves become sugars that can be transported to growing tissues.

A: This reverses the direction of conversion.
B: Digesting the coat is not their role.
C: Fat reserves become sugars that can be transported to growing tissues.
D: Glyoxysomes do not capture light. The right answer is: They convert immobile fat reserves into transportable sugars.

Q228 · Devil · *codex, slides 106 to 107*

Which sequence describes what happens to seed fats in glyoxysomes?

1. Fats form succinate, the cycle gives acetyl CoA, and acetyl CoA goes to mitochondria for gluconeogenesis
2. Fats form acetyl CoA, the glyoxylate cycle gives succinate, and succinate goes to mitochondria for gluconeogenesis
3. Fats form glucose, glucose gives acetyl CoA, and acetyl CoA is stored in the nucleus
4. Fats form acetyl CoA, which goes straight to chloroplasts for photosynthesis

✓ **Answer: B** — This is the sequence given in the lecture.

A: Acetyl CoA feeds the cycle and succinate is the product.
B: This is the sequence given in the lecture.
C: This does not follow the glyoxylate pathway.
D: Succinate goes to mitochondria, not chloroplasts.

Hydrogenosomes · Q229–233

Q229 · Easy · *codex, slide 108*

Which gas does a hydrogenosome release as a by-product?

1. Molecular hydrogen (H_2)
2. Oxygen
3. Methane
4. Nitrogen

✓ **Answer: A** — Hydrogenosomes release molecular hydrogen.

A: Hydrogenosomes release molecular hydrogen. It matches what the lecture slides state.
B: Oxygen is not the by-product. The right answer is: Molecular hydrogen (H_2).
C: Methane is produced by some archaea, not by hydrogenosomes.
D: Nitrogen is not the by-product. The right answer is: Molecular hydrogen (H_2).

Q230 · Easy · *codex, slide 108*

Hydrogenosomes are found in which kind of cells?

1. All aerobic bacterial cells
2. Some anaerobic eukaryotic cells
3. Only plant leaf mesophyll cells
4. Only mature red blood cells

✓ **Answer: B** — They occur in some anaerobic eukaryotes.

A: They are found in eukaryotes. The right answer is: Some anaerobic eukaryotic cells.
B: They occur in some anaerobic eukaryotes.
C: They are not limited to plants.
D: Red blood cells lack organelles like these.

Q231 · Medium · *codex, slide 108*

Under which condition do hydrogenosomes release hydrogen during energy generation?

1. Bright light and high temperatures
2. High oxygen levels and abundant air
3. Freezing temperatures and darkness
4. Anaerobic, oxygen-deficient conditions

✓ **Answer: D** — Hydrogen release occurs under anaerobic conditions.

A: Light is not the condition. The right answer is: Anaerobic, oxygen-deficient conditions.
B: Oxygen-rich conditions are not the setting.
C: Temperature is not the condition named.
D: Hydrogen release occurs under anaerobic conditions.

Q232 · Medium · *codex, slide 108*

Which groups are listed as having hydrogenosomes?

1. Cyanobacteria, archaea and spirochetes
2. Ciliates, trichomonads, fungi and animals
3. Mosses, ferns and flowering plants
4. Viruses, prions, viroids and phages

✓ **Answer: B** — Hydrogenosomes occur in some of each group.

A: These are prokaryotes without hydrogenosomes. The right answer is: Ciliates, trichomonads, fungi and animals.
B: Hydrogenosomes occur in some of each group.
C: These plant groups are not listed.
D: These are not cells. The right answer is: Ciliates, trichomonads, fungi and animals.

Q233 · Hard · *codex, slide 108*

Which statement about hydrogenosomes is correct?

1. They are double-membrane organelles that release O_2 during photosynthesis
2. They are membrane-enclosed organelles that release H_2 under anaerobic conditions
3. They are membraneless granules that store nutrients in bacteria
4. They are single-membrane organelles that digest cell debris at pH 5

✓ **Answer: B** — This summarises the lecture definition.

A: This describes chloroplasts. The right answer is: They are membrane-enclosed organelles that release H_2 under anaerobic conditions.
B: This summarises the lecture definition.
C: This describes inclusion granules. The right answer is: They are membrane-enclosed organelles that release H_2 under anaerobic conditions.
D: This describes lysosomes. The right answer is: They are membrane-enclosed organelles that release H_2 under anaerobic conditions.

Lysosomes: formation, enzymes and pH · Q234–247

Q234 · Easy · *codex, slides 109 to 111*

Where are lysosomes formed?

1. In the Golgi complex
2. In the nucleolus
3. In the mitochondrion
4. In the chloroplast

✓ **Answer: A** — Lysosomes are formed in the Golgi complex.

A: Lysosomes are formed in the Golgi complex.
B: The nucleolus assembles ribosomal subunits. The right answer is: In the Golgi complex.
C: Mitochondria make ATP. The right answer is: In the Golgi complex.
D: Chloroplasts carry out photosynthesis. The right answer is: In the Golgi complex.

Q235 · Easy · *codex, slides 109 to 111*

What are lysosomes filled with?

1. Chlorophyll
2. Ribosomal RNA
3. Digestive enzymes
4. Hydrogen gas

✓ **Answer: C** — Lysosomes are filled with digestive enzymes.

A: Chlorophyll is found in chloroplasts. The right answer is: Digestive enzymes.
B: rRNA is found in the nucleolus and ribosomes.
C: Lysosomes are filled with digestive enzymes.
D: Hydrogen is released by hydrogenosomes. The right answer is: Digestive enzymes.

Q236 · Easy · *codex, slides 109 to 111*

What internal pH do lysosomes reach?

1. About 7.0
2. About 9.0
3. About 2.0
4. About 5.0

✓ **Answer: D** — Lysosomes pump in H^+ until the internal pH reaches about 5.0.

A: This is neutral and not the lysosomal pH.
B: This is alkaline and not the lysosomal pH.
C: This is too acidic. The right answer is: About 5.0.
D: Lysosomes pump in H^+ until the internal pH reaches about 5.0.

Q237 · Easy · *codex, slides 109 to 111*

Roughly how many hydrolytic enzymes do lysosomes contain?

1. About 6
2. About 600
3. About 60
4. About 6,000

✓ **Answer: C** — Lysosomes contain about 60 hydrolytic enzymes.

A: This is far too few. The right answer is: About 60.
B: This is ten times too many.
C: Lysosomes contain about 60 hydrolytic enzymes.
D: This is far too many. The right answer is: About 60.

Q238 · Easy · *codex, slides 109 to 111*

Which ions do lysosomes pump in to reach their internal pH?

1. Na^+ ions
2. Ca^{2+} ions
3. Cl^- ions
4. H^+ ions

✓ **Answer: D** — Protons are pumped in until the pH is about 5.0.

A: Sodium is not the ion pumped in.
B: Calcium is stored in the smooth ER.
C: Chloride is not the ion pumped in.
D: Protons are pumped in until the pH is about 5.0.

Q239 · Easy · *codex, slides 109 to 111*

What do lysosomes do to foreign substances?

1. They store them as pigments
2. They oxidise them using catalase
3. They digest them
4. They export them from the cell

✓ **Answer: C** — Lysosomes digest foreign substances.

A: Pigment storage is a vacuole function.
B: Catalase is found in peroxisomes. The right answer is: They digest them.
C: Lysosomes digest foreign substances. It matches what the lecture slides state.
D: Export involves the Golgi and plasma membrane.

Q240 · Medium · *codex, slides 109 to 111*

Which pump moves protons into the lysosome?

1. A porin in the outer membrane
2. A calcium channel in the smooth ER
3. A nucleoporin in the nuclear pore
4. An H^+-ATPase in the lysosome membrane

✓ **Answer: D** — The H^+-ATPase pumps protons into the lysosome.

A: Porins are bacterial channels. The right answer is: An H^+-ATPase in the lysosome membrane.
B: This is not the proton pump.
C: Nucleoporins form pores in the nuclear envelope.
D: The H^+-ATPase pumps protons into the lysosome.

Q241 · Medium · *codex, slides 109 to 111*

What does the internal pH of about 5.0 do?

1. It destroys the lysosomal membrane
2. It activates the lysosomal enzymes
3. It stops hydrolysis completely
4. It makes the lysosome permeable to enzymes

✓ **Answer: B** — The acidic pH activates the lysosomal enzymes.

A: The membrane resists digestion. The right answer is: It activates the lysosomal enzymes.
B: The acidic pH activates the lysosomal enzymes.
C: The pH activates the enzymes. The right answer is: It activates the lysosomal enzymes.
D: The membrane is impermeable to the enzymes.

Q242 · Medium · *codex, slides 109 to 111*

What does autolysis mean for lysosomes?

1. They digest bacteria taken in by phagocytes
2. They are formed by the Golgi complex
3. They release hydrogen under anaerobic conditions
4. They recycle the cell's own organelles

✓ **Answer: D** — Autolysis is the recycling of the cell's own organelles.

A: That is heterophagy. The right answer is: They recycle the cell's own organelles.
B: That describes lysosome formation. The right answer is: They recycle the cell's own organelles.
C: That describes hydrogenosomes. The right answer is: They recycle the cell's own organelles.
D: Autolysis is the recycling of the cell's own organelles.

Q243 · Medium · *codex, slides 109 to 111*

What does the lecture say happens to lysosomes after cell death?

1. Lysosomal damage occurs after death
2. Lysosomes multiply after death
3. Lysosomes turn into peroxisomes
4. Lysosomes remain unchanged

✓ **Answer: A** — The lecture notes lysosomal damage after death.

A: The lecture notes lysosomal damage after death.
B: They are damaged, not multiplied. The right answer is: Lysosomal damage occurs after death.
C: There is no such conversion. The right answer is: Lysosomal damage occurs after death.
D: The lecture notes damage after death.

Q244 · Medium · *codex, slides 109 to 111*

Lysosomes are described as what kind of structures?

1. Membrane-bound vesicles
2. Membraneless granules
3. Double-membrane organelles
4. Protein filaments

✓ **Answer: A** — Lysosomes are membrane-bound vesicles.

A: Lysosomes are membrane-bound vesicles. It matches what the lecture slides state.
B: Lysosomes have a membrane. The right answer is: Membrane-bound vesicles.
C: Lysosomes have a single membrane. The right answer is: Membrane-bound vesicles.
D: Filaments belong to the cytoskeleton. The right answer is: Membrane-bound vesicles.

Q245 · Medium · *codex, slides 109 to 111*

All of the following are true of lysosomes EXCEPT which one?

1. They are formed in the Golgi complex
2. They are filled with digestive enzymes
3. They are formed in the nucleolus
4. They pump H^+ ions until the pH reaches 5.0

✓ **Answer: C** — Correct choice.

A: This is true. The right answer is: They are formed in the nucleolus.
B: This is true. The right answer is: They are formed in the nucleolus.
C: Correct choice. Lysosomes are formed in the Golgi complex.
D: This is true. The right answer is: They are formed in the nucleolus.

Q246 · Hard · *codex, slides 109 to 111*

A lysosome has a defective H^+-ATPase. Why would it fail to digest material?

1. Without proton pumping the lysosome membrane dissolves in its own enzymes
2. Without proton pumping the lysosome cannot form in the Golgi complex
3. Without proton pumping the pH does not fall to about 5.0, so the enzymes stay inactive
4. Without proton pumping the hydrolases move out into the cytosol

✓ **Answer: C** — The enzymes are activated by the acidic pH.

A: The membrane resists digestion by the hydrolases.
B: Formation in the Golgi does not depend on this pump.
C: The enzymes are activated by the acidic pH.
D: The membrane is normally impermeable to the enzymes.

Q247 · Hard · *codex, slides 109 to 111*

Which sequence is correct for a lysosome?

1. The hydrolases become active, the H^+-ATPase acidifies it, and the Golgi then forms it
2. The nucleolus forms it, catalase acidifies it, and the hydrolases become active
3. The Golgi forms it, the H^+-ATPase acidifies it to about pH 5, and the hydrolases become active
4. The ER forms it, the porins acidify it, and the hydrolases become active

✓ **Answer: C** — Formation, acidification and enzyme activation follow this order.

A: The order is reversed. The right answer is: The Golgi forms it, the H^+-ATPase acidifies it to about pH 5, and the hydrolases become active.
B: The nucleolus and catalase are not involved.
C: Formation, acidification and enzyme activation follow this order.
D: Porins are bacterial channels. The right answer is: The Golgi forms it, the H^+-ATPase acidifies it to about pH 5, and the hydrolases become active.

Lysosomal digestion pathways · Q248–257

Q248 · Easy · *codex, slides 110 to 112*

Digestion of material that enters from outside the cell is called what?

1. Autophagy
2. Apoptosis
3. Heterophagy
4. Endocytosis

✓ **Answer: C** — Digestion of extracellular material is heterophagy.

A: Autophagy is degradation of intracellular material.
B: Apoptosis is programmed cell death. The right answer is: Heterophagy.
C: Digestion of extracellular material is heterophagy.
D: Endocytosis is the uptake of material into the cell.

Q249 · Easy · *codex, slides 110 to 112*

What is it called when lysosomes break down the cell's own components?

1. Autophagy
2. Heterophagy
3. Transcription
4. Exocytosis

✓ **Answer: A** — Degradation of intracellular material is autophagy.

A: Degradation of intracellular material is autophagy.
B: Heterophagy is digestion of extracellular material.
C: Transcription copies DNA into RNA. The right answer is: Autophagy.
D: Exocytosis releases material from the cell.

Q250 · Easy · *codex, slides 110 to 112*

What does an endosome fuse with to form a secondary lysosome?

1. A peroxisome
2. A mitochondrion
3. A primary lysosome
4. A chloroplast

✓ **Answer: C** — An endosome fuses with a primary lysosome.

A: Peroxisomes are not the fusion partner.
B: Mitochondria are not the fusion partner.
C: An endosome fuses with a primary lysosome.
D: Chloroplasts are not the fusion partner.

Q251 · Medium · *codex, slides 110 to 112*

What are phagocytic vesicles also called?

1. Phagosomes
2. Endosomes
3. Cisternae
4. Thylakoids

✓ **Answer: A** — Phagocytic vesicles are also called phagosomes.

A: Phagocytic vesicles are also called phagosomes.
B: Endosomes arise from receptor-mediated endocytosis. The right answer is: Phagosomes.
C: Cisternae are Golgi sacs. The right answer is: Phagosomes.
D: Thylakoids are chloroplast disks. The right answer is: Phagosomes.

Q252 · Medium · *codex, slides 110 to 112*

Coated vesicles from receptor-mediated endocytosis deliver their contents to which vesicle?

1. A glyoxysome
2. An endosome
3. A hydrogenosome
4. A nucleolus

✓ **Answer: B** — Coated vesicles deliver contents to an endosome.

A: Glyoxysomes occur in plant seeds. The right answer is: An endosome.
B: Coated vesicles deliver contents to an endosome.
C: Hydrogenosomes release hydrogen. The right answer is: An endosome.
D: The nucleolus is inside the nucleus.

Q253 · Medium · *codex, slides 110 to 112*

Which intracellular materials can lysosomes degrade?

1. Only chromosomes
2. Only the nuclear envelope
3. Only the cell wall
4. Mitochondria and ribosomes

✓ **Answer: D** — Lysosomes can degrade mitochondria and ribosomes.

A: Chromosomes are not the example given.
B: The nuclear envelope is not the example given.
C: Lysosomes digest intracellular material. The right answer is: Mitochondria and ribosomes.
D: Lysosomes can degrade mitochondria and ribosomes.

Q254 · Medium · *codex, slides 110 to 112*

The lysosomal membrane is freely permeable to which molecules?

1. The hydrolytic enzymes themselves
2. Low molecular weight products of hydrolysis
3. The large substrates awaiting digestion
4. All large proteins of the cytosol

✓ **Answer: B** — The small products can leave the lysosome.

A: The membrane is impermeable to the enzymes.
B: The small products can leave the lysosome.
C: It is impermeable to substrates normally.
D: The membrane does not freely pass large proteins.

Q255 · Hard · *codex, slides 110 to 112*

Which statement about the lysosomal membrane is NOT true?

1. It is readily digested by the hydrolases inside the lysosome
2. It is normally impermeable to the enzymes and their substrates
3. It is freely permeable to low molecular weight products of hydrolysis
4. It resists digestion by the lysosomal hydrolases

✓ **Answer: A** — Correct choice.

A: Correct choice. The membrane is resistant to digestion by the lysosomal hydrolases.
B: This is true. The right answer is: It is readily digested by the hydrolases inside the lysosome.
C: This is true. The right answer is: It is readily digested by the hydrolases inside the lysosome.
D: This is true. The right answer is: It is readily digested by the hydrolases inside the lysosome.

Q256 · Hard · *codex, slides 110 to 112*

A phagocytic vesicle fuses with a primary lysosome. What forms, and what does it allow?

1. A primary lysosome, allowing synthesis of new enzymes
2. A secondary lysosome, allowing digestion of the ingested material
3. A glyoxysome, allowing conversion of fats into sugars
4. A hydrogenosome, allowing release of hydrogen

✓ **Answer: B** — Fusion forms a secondary lysosome where digestion occurs.

A: The product is a secondary lysosome that digests.
B: Fusion forms a secondary lysosome where digestion occurs.
C: Glyoxysomes are plant microbodies. The right answer is: A secondary lysosome, allowing digestion of the ingested material.
D: Hydrogenosomes are different organelles. The right answer is: A secondary lysosome, allowing digestion of the ingested material.

Q257 · Devil · *codex, slides 110 to 112*

Which pathway describes digestion after receptor-mediated endocytosis?

1. Coated vesicle, endosome, fusion to a secondary lysosome, then products enter the cytosol
2. Coated vesicle, secondary lysosome, endosome, then fusion with a primary lysosome
3. Endosome, coated vesicle, peroxisome, then absorption into the nucleus
4. Phagosome, glyoxysome, hydrogenosome, then release from the cell

✓ **Answer: A** — This is the pathway in the lecture.

A: This is the pathway in the lecture.
B: The endosome comes before the secondary lysosome.
C: Peroxisomes and the nucleus are not on this pathway.
D: These organelles are not on the pathway.

Lysosomes in disease · Q258–269

Q258 · Easy · *codex, slides 113 to 116*

Which condition results from inhaling silica particles into the lungs?

1. Asbestosis
2. Black lung disease
3. Silicosis
4. Tay-Sachs disease

✓ **Answer: C** — Silicosis results from inhaling silica particles.

A: Asbestosis results from inhaling asbestos fibres.
B: Black lung disease results from inhaling coal dust.
C: Silicosis results from inhaling silica particles.
D: Tay-Sachs disease is a genetic lysosomal disorder.

Q259 · Easy · *codex, slides 113 to 116*

Asbestosis is caused by breathing in what?

1. Silica particles
2. Coal dust
3. Pollen grains
4. Asbestos fibres

✓ **Answer: D** — Asbestosis is caused by breathing in asbestos fibres.

A: That causes silicosis. The right answer is: Asbestos fibres.
B: That causes black lung disease. The right answer is: Asbestos fibres.
C: Pollen is not the cause named.
D: Asbestosis is caused by breathing in asbestos fibres.

Q260 · Easy · *codex, slides 113 to 116*

Black lung disease is caused by breathing in what?

1. Asbestos fibres
2. Coal dust
3. Silica particles
4. Smoke from wood fires

✓ **Answer: B** — Black lung disease is caused by breathing in coal dust.

A: That causes asbestosis. The right answer is: Coal dust.
B: Black lung disease is caused by breathing in coal dust.
C: That causes silicosis. The right answer is: Coal dust.
D: This is not the cause named.

Q261 · Easy · *codex, slides 113 to 116*

Which cells take up inhaled silica particles?

1. Phagocytes
2. Fibroblasts
3. Red blood cells
4. Osteocytes

✓ **Answer: A** — Phagocytes take up the silica particles.

A: Phagocytes take up the silica particles.
B: Fibroblasts deposit collagen later. The right answer is: Phagocytes.
C: Red blood cells carry oxygen. The right answer is: Phagocytes.
D: Osteocytes maintain bone matrix. The right answer is: Phagocytes.

Q262 · Easy · *codex, slides 113 to 116*

Tay-Sachs disease is caused by the absence of what?

1. A single lysosomal enzyme
2. A mitochondrial membrane
3. A nuclear pore protein
4. A ribosomal subunit

✓ **Answer: A** — It is caused by absence of a single lysosomal enzyme.

A: It is caused by absence of a single lysosomal enzyme.
B: Mitochondrial membranes are not the cause.
C: Nuclear pore proteins are not the cause.
D: Ribosomal subunits are not the cause.

Q263 · Medium · *codex, slides 113 to 116*

What does inhaled silica do to lysosomal membranes in phagocytes?

1. It strengthens them against digestion
2. It converts them into peroxisomes
3. It reacts with them, rupturing them
4. It has no effect on them at all

✓ **Answer: C** — Silica reacts with the lysosomal membranes, which then rupture.

A: The silica damages the membranes. The right answer is: It reacts with them, rupturing them.
B: There is no such conversion. The right answer is: It reacts with them, rupturing them.
C: Silica reacts with the lysosomal membranes, which then rupture.
D: The reaction ruptures the membranes. The right answer is: It reacts with them, rupturing them.

Q264 · Medium · *codex, slides 113 to 116*

Which cells deposit collagen fibres in silicosis?

1. Phagocytes
2. Fibroblasts
3. Red blood cells
4. Neurons

✓ **Answer: B** — Fibroblasts are stimulated to deposit collagen.

A: Phagocytes die after taking up silica.
B: Fibroblasts are stimulated to deposit collagen.
C: They are not involved. The right answer is: Fibroblasts.
D: They are not involved. The right answer is: Fibroblasts.

Q265 · Medium · *codex, slides 113 to 116*

What does collagen deposition do to the lung in silicosis?

1. It reduces lung elasticity and impairs breathing
2. It increases lung elasticity and breathing
3. It makes the lung produce more silica
4. It removes the silica from the lung tissue

✓ **Answer: A** — Elasticity falls and breathing is impaired.

A: Elasticity falls and breathing is impaired.
B: Elasticity decreases. The right answer is: It reduces lung elasticity and impairs breathing.
C: The lung does not produce silica.
D: Collagen does not remove silica. The right answer is: It reduces lung elasticity and impairs breathing.

Q266 · Medium · *codex, slides 113 to 116*

Which substance accumulates in nerve cells in Tay-Sachs disease?

1. Starch granules
2. Hydrogen peroxide
3. Cellulose
4. Glycolipids

✓ **Answer: D** — Glycolipids accumulate in nerve cells.

A: Starch is not the substance. The right answer is: Glycolipids.
B: Hydrogen peroxide is handled in peroxisomes.
C: Cellulose is a plant wall material.
D: Glycolipids accumulate in nerve cells.

Q267 · Medium · *codex, slides 113 to 116*

What happens when a specific hydrolase is absent from lysosomes?

1. The substrate is digested by catalase instead
2. The lysosome becomes a peroxisome
3. Its substrate accumulates inside the lysosomes
4. The substrate is exported by the Golgi

✓ **Answer: C** — The substrate accumulates, often with severe medical consequences.

A: Catalase acts on hydrogen peroxide. The right answer is: Its substrate accumulates inside the lysosomes.
B: There is no such conversion. The right answer is: Its substrate accumulates inside the lysosomes.
C: The substrate accumulates, often with severe medical consequences.
D: The substrate accumulates in the lysosome.

Q268 · Hard · *codex, slides 113 to 116*

Which sequence describes how silicosis develops?

1. Fibroblasts deposit collagen, phagocytes take up silica, and lysosomal membranes rupture
2. Lysosomal membranes rupture, silica enters the blood, and phagocytes deposit collagen
3. Phagocytes die, silica reacts with lysosomes, and collagen is digested
4. Phagocytes take up silica, lysosomal membranes rupture, phagocytes die, and fibroblasts deposit collagen

✓ **Answer: D** — This is the sequence given in the lecture.

A: Collagen deposition comes last. The right answer is: Phagocytes take up silica, lysosomal membranes rupture, phagocytes die, and fibroblasts deposit collagen.
B: Fibroblasts, not phagocytes, deposit collagen. The right answer is: Phagocytes take up silica, lysosomal membranes rupture, phagocytes die, and fibroblasts deposit collagen.
C: This does not follow the lecture sequence.
D: This is the sequence given in the lecture.

Q269 · Devil · *codex, slides 113 to 116*

Which statement correctly contrasts silicosis with Tay-Sachs disease?

1. Silicosis follows lysosomal rupture, and Tay-Sachs follows a missing lysosomal enzyme
2. Silicosis follows absence of one lysosomal enzyme, whereas Tay-Sachs follows silica uptake
3. Both follow rupture of the nuclear envelope after particle uptake
4. Both follow loss of catalase from the peroxisomes of liver cells

✓ **Answer: A** — These are the two mechanisms described.

A: These are the two mechanisms described.
B: The mechanisms are swapped. The right answer is: Silicosis follows lysosomal rupture, and Tay-Sachs follows a missing lysosomal enzyme.
C: Neither involves the nuclear envelope. The right answer is: Silicosis follows lysosomal rupture, and Tay-Sachs follows a missing lysosomal enzyme.
D: Both involve lysosomes, not catalase. The right answer is: Silicosis follows lysosomal rupture, and Tay-Sachs follows a missing lysosomal enzyme.

Prokaryotes and eukaryotes compared · Q270–283

Q270 · Easy · *codex, slides 126 to 128*

Where is DNA located in a prokaryotic cell?

1. In a double-membrane nucleus
2. In the nucleolus
3. In the nucleoid region
4. In the Golgi apparatus

✓ **Answer: C** — Prokaryotic DNA is located in the nucleoid region.

A: Prokaryotes lack a nucleus. The right answer is: In the nucleoid region.
B: The nucleolus is a eukaryotic structure.
C: Prokaryotic DNA is located in the nucleoid region.
D: The Golgi is a eukaryotic organelle.

Q271 · Easy · *codex, slides 126 to 128*

Which organism is cited as an example of a prokaryote?

1. E. coli
2. Amoeba
3. Yeast
4. Spirogyra

✓ **Answer: A** — Bacteria such as E.

A: Bacteria such as E. coli are prokaryotes.
B: Amoebae are eukaryotes. The right answer is: E. coli.
C: Yeasts are eukaryotic fungi. The right answer is: E. coli.
D: Spirogyra is a eukaryotic alga. The right answer is: E. coli.

Q272 · Easy · *codex, slides 126 to 128*

Which structure do prokaryotic cells lack?

1. A cell membrane
2. Ribosomes
3. DNA
4. A membrane-bound nucleus

✓ **Answer: D** — Prokaryotic cells lack a nucleus.

A: Prokaryotes have a cell membrane. The right answer is: A membrane-bound nucleus.
B: Prokaryotes have ribosomes. The right answer is: A membrane-bound nucleus.
C: Prokaryotes have DNA. The right answer is: A membrane-bound nucleus.
D: Prokaryotic cells lack a nucleus.

Q273 · Easy · *codex, slides 126 to 128*

Which type of cells make up animals, plants, fungi and protists?

1. Prokaryotic cells
2. Archaeal cells only
3. Eukaryotic cells
4. Viral cells

✓ **Answer: C** — These organisms are made of eukaryotic cells.

A: Prokaryotes are bacteria and archaea. The right answer is: Eukaryotic cells.
B: Archaea are prokaryotes. The right answer is: Eukaryotic cells.
C: These organisms are made of eukaryotic cells.
D: Viruses are not cells. The right answer is: Eukaryotic cells.

Q274 · Easy · *codex, slides 126 to 128*

How do eukaryotic cells compare in size with prokaryotic cells?

1. They are smaller
2. They are the same size
3. They are always microscopic only
4. They are larger

✓ **Answer: D** — Eukaryotic cells are larger cells.

A: Prokaryotes are the small cells. The right answer is: They are larger.
B: Eukaryotic cells are larger. The right answer is: They are larger.
C: They are larger, not defined by this.
D: Eukaryotic cells are larger cells.

Q275 · Easy · *codex, slides 126 to 128*

The genome of a eukaryotic cell is enclosed in what?

1. A cell wall
2. A capsule
3. A double-membrane nucleus
4. A lysosome

✓ **Answer: C** — The genome is enclosed in a double-membrane nucleus.

A: The wall surrounds the cell, not the genome.
B: A capsule is a bacterial surface layer.
C: The genome is enclosed in a double-membrane nucleus.
D: Lysosomes digest materials. The right answer is: A double-membrane nucleus.

Q276 · Medium · *codex, slides 126 to 128*

How is prokaryotic DNA packaged compared with eukaryotic DNA?

1. It is wrapped around histones in a nucleus
2. It is packaged inside a double-membrane nucleus
3. It is packaged into nucleoli
4. It is not wrapped around histones

✓ **Answer: D** — Prokaryotic DNA is not wrapped around histones.

A: This describes eukaryotes. The right answer is: It is not wrapped around histones.
B: Prokaryotes have no nucleus. The right answer is: It is not wrapped around histones.
C: Nucleoli are eukaryotic. The right answer is: It is not wrapped around histones.
D: Prokaryotic DNA is not wrapped around histones.

Q277 · Medium · *codex, slides 126 to 128*

What makes up the cell wall of bacteria?

1. Cellulose
2. Collagen
3. Chitin
4. Peptidoglycan

✓ **Answer: D** — Bacterial walls are made of peptidoglycan.

A: Cellulose forms plant cell walls. The right answer is: Peptidoglycan.
B: Collagen is an animal extracellular protein.
C: Chitin is not the bacterial wall material.
D: Bacterial walls are made of peptidoglycan.

Q278 · Medium · *codex, slides 126 to 128*

How does the archaeal cell wall differ from the bacterial wall?

1. It is made of peptidoglycan like bacteria
2. It is tough and made of other chemicals
3. It is made of cellulose like plants
4. It is absent in all archaeal cells

✓ **Answer: B** — Archaeal walls are made of other distinct chemicals.

A: That describes bacteria. The right answer is: It is tough and made of other chemicals.
B: Archaeal walls are made of other distinct chemicals.
C: That describes plants. The right answer is: It is tough and made of other chemicals.
D: Archaea have walls without peptidoglycan. The right answer is: It is tough and made of other chemicals.

Q279 · Medium · *codex, slides 126 to 128*

Which internal structures are absent from prokaryotes?

1. Ribosomes that make proteins
2. Cytoplasm filling the cell
3. Complex membrane-bound organelles
4. A cell membrane around the cell

✓ **Answer: C** — Prokaryotes lack complex membrane-bound organelles.

A: Prokaryotes have ribosomes. The right answer is: Complex membrane-bound organelles.
B: Prokaryotes have cytoplasm. The right answer is: Complex membrane-bound organelles.
C: Prokaryotes lack complex membrane-bound organelles.
D: Prokaryotes have a cell membrane. The right answer is: Complex membrane-bound organelles.

Q280 · Medium · *codex, slides 126 to 128*

Which type of prokaryote inhabits extreme environments?

1. Amoebae
2. Algae
3. Fungi
4. Archaea

✓ **Answer: D** — Archaea inhabit extreme environments.

A: Amoebae are eukaryotes. The right answer is: Archaea.
B: Algae are eukaryotes. The right answer is: Archaea.
C: Fungi are eukaryotes. The right answer is: Archaea.
D: Archaea inhabit extreme environments. It matches what the lecture slides state.

Q281 · Medium · *codex, slides 126 to 128*

Which of these is NOT a feature of prokaryotic cells?

1. DNA in a nucleoid region
2. A cell wall for protection
3. A double-membrane nucleus
4. Some capsules and flagella

✓ **Answer: C** — Correct choice.

A: This is a prokaryotic feature. The right answer is: A double-membrane nucleus.
B: This is a prokaryotic feature. The right answer is: A double-membrane nucleus.
C: Correct choice. Prokaryotes have no nucleus.
D: These occur in prokaryotes. The right answer is: A double-membrane nucleus.

Q282 · Hard · *codex, slides 126 to 128*

A hot spring sample contains a single-celled organism with a wall, no nucleus and no peptidoglycan. How is it classified?

1. Bacteria
2. Archaea
3. Fungi
4. Protista

> ✓ **Answer: B** — Archaea are prokaryotes without peptidoglycan that live in extreme places.

A: Bacterial walls contain peptidoglycan. The right answer is: Archaea.
B: Archaea are prokaryotes without peptidoglycan that live in extreme places.
C: Fungi are eukaryotes with a nucleus.
D: Protists are eukaryotes with a nucleus.

Q283 · Hard · *codex, slides 126 to 128*

Which statement correctly compares prokaryotes and eukaryotes?

1. Prokaryotes enclose DNA in a nucleus, while eukaryotes have a nucleoid
2. Prokaryotes have nucleoid DNA without histones, eukaryotes have a nucleus
3. Both enclose all their DNA in a double-membrane nucleus
4. Both wrap their DNA around histones inside nucleoli

> ✓ **Answer: B** — This matches the lecture comparison.

A: The two are swapped. The right answer is: Prokaryotes have nucleoid DNA without histones, eukaryotes have a nucleus.
B: This matches the lecture comparison.
C: Prokaryotes have no nucleus. The right answer is: Prokaryotes have nucleoid DNA without histones, eukaryotes have a nucleus.
D: Prokaryotes lack histone-wrapped DNA and nucleoli.

Inside the bacterial cell · Q284–295

Q284 · Easy · *codex, slides 130 to 135*

Which structure is common to all bacterial cells?

1. Capsules
2. Ribosomes
3. Endospores
4. Flagella

> ✓ **Answer: B** — Ribosomes are common to all bacterial cells.

A: Capsules are found in only some bacteria.
B: Ribosomes are common to all bacterial cells.
C: Endospores are made by only a few bacteria.
D: Flagella are found in only some bacteria.

Q285 · Easy · *codex, slides 130 to 135*

What is the shape of the bacterial chromosome?

1. Several linear strands of DNA
2. A single circular strand of DNA
3. A set of 46 rod-shaped chromosomes
4. A ring of histone proteins only

✓ **Answer: B** — The bacterial chromosome is a single circular strand.

A: It is a circular strand. The right answer is: A single circular strand of DNA.
B: The bacterial chromosome is a single circular strand.
C: That describes human chromosomes. The right answer is: A single circular strand of DNA.
D: DNA is not wrapped around histones.

Q286 · Easy · *codex, slides 130 to 135*

What is the dense area where bacterial DNA aggregates called?

1. The nucleolus
2. The nuclear envelope
3. The nucleoid
4. The matrix

✓ **Answer: C** — Bacterial DNA aggregates in the nucleoid.

A: The nucleolus is a eukaryotic structure.
B: Bacteria have no nuclear envelope. The right answer is: The nucleoid.
C: Bacterial DNA aggregates in the nucleoid.
D: The matrix is the inner mitochondrial compartment.

Q287 · Easy · *codex, slides 130 to 135*

About how much of bacterial cytoplasm is water?

1. 7 to 8 percent
2. About 20 percent
3. Nearly 100 percent
4. 70 to 80 percent

✓ **Answer: D** — Cytoplasm is 70 to 80 percent water.

A: This is far too low. The right answer is: 70 to 80 percent.
B: This is too low. The right answer is: 70 to 80 percent.
C: The cytoplasm also contains solutes and masses.
D: Cytoplasm is 70 to 80 percent water.

Q288 · Easy · *codex, slides 130 to 135*

Plasmids are small circles of what?

1. Protein
2. DNA
3. Lipid
4. Cellulose

✓ **Answer: B** — Plasmids are circles of DNA.

A: Plasmids are DNA, not protein. The right answer is: DNA.
B: Plasmids are circles of DNA.
C: Plasmids are DNA, not lipid. The right answer is: DNA.
D: Plasmids are DNA, not cellulose. The right answer is: DNA.

Q289 · Medium · *codex, slides 130 to 135*

Plasmids often confer which protective trait?

1. A nucleus
2. Photosynthesis in chloroplasts
3. Drug resistance
4. A double membrane

✓ **Answer: C** — Plasmids often confer drug resistance.

A: Prokaryotes have no nucleus. The right answer is: Drug resistance.
B: Prokaryotes have no chloroplasts. The right answer is: Drug resistance.
C: Plasmids often confer drug resistance.
D: Plasmids do not provide a double membrane.

Q290 · Medium · *codex, slides 130 to 135*

How are plasmids passed from one bacterium to another?

1. In mitosis
2. By osmosis
3. By photosynthesis
4. In conjugation

✓ **Answer: D** — Plasmids are passed on in conjugation.

A: Bacteria do not undergo mitosis. The right answer is: In conjugation.
B: Osmosis is movement of water. The right answer is: In conjugation.
C: Photosynthesis is not a transfer process.
D: Plasmids are passed on in conjugation.

Q291 · Medium · *codex, slides 130 to 135*

What is the role of inclusion bodies in bacteria?

1. They make ATP using their cristae
2. They assemble ribosomal subunits
3. They hold the chromosome inside a nucleus
4. They store nutrients for times of depletion

✓ **Answer: D** — Inclusions act as a storehouse.

A: Bacteria have no cristae. The right answer is: They store nutrients for times of depletion.
B: Ribosomal subunits are assembled in the nucleolus of eukaryotes.
C: Bacteria have no nucleus. The right answer is: They store nutrients for times of depletion.
D: Inclusions act as a storehouse.

Q292 · Medium · *codex, slides 130 to 135*

Which statement about granules is correct?

1. They are membrane-bound organelles with hydrolytic enzymes
2. They are circular DNA that confers resistance
3. They are inclusions of inorganic crystals with no membrane
4. They are thick coats of polysaccharide on the cell

✓ **Answer: C** — Granules are not enclosed by membranes.

A: That describes lysosomes. The right answer is: They are inclusions of inorganic crystals with no membrane.
B: That describes plasmids. The right answer is: They are inclusions of inorganic crystals with no membrane.
C: Granules are not enclosed by membranes.
D: That describes capsules. The right answer is: They are inclusions of inorganic crystals with no membrane.

Q293 · Medium · *codex, slides 130 to 135*

Which statements about bacterial plasmids are correct? 1. They are circles of DNA. 2. They carry about 5 to 100 genes. 3. They are essential for the survival of every bacterium. 4. They can be passed on in conjugation.

1. 1 and 2 only
2. 1, 2 and 4 only
3. 2, 3 and 4 only
4. 1, 3 and 4 only

✓ **Answer: B** — Statements 1, 2 and 4 are true; plasmids are nonessential, so statement 3 is false.

A: This leaves out statement 4, which is also correct.
B: Statements 1, 2 and 4 are true; plasmids are nonessential, so statement 3 is false.
C: Statement 3 is false and this option omits statement 1.
D: Statement 3 is false because plasmids are nonessential.

Q294 · Hard · *codex, slides 130 to 135*

All of the following are found in only SOME bacteria EXCEPT which one?

1. Flagella
2. Ribosomes
3. Capsules
4. Endospores

✓ **Answer: B** — Correct choice.

A: Flagella are found in only some bacteria.
B: Correct choice. Ribosomes are found in all bacteria.
C: Capsules are found in only some bacteria.
D: Endospores are made by a small number of bacteria.

Q295 · Hard · *codex, slides 130 to 135*

Some aquatic bacteria float near the surface. Which structure explains this?

1. Granules of inorganic crystals, which add weight
2. Plasmids carrying drug resistance
3. Capsules that anchor the cell to rocks
4. Gas vesicles in inclusions, which provide buoyancy

✓ **Answer: D** — Gas vesicles provide buoyancy and flotation.

A: Granules do not provide buoyancy. The right answer is: Gas vesicles in inclusions, which provide buoyancy.
B: Plasmids do not provide flotation. The right answer is: Gas vesicles in inclusions, which provide buoyancy.
C: Capsules help adhesion, not flotation. The right answer is: Gas vesicles in inclusions, which provide buoyancy.
D: Gas vesicles provide buoyancy and flotation.

Glycocalyx, capsule and slime layer · Q296–305

Q296 · Easy · *codex, slides 136 to 138*

What is a glycocalyx?

1. A ring of DNA that carries drug resistance
2. A dormant tough structure made in soil bacteria
3. A tube used to transfer DNA between cells
4. A coating of repeating polysaccharide, protein, or both

✓ **Answer: D** — A glycocalyx is a coating of polysaccharide, protein or both.

A: That describes a plasmid. The right answer is: A coating of repeating polysaccharide, protein, or both.
B: That describes an endospore. The right answer is: A coating of repeating polysaccharide, protein, or both.
C: That describes a pilus. The right answer is: A coating of repeating polysaccharide, protein, or both.
D: A glycocalyx is a coating of polysaccharide, protein or both.

Q297 · Easy · *codex, slides 136 to 138*

A loose shield that protects bacteria from loss of water and nutrients is called what?

1. A slime layer
2. A capsule
3. An endospore
4. A flagellum

✓ **Answer: A** — A loose shield is a slime layer.

A: A loose shield is a slime layer.
B: A capsule is more tightly bound, denser and thicker.
C: An endospore is a dormant structure.
D: A flagellum is a motility appendage.

Q298 · Easy · *codex, slides 136 to 138*

A dense, thick glycocalyx tightly bound to the bacterial cell is called what?

1. A slime layer
2. A plasmid
3. A capsule
4. A granule

✓ **Answer: C** — A tightly bound dense glycocalyx is a capsule.

A: A slime layer is a loose shield.
B: A plasmid is a circle of DNA.
C: A tightly bound dense glycocalyx is a capsule.
D: A granule is an inclusion of crystals.

Q299 · Easy · *codex, slides 136 to 138*

Which bacterium's slime layer helps it accumulate on tooth enamel?

1. Escherichia coli
2. Mycoplasma
3. Streptococcus mutans
4. Corynebacterium diphtheriae

✓ **Answer: C** — S.

A: E. coli is not the example given.
B: Mycoplasmas lack a cell wall and are not the example.
C: S. mutans forms a slime layer that builds up on tooth enamel.
D: This is named for envelope interaction with tissue, not dental plaque.

Q300 · Medium · *codex, slides 136 to 138*

Glycocalyces are important in the formation of what?

1. Chloroplasts
2. Nuclear pores
3. Biofilms
4. Lysosomes

✓ **Answer: C** — Glycocalyces take part in biofilm formation.

A: Bacteria have no chloroplasts. The right answer is: Biofilms.
B: Bacteria have no nucleus. The right answer is: Biofilms.
C: Glycocalyces take part in biofilm formation.
D: Bacteria have no lysosomes. The right answer is: Biofilms.

Q301 · Medium · *codex, slides 136 to 138*

Streptococcus mutans slime on tooth enamel contributes to which condition?

1. Silicosis
2. Tay-Sachs disease
3. Dental plaque and cavities
4. Black lung disease

✓ **Answer: C** — The slime builds plaque that contributes to cavities.

A: Silicosis results from inhaled silica. The right answer is: Dental plaque and cavities.
B: Tay-Sachs is a lysosomal genetic disorder.
C: The slime builds plaque that contributes to cavities.
D: Black lung results from coal dust.

Q302 · Medium · *codex, slides 136 to 138*

What is a bacterial capsule composed of?

1. Phospholipids embedded with porin proteins
2. Circular DNA carrying 5 to 100 genes
3. Hollow tubes made of flagellin protein
4. Polysaccharides firmly attached to the cell wall

✓ **Answer: D** — A capsule is composed of polysaccharides attached to the wall.

A: That describes a membrane. The right answer is: Polysaccharides firmly attached to the cell wall.
B: That describes a plasmid. The right answer is: Polysaccharides firmly attached to the cell wall.
C: That is not the capsule composition.
D: A capsule is composed of polysaccharides attached to the wall.

Q303 · Medium · *codex, slides 136 to 138*

Which are roles of a bacterial capsule? 1. Protection from phagocytosis. 2. Adhesion to surfaces. 3. Transfer of plasmids. 4. Formation of endospores.

1. 1 and 3 only
2. 2 and 4 only
3. 3 and 4 only
4. 1 and 2 only

✓ **Answer: D** — Capsules protect against phagocytosis and help bacteria adhere to surfaces.

A: Plasmid transfer is a pilus role, so statement 3 is not a capsule role.
B: Endospore formation is not a capsule role.
C: Statements 3 and 4 are not capsule roles.
D: Capsules protect against phagocytosis and help bacteria adhere to surfaces.

Q304 · Hard · *codex, slides 136 to 138*

How do a slime layer and a capsule differ?

1. The capsule is a loose shield, while the slime layer is tightly bound and thick
2. The slime layer contains DNA, while the capsule contains only lipid
3. The slime layer is found only in archaea, while the capsule is found in humans
4. The slime layer is a loose shield, while the capsule is more tightly bound, denser and thicker

✓ **Answer: D** — This is the distinction in the lecture.

A: This swaps the two. The right answer is: The slime layer is a loose shield, while the capsule is more tightly bound, denser and thicker.
B: Neither is defined this way. The right answer is: The slime layer is a loose shield, while the capsule is more tightly bound, denser and thicker.
C: Both are bacterial surface coats. The right answer is: The slime layer is a loose shield, while the capsule is more tightly bound, denser and thicker.
D: This is the distinction in the lecture.

Q305 · Devil · *codex, slides 136 to 138*

A capsule-deficient mutant is cleared faster by phagocytes and adheres poorly to surfaces. Which pair of capsule roles explains both observations?

1. Storage of nutrients and release of hydrogen
2. Transfer of plasmids and swimming movement
3. Protection from phagocytosis and adhesion to surfaces
4. Formation of spores and digestion of waste

✓ **Answer: C** — Capsules protect from phagocytes and help bacteria adhere.

A: These are not capsule roles. The right answer is: Protection from phagocytosis and adhesion to surfaces.
B: These are pilus and flagellum roles.
C: Capsules protect from phagocytes and help bacteria adhere.
D: These are not capsule roles. The right answer is: Protection from phagocytosis and adhesion to surfaces.

Endospores · Q306–311

Q306 · Easy · *codex, slide 139*

What is an endospore?

1. A circular piece of extra bacterial DNA
2. A dormant, tough, non-reproductive structure
3. A tube that transfers DNA between cells
4. A coating of repeating polysaccharide

✓ **Answer: B** — An endospore is a dormant tough structure that does not reproduce.

A: That describes a plasmid. The right answer is: A dormant, tough, non-reproductive structure.
B: An endospore is a dormant tough structure that does not reproduce.
C: That describes a pilus. The right answer is: A dormant, tough, non-reproductive structure.
D: That describes a glycocalyx. The right answer is: A dormant, tough, non-reproductive structure.

Q307 · Easy · *codex, slide 139*

Endospores are produced by what?

1. All bacteria
2. A small number of bacteria
3. Only archaea
4. Only fungi

✓ **Answer: B** — Only a small number of bacteria make endospores.

A: Only a few make endospores. The right answer is: A small number of bacteria.
B: Only a small number of bacteria make endospores.
C: Endospores are made by some bacteria.
D: Endospores are made by bacteria. The right answer is: A small number of bacteria.

Q308 · Easy · *codex, slide 139*

Where are endospores commonly found?

1. Only inside lysosomes
2. Only inside the nucleus
3. In soil and water
4. Only in germinating seeds

✓ **Answer: C** — Endospores are found in soil and water.

A: They are bacterial structures. The right answer is: In soil and water.
B: Bacteria have no nucleus. The right answer is: In soil and water.
C: Endospores are found in soil and water.
D: They are bacterial, not plant. The right answer is: In soil and water.

Q309 · Medium · *codex, slide 139*

Endospores are resistant to which enzyme?

1. Catalase
2. Amylase
3. Pepsin
4. Lysozyme

✓ **Answer: D** — Endospores resist lysozyme.

A: Catalase is not named. The right answer is: Lysozyme.
B: Amylase is not named. The right answer is: Lysozyme.
C: Pepsin is not named. The right answer is: Lysozyme.
D: Endospores resist lysozyme. It matches what the lecture slides state.

Q310 · Medium · *codex, slide 139*

Why are endospores called non-reproductive?

1. A dormant survival form, not a way to make cells
2. They always produce two cells at once
3. They transfer DNA to other living cells
4. They are made only by dead bacterial cells

✓ **Answer: A** — They allow survival, not reproduction.

A: They allow survival, not reproduction.
B: That describes binary fission. The right answer is: A dormant survival form, not a way to make cells.
C: That describes conjugation. The right answer is: A dormant survival form, not a way to make cells.
D: They are produced by living bacteria.

Q311 · Hard · *codex, slide 139*

A food sample treated with a chemical disinfectant still contains viable bacteria after heating. Which structure best explains survival?

1. Endospores
2. Slime layers
3. Plasmids
4. Fimbriae

✓ **Answer: A** — Endospores resist disinfectants, heat and starvation.

A: Endospores resist disinfectants, heat and starvation.
B: A slime layer only shields from loss of water and nutrients.
C: Plasmids carry genes but do not protect against disinfectants.
D: Fimbriae help adhesion. The right answer is: Endospores.

Prokaryotic cytoskeleton and ribosomes · Q312–317

Q312 · Easy · *codex, slides 140 to 141*

What do bacterial ribosomes make?

1. Proteins
2. Lipids
3. Cellulose
4. DNA

✓ **Answer: A** — Ribosomes carry out protein synthesis.

A: Ribosomes carry out protein synthesis.
B: Lipids are made elsewhere. The right answer is: Proteins.
C: Cellulose is made in plants. The right answer is: Proteins.
D: DNA is made by polymerases. The right answer is: Proteins.

Q313 · Easy · *codex, slides 140 to 141*

How many subunits make up a prokaryotic ribosome?

1. One
2. Three
3. Two
4. Four

✓ **Answer: C** — A prokaryotic ribosome has two subunits.

A: It has two subunits. The right answer is: Two.
B: It has two subunits. The right answer is: Two.
C: A prokaryotic ribosome has two subunits.
D: It has two subunits. The right answer is: Two.

Q314 · Easy · *codex, slides 140 to 141*

Prokaryotic ribosomes are made of protein and what else?

1. Phospholipid
2. Peptidoglycan
3. rRNA
4. Glycogen

✓ **Answer: C** — Ribosomes contain protein and rRNA.

A: Phospholipid forms membranes. The right answer is: rRNA.
B: Peptidoglycan is a wall polymer. The right answer is: rRNA.
C: Ribosomes contain protein and rRNA.
D: Glycogen is a storage carbohydrate. The right answer is: rRNA.

Q315 · Medium · *codex, slides 140 to 141*

Where may prokaryotic ribosomes be found?

1. Inside a nucleus or inside a nucleolus
2. In the cytoplasm or on the plasma membrane
3. Inside mitochondria and inside chloroplasts
4. On the rough ER and the Golgi only

✓ **Answer: B** — They may be free or attached to the plasma membrane.

A: Prokaryotes have neither. The right answer is: In the cytoplasm or on the plasma membrane.
B: They may be free or attached to the plasma membrane.
C: Prokaryotes have no mitochondria. The right answer is: In the cytoplasm or on the plasma membrane.
D: Prokaryotes have no ER. The right answer is: In the cytoplasm or on the plasma membrane.

Q316 · Medium · *codex, slides 140 to 141*

Until recently, the cytoskeleton was thought to occur in which cells only?

1. Archaeal cells
2. Viral particles
3. Bacterial spores
4. Eukaryotic cells

✓ **Answer: D** — It was thought to be only eukaryotic.

A: It was thought only eukaryotic. The right answer is: Eukaryotic cells.
B: Viruses are not cells. The right answer is: Eukaryotic cells.
C: Spores were not the cells named.
D: It was thought to be only eukaryotic.

Q317 · Hard · *codex, slides 140 to 141*

Which statement about the prokaryotic cytoskeleton is correct?

1. It is a double membrane around the chromosome
2. It is a cell wall made of peptidoglycan
3. It is absent from all prokaryotic cells
4. It is a scaffold in the cytoplasm

✓ **Answer: D** — The lecture calls it a major advance.

A: That is not a cytoskeleton. The right answer is: It is a scaffold in the cytoplasm.
B: That is the wall. The right answer is: It is a scaffold in the cytoplasm.
C: Prokaryotes have a cytoskeleton scaffold. The right answer is: It is a scaffold in the cytoplasm.
D: The lecture calls it a major advance.

Cell envelope and plasma membrane · Q318–325

Q318 · Easy · *codex, slides 142 to 145*

Which layers can make up the bacterial cell envelope?

1. Membrane, wall and sometimes an outer membrane
2. Nuclear envelope, ER and Golgi apparatus
3. Capsule, plasmid and granule inclusions
4. Cristae, matrix and ribosome subunits

✓ **Answer: A** — The envelope has two or three layers.

A: The envelope has two or three layers.
B: These are eukaryotic structures. The right answer is: Membrane, wall and sometimes an outer membrane.
C: These are not the envelope layers.
D: These are mitochondrial and ribosomal features.

Q319 · Easy · *codex, slides 142 to 145*

The bacterial plasma membrane is made of what type of structure?

1. A phospholipid bilayer with proteins
2. A thick layer of pure cellulose
3. A coat of silica around the cell
4. A single layer of lipid and sugar

✓ **Answer: A** — It is a phospholipid bilayer with proteins.

A: It is a phospholipid bilayer with proteins.
B: Cellulose is a plant wall material.
C: Silica is not the membrane material.
D: It is a bilayer. The right answer is: A phospholipid bilayer with proteins.

Q320 · Easy · *codex, slides 142 to 145*

Where does the cell envelope lie relative to the cytoplasm?

1. Inside it
2. Within the nucleus
3. Outside it
4. Within the nucleoid

✓ **Answer: C** — The envelope lies outside the cytoplasm.

A: The envelope encloses the cytoplasm. The right answer is: Outside it.
B: Bacteria have no nucleus. The right answer is: Outside it.
C: The envelope lies outside the cytoplasm.
D: The nucleoid is inside the cell.

Q321 · Medium · *codex, slides 142 to 145*

Which function does the bacterial plasma membrane provide?

1. Photosynthesis in chloroplasts of the cell
2. Storage of DNA inside a true nucleus
3. Attachment of the cell to a tooth surface
4. A site for energy reactions and synthesis

✓ **Answer: D** — These are listed functions.

A: Bacteria have no chloroplasts. The right answer is: A site for energy reactions and synthesis.
B: Bacteria have no nucleus. The right answer is: A site for energy reactions and synthesis.
C: That is a role of glycocalyx.
D: These are listed functions. It matches what the lecture slides state.

Q322 · Medium · *codex, slides 142 to 145*

The plasma membrane is selectively permeable. What does this mean?

1. It lets all materials pass in and out freely
2. It regulates which materials move in and out
3. It lets nothing pass in or out at all
4. It lets only water pass in and out

✓ **Answer: B** — It regulates transport.

A: This contradicts selective permeability. The right answer is: It regulates which materials move in and out.
B: It regulates transport. It matches what the lecture slides state.
C: The membrane does allow selected transport.
D: It regulates transport of many substances.

Q323 · Medium · *codex, slides 142 to 145*

How many layers does the Gram-positive envelope have?

1. Two
2. One
3. Three
4. Four

✓ **Answer: A** — Gram-positive bacteria have two layers.

A: Gram-positive bacteria have two layers.
B: They have two layers. The right answer is: Two.
C: Gram-negative bacteria have three. The right answer is: Two.
D: No bacterial envelope here has four.

Q324 · Hard · *codex, slides 142 to 145*

How many layers does the Gram-negative envelope have, and which are they?

1. Two: cell wall and cytoplasmic membrane
2. Three: capsule, nucleus and cell wall
3. Four: outer membrane, wall, plasma membrane and nucleoid
4. Three: outer membrane, cell wall and cytoplasmic membrane

✓ **Answer: D** — Gram-negative envelopes have three layers.

A: That describes Gram-positive. The right answer is: Three: outer membrane, cell wall and cytoplasmic membrane.
B: Bacteria have no nucleus. The right answer is: Three: outer membrane, cell wall and cytoplasmic membrane.
C: The nucleoid is not an envelope layer.
D: Gram-negative envelopes have three layers.

Q325 · Hard · *codex, slides 142 to 145*

All of the following are functions of the bacterial plasma membrane EXCEPT which one?

1. Regulating the transport of materials
2. Storing the chromosome inside a nucleus
3. Hosting energy reactions for the cell
4. Secreting some substances outward

✓ **Answer: B** — Correct choice.

A: This is a membrane function. The right answer is: Storing the chromosome inside a nucleus.
B: Correct choice. Bacteria have no nucleus.
C: This is a membrane function. The right answer is: Storing the chromosome inside a nucleus.
D: This is a membrane function. The right answer is: Storing the chromosome inside a nucleus.

Bacterial cell walls · Q326–341

Q326 · Easy · *codex, slides 146 to 156*

What is the main polymer of the bacterial cell wall?

1. Peptidoglycan
2. Cellulose
3. Collagen
4. Chitin

✓ **Answer: A** — Peptidoglycan gives the wall its rigidity.

A: Peptidoglycan gives the wall its rigidity.
B: Cellulose is in plant walls. The right answer is: Peptidoglycan.
C: Collagen is an animal protein. The right answer is: Peptidoglycan.
D: Chitin is not the bacterial polymer.

Q327 · Easy · *codex, slides 146 to 156*

What does the bacterial cell wall provide?

1. Photosynthesis using chlorophyll
2. Protein synthesis on ribosomes
3. Motility through the environment
4. Shape and strong structural support

✓ **Answer: D** — The wall gives shape and strength.

A: Photosynthesis needs chlorophyll. The right answer is: Shape and strong structural support.
B: Ribosomes make proteins. The right answer is: Shape and strong structural support.
C: Flagella give motility. The right answer is: Shape and strong structural support.
D: The wall gives shape and strength.

Q328 · Easy · *codex, slides 146 to 156*

Which bacteria have a thick peptidoglycan layer?

1. Gram-positive bacteria
2. Gram-negative bacteria
3. Mycoplasmas
4. Archaea

✓ **Answer: A** — Gram-positive walls are thick.

A: Gram-positive walls are thick. It matches what the lecture slides state.
B: Their peptidoglycan layer is thin. The right answer is: Gram-positive bacteria.
C: They lack a wall. The right answer is: Gram-positive bacteria.
D: Archaea lack peptidoglycan. The right answer is: Gram-positive bacteria.

Q329 · Easy · *codex, slides 146 to 156*

Which bacteria have an outer membrane?

1. Gram-positive bacteria
2. Mycoplasmas
3. Gram-negative bacteria
4. Endospores

✓ **Answer: C** — Gram-negative bacteria have an outer membrane.

A: They have a thick wall and no outer membrane.
B: They lack a wall. The right answer is: Gram-negative bacteria.
C: Gram-negative bacteria have an outer membrane.
D: Endospores are dormant structures. The right answer is: Gram-negative bacteria.

Q330 · Easy · *codex, slides 146 to 156*

Which molecule is in the outermost layer of the Gram-negative outer membrane?

1. Cellulose
2. Lipopolysaccharide (LPS)
3. Teichoic acid
4. Histone

> ✓ **Answer: B** — LPS is in the outermost layer.

A: Cellulose is a plant material. The right answer is: Lipopolysaccharide (LPS).
B: LPS is in the outermost layer.
C: Teichoic acids are in Gram-positive walls.
D: Histones are chromatin proteins. The right answer is: Lipopolysaccharide (LPS).

Q331 · Easy · *codex, slides 146 to 156*

What is absent from archaeal cell walls?

1. Any protective layer
2. Ribosomes
3. Peptidoglycan
4. DNA

> ✓ **Answer: C** — Archaea have no peptidoglycan.

A: Archaeal walls are tough. The right answer is: Peptidoglycan.
B: Archaea have ribosomes. The right answer is: Peptidoglycan.
C: Archaea have no peptidoglycan. It matches what the lecture slides state.
D: Archaea have DNA. The right answer is: Peptidoglycan.

Q332 · Medium · *codex, slides 146 to 156*

What connects the glycan strands of peptidoglycan?

1. Phosphodiester bonds
2. Interlocking peptide bridges
3. Disulfide loops in histones
4. Hydrogen peroxide bridges

> ✓ **Answer: B** — Peptide bridges connect strands.

A: These bind nucleotides. The right answer is: Interlocking peptide bridges.
B: Peptide bridges connect strands. It matches what the lecture slides state.
C: Histones are not involved. The right answer is: Interlocking peptide bridges.
D: This is not a linkage. The right answer is: Interlocking peptide bridges.

Q333 · Medium · *codex, slides 146 to 156*

How thick is the peptidoglycan wall of Gram-positive bacteria?

1. About 1 to 3 nm
2. About 20 to 80 nm
3. About 2 mm
4. About 200 µm

✓ **Answer: B** — The wall is about 20 to 80 nm.

A: That is the Gram-negative layer. The right answer is: About 20 to 80 nm.
B: The wall is about 20 to 80 nm.
C: This is far too thick. The right answer is: About 20 to 80 nm.
D: This is far too thick. The right answer is: About 20 to 80 nm.

Q334 · Medium · *codex, slides 146 to 156*

Gram-negative bacteria have a single peptidoglycan sheet. How thin is it?

1. About 20 to 80 nm
2. About 1 mm
3. About 1 to 3 nm
4. About 3 cm

✓ **Answer: C** — It is a single thin sheet of 1 to 3 nm.

A: That is the Gram-positive wall. The right answer is: About 1 to 3 nm.
B: This is far too thick. The right answer is: About 1 to 3 nm.
C: It is a single thin sheet of 1 to 3 nm.
D: This is far too thick. The right answer is: About 1 to 3 nm.

Q335 · Medium · *codex, slides 146 to 156*

What forms the channels that let small molecules cross the Gram-negative outer membrane?

1. Nucleoporins
2. Histone rings
3. Aquaporin granules
4. Porin proteins

✓ **Answer: D** — Porin channels admit small molecules.

A: Nucleoporins form nuclear pores. The right answer is: Porin proteins.
B: Histones bind DNA. The right answer is: Porin proteins.
C: These are not the bacterial channels named.
D: Porin channels admit small molecules.

Q336 · Medium · *codex, slides 146 to 156*

Which bacteria lack a cell wall entirely?

1. Mycobacterium
2. Mycoplasmas
3. Nocardia
4. Escherichia coli

✓ **Answer: B** — Mycoplasmas lack a wall.

A: Mycobacterium has a wall with unique lipids.
B: Mycoplasmas lack a wall. It matches what the lecture slides state.
C: Nocardia has a wall with unique lipids.
D: E. coli is a Gram-negative bacterium with a wall.

Q337 · Medium · *codex, slides 146 to 156*

Which are features of Gram-negative bacteria? 1. An outer membrane. 2. A single thin peptidoglycan sheet. 3. Lipopolysaccharide in the outer layer. 4. A thick peptidoglycan wall of 20 to 80 nm.

1. 1 and 4 only
2. 2 and 3 only
3. 1, 2 and 3 only
4. 1, 3 and 4 only

✓ **Answer: C** — Gram-negative bacteria have an outer membrane, a thin peptidoglycan sheet and LPS; the thick wall is Gram-positive.

A: Statement 4 describes Gram-positive bacteria, and this option omits statements 2 and 3.
B: This omits statement 1, which is also a feature.
C: Gram-negative bacteria have an outer membrane, a thin peptidoglycan sheet and LPS; the thick wall is Gram-positive.
D: Statement 4 describes Gram-positive bacteria and this option omits statement 2.

Q338 · Hard · *codex, slides 146 to 156*

Why are Gram-negative bacteria generally harder to inhibit or kill?

1. Their outer membrane is an extra barrier to some chemicals
2. They have a thicker peptidoglycan layer than Gram-positive bacteria
3. They make endospores in all of their cells
4. They have a nucleus that shields the DNA

✓ **Answer: A** — The outer membrane is impervious to some chemicals.

A: The outer membrane is impervious to some chemicals.
B: Their layer is thinner. The right answer is: Their outer membrane is an extra barrier to some chemicals.
C: Only a few bacteria make endospores.
D: Bacteria have no nucleus. The right answer is: Their outer membrane is an extra barrier to some chemicals.

Q339 · Hard · *codex, slides 146 to 156*

Mycobacterium and Nocardia are called acid-fast because of which feature?

1. A thick coat of cellulose
2. A double-membrane nucleus
3. A layer of teichoic acids only
4. Unique lipids in their cell walls

> ✓ **Answer: D** — Their walls contain unique lipids.

A: Cellulose is not present. The right answer is: Unique lipids in their cell walls.
B: Bacteria have no nucleus. The right answer is: Unique lipids in their cell walls.
C: The lecture names unique lipids. The right answer is: Unique lipids in their cell walls.
D: Their walls contain unique lipids.

Q340 · Hard · *codex, slides 146 to 156*

All of the following are true of peptidoglycan EXCEPT which one?

1. It provides rigid support to the bacterial wall
2. It has a backbone of NAG and NAM
3. It is freely permeable to solutes
4. It is found in the walls of archaea

> ✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: It is found in the walls of archaea.
B: This is true. The right answer is: It is found in the walls of archaea.
C: This is true. The right answer is: It is found in the walls of archaea.
D: Correct choice. Archaea lack peptidoglycan. It matches what the lecture slides state.

Q341 · Devil · *codex, slides 146 to 156*

A penicillin-class antibiotic damages the cell wall. Why would Mycoplasma be unaffected?

1. They have a thicker outer membrane
2. They form endospores
3. They have a nucleus
4. They lack a cell wall entirely

> ✓ **Answer: D** — Without a wall there is nothing for the drug to act on.

A: Mycoplasmas have no wall. The right answer is: They lack a cell wall entirely.
B: Mycoplasmas are not endospore formers here.
C: Bacteria have no nucleus. The right answer is: They lack a cell wall entirely.
D: Without a wall there is nothing for the drug to act on.

Surface appendages · Q342–349

Q342 · Easy · *codex, slides 157 to 158*

Which appendages provide bacterial motility?

1. Fimbriae
2. Capsules
3. Flagella
4. Plasmids

> ✓ **Answer: C** — Flagella provide motility.

A: Fimbriae do not provide motility. The right answer is: Flagella.
B: Capsules protect and help adhesion. The right answer is: Flagella.
C: Flagella provide motility. It matches what the lecture slides state.
D: Plasmids are DNA circles. The right answer is: Flagella.

Q343 · Easy · *codex, slides 157 to 158*

Which appendages help bacteria attach to surfaces and mate?

1. Pili and fimbriae
2. Flagella and axial filaments
3. Capsules and slime layers
4. Granules and inclusions

> ✓ **Answer: A** — Pili and fimbriae are used for attachment and mating.

A: Pili and fimbriae are used for attachment and mating.
B: These provide motility. The right answer is: Pili and fimbriae.
C: These are glycocalyces. The right answer is: Pili and fimbriae.
D: These are storage bodies. The right answer is: Pili and fimbriae.

Q344 · Easy · *codex, slides 157 to 158*

Do fimbriae play a role in bacterial motility?

1. No, they help bacteria adhere to solid surfaces
2. Yes, they act as the main swimming organs
3. Yes, they transfer plasmids by contact
4. Yes, they pump protons into lysosomes

> ✓ **Answer: A** — Fimbriae have no role in motility.

A: Fimbriae have no role in motility.
B: Flagella do the swimming. The right answer is: No, they help bacteria adhere to solid surfaces.
C: That describes conjugation pili. The right answer is: No, they help bacteria adhere to solid surfaces.
D: They have no such role. The right answer is: No, they help bacteria adhere to solid surfaces.

Q345 · Medium · *codex, slides 157 to 158*

Which bacteria typically have fimbriae?

1. Most Gram-negative bacteria
2. Most Gram-positive bacteria
3. Only archaea
4. Only endospore formers

✓ **Answer: A** — Most Gram-negative bacteria have fimbriae.

A: Most Gram-negative bacteria have fimbriae.
B: The lecture says Gram-positive bacteria lack them.
C: Fimbriae are described in bacteria. The right answer is: Most Gram-negative bacteria.
D: They are not limited to endospore formers.

Q346 · Medium · *codex, slides 157 to 158*

How do pili compare in length with other appendages?

1. They are shorter than fimbriae and longer than flagella
2. They are the same length as the fimbriae
3. They are longer than the flagella of the cell
4. They are longer than fimbriae and shorter than flagella

✓ **Answer: D** — Pili are intermediate in length.

A: This reverses the order. The right answer is: They are longer than fimbriae and shorter than flagella.
B: Pili are longer. The right answer is: They are longer than fimbriae and shorter than flagella.
C: Flagella are longer. The right answer is: They are longer than fimbriae and shorter than flagella.
D: Pili are intermediate in length.

Q347 · Medium · *codex, slides 157 to 158*

What do conjugation pili transfer between cells?

1. Ribosomes
2. Plasmids
3. Mitochondria
4. Capsules

✓ **Answer: B** — Conjugation pili transfer plasmids.

A: Ribosomes are not transferred. The right answer is: Plasmids.
B: Conjugation pili transfer plasmids. It matches what the lecture slides state.
C: Bacteria have none. The right answer is: Plasmids.
D: Capsules are surface coats. The right answer is: Plasmids.

Q348 · Hard · *codex, slides 157 to 158*

Which statement about fimbriae and disease is correct?

1. They synthesise toxins on their ribosomes
2. They help bacteria adhere and are a virulence factor
3. They prevent bacteria from sticking to tissue
4. They store energy in granules for the cell

> ✓ **Answer: B** — Adhesion makes fimbriae a virulence factor.

A: They are not ribosomal. The right answer is: They help bacteria adhere and are a virulence factor.
B: Adhesion makes fimbriae a virulence factor.
C: They aid adhesion. The right answer is: They help bacteria adhere and are a virulence factor.
D: They do not store energy. The right answer is: They help bacteria adhere and are a virulence factor.

Q349 · Devil · *codex, slides 157 to 158*

Which pairing of appendage and role is correct?

1. Fimbriae: grappling-hook movement; pili: adhesion without motility
2. Flagella: DNA transfer; pili: swimming movement
3. Fimbriae: adhesion; pili: grappling-hook movement and conjugation
4. Pili: nutrient storage; fimbriae: gas buoyancy in water

> ✓ **Answer: C** — These are the roles described.

A: The roles are swapped. The right answer is: Fimbriae: adhesion; pili: grappling-hook movement and conjugation.
B: The roles are swapped. The right answer is: Fimbriae: adhesion; pili: grappling-hook movement and conjugation.
C: These are the roles described.
D: These are not their roles. The right answer is: Fimbriae: adhesion; pili: grappling-hook movement and conjugation.

Bacterial shapes and arrangements · Q350–359

Q350 · Easy · *codex, slides 159 to 162*

A bacterium shaped like a rod is called what?

1. A bacillus
2. A coccus
3. A spirillum
4. A vibrio

> ✓ **Answer: A** — A rod is a bacillus.

A: A rod is a bacillus.
B: A coccus is spherical. The right answer is: A bacillus.
C: A spirillum is spiral. The right answer is: A bacillus.
D: A vibrio is a short curved rod.

Q351 · Easy · *codex, slides 159 to 162*

What is the name for a spherical bacterium?

1. A bacillus
2. A spirochete
3. A coccus
4. A vibrio

> ✓ **Answer: C** — A sphere is a coccus.

A: A bacillus is a rod. The right answer is: A coccus.
B: A spirochete is spiral and flexible.
C: A sphere is a coccus.
D: A vibrio is a curved rod.

Q352 · Easy · *codex, slides 159 to 162*

Cocci arranged in chains are called what?

1. Staphylococci
2. Streptococci
3. Diplococci
4. Tetrads

> ✓ **Answer: B** — Chains of cocci are streptococci.

A: These form irregular clusters. The right answer is: Streptococci.
B: Chains of cocci are streptococci.
C: These form pairs. The right answer is: Streptococci.
D: These form groups of four. The right answer is: Streptococci.

Q353 · Easy · *codex, slides 159 to 162*

What do we call cocci grouped in irregular clusters?

1. Streptococci
2. Diplococci
3. Staphylococci
4. Sarcinae

> ✓ **Answer: C** — Irregular clusters are staphylococci.

A: These form chains. The right answer is: Staphylococci.
B: These form pairs. The right answer is: Staphylococci.
C: Irregular clusters are staphylococci. It matches what the lecture slides state.
D: These form cubical packets. The right answer is: Staphylococci.

Q354 · Medium · *codex, slides 159 to 162*

Which spiral bacterium has a flexible wall and an axial filament?

1. Spirillum
2. Bacillus
3. Spirochete
4. Coccus

✓ **Answer: C** — A spirochete has a flexible wall and axial filament.

A: A spirillum has a rigid wall.
B: A bacillus is a rod. The right answer is: Spirochete.
C: A spirochete has a flexible wall and axial filament.
D: A coccus is spherical. The right answer is: Spirochete.

Q355 · Medium · *codex, slides 159 to 162*

What does pleomorphism mean?

1. Cells of one species always form chains
2. Cells of one species make endospores
3. Cells of one species lack a cell wall
4. Cells of one species vary in shape and size

✓ **Answer: D** — Pleomorphism means variable shape and size.

A: This is an arrangement, not pleomorphism.
B: This is not pleomorphism. The right answer is: Cells of one species vary in shape and size.
C: This describes mycoplasmas. The right answer is: Cells of one species vary in shape and size.
D: Pleomorphism means variable shape and size.

Q356 · Medium · *codex, slides 159 to 162*

What is a short, slightly curved rod called?

1. A spirillum
2. A vibrio
3. A coccus
4. A fusiform

✓ **Answer: B** — A vibrio is a short curved rod.

A: A spirillum is spiral. The right answer is: A vibrio.
B: A vibrio is a short curved rod.
C: A coccus is spherical. The right answer is: A vibrio.
D: A fusiform has tapered ends. The right answer is: A vibrio.

Q357 · Medium · *codex, slides 159 to 162*

Which of these bacterial shapes are spiral? 1. Spirillum. 2. Spirochete. 3. Vibrio. 4. Coccus.

1. 1 and 2 only
2. 1, 2 and 3 only
3. 2 and 4 only
4. 3 and 4 only

✓ **Answer: A** — Spirilla and spirochetes are spiral; a vibrio is a curved rod and a coccus is spherical.

A: Spirilla and spirochetes are spiral; a vibrio is a curved rod and a coccus is spherical.
B: A vibrio is a short curved rod, not a spiral.
C: A coccus is spherical, and this option omits the spirillum.
D: A vibrio and a coccus are not spiral.

Q358 · Hard · *codex, slides 159 to 162*

Why do bacilli appear only singly, in pairs or in chains, while cocci can also form clusters and packets?

1. Bacilli divide on a single axis, cocci on one or more planes
2. Bacilli have no cell wall, whereas cocci have a thick wall
3. Bacilli lack ribosomes, whereas cocci have many of them
4. Bacilli make endospores, whereas cocci make capsules

✓ **Answer: A** — The division planes determine the arrangement.

A: The division planes determine the arrangement.
B: Both normally have walls. The right answer is: Bacilli divide on a single axis, cocci on one or more planes.
C: Both have ribosomes. The right answer is: Bacilli divide on a single axis, cocci on one or more planes.
D: These are unrelated to arrangement. The right answer is: Bacilli divide on a single axis, cocci on one or more planes.

Q359 · Hard · *codex, slides 159 to 162*

A Gram stain shows spheres in cubical packets. Which arrangement is this?

1. Sarcina
2. Staphylococci
3. Diplococci
4. Streptobacilli

✓ **Answer: A** — A cubical packet is a sarcina.

A: A cubical packet is a sarcina.
B: These form irregular clusters. The right answer is: Sarcina.
C: These form pairs. The right answer is: Sarcina.
D: These are chains of rods. The right answer is: Sarcina.

Prokaryotic reproduction · Q360–365

Q360 · Easy · *codex, slide 163*

What is the asexual way prokaryotes reproduce?

1. Binary fission
2. Mitosis
3. Meiosis
4. Budding of the nucleus

✓ **Answer: A** — Binary fission separates one cell into two.

A: Binary fission separates one cell into two.
B: Prokaryotes do not undergo mitosis. The right answer is: Binary fission.
C: Meiosis occurs in eukaryotes. The right answer is: Binary fission.
D: Bacteria have no nucleus. The right answer is: Binary fission.

Q361 · Easy · *codex, slide 163*

In conjugation, DNA is transferred by means of what?

1. A phage
2. The environment
3. A pilus
4. A spore

✓ **Answer: C** — DNA moves through a pilus.

A: That describes transduction. The right answer is: A pilus.
B: That describes transformation. The right answer is: A pilus.
C: DNA moves through a pilus.
D: Spores do not transfer DNA. The right answer is: A pilus.

Q362 · Easy · *codex, slide 163*

Transduction uses which agents to move DNA?

1. Pili
2. Capsules
3. Bacteriophages
4. Plasmid rings only

✓ **Answer: C** — Bacteriophages move DNA in transduction.

A: Pili are used in conjugation. The right answer is: Bacteriophages.
B: Capsules are surface coats. The right answer is: Bacteriophages.
C: Bacteriophages move DNA in transduction.
D: Phages carry the DNA. The right answer is: Bacteriophages.

Q363 · Medium · *codex, slide 163*

In transformation, a prokaryote takes up what?

1. Proteins from lysosomes
2. Chloroplasts from plants
3. DNA from its environment
4. Phages from the soil

✓ **Answer: C** — It takes up DNA shed by other prokaryotes.

A: Bacteria lack lysosomes. The right answer is: DNA from its environment.
B: This is not transformation. The right answer is: DNA from its environment.
C: It takes up DNA shed by other prokaryotes.
D: That describes transduction. The right answer is: DNA from its environment.

Q364 · Medium · *codex, slide 163*

What happens during binary fission?

1. Two cells fuse to make one larger cell
2. A cell forms an endospore for survival
3. Genes are transferred through a pilus
4. The chromosome is copied and the cell divides

✓ **Answer: D** — This is binary fission.

A: This is not fission. The right answer is: The chromosome is copied and the cell divides.
B: Endospores are dormant forms. The right answer is: The chromosome is copied and the cell divides.
C: That is conjugation. The right answer is: The chromosome is copied and the cell divides.
D: This is binary fission. It matches what the lecture slides state.

Q365 · Hard · *codex, slide 163*

Which matching of mechanism and source of DNA is correct?

1. Transformation: DNA through a pilus; transduction: environmental DNA; conjugation: phage DNA
2. Transformation: environmental DNA; transduction: phage DNA; conjugation: pilus DNA
3. Transformation: phage DNA; transduction: pilus DNA; conjugation: environmental DNA
4. All three move DNA only by binary fission of cells

✓ **Answer: B** — These are the three mechanisms.

A: The matches are mixed up. The right answer is: Transformation: environmental DNA; transduction: phage DNA; conjugation: pilus DNA.
B: These are the three mechanisms.
C: The matches are mixed up. The right answer is: Transformation: environmental DNA; transduction: phage DNA; conjugation: pilus DNA.
D: Binary fission is asexual reproduction. The right answer is: Transformation: environmental DNA; transduction: phage DNA; conjugation: pilus DNA.

Cell size, shape and surface area · Q366–371

Q366 · Easy · *codex, slides 166 to 171*

What does a large surface area-to-volume ratio help a cell do?

1. Exchange materials with its environment
2. Store more DNA in a small space
3. Divide without a cell membrane
4. Avoid needing ATP for transport

✓ **Answer: A** — It aids exchange of materials.

A: It aids exchange of materials.
B: It does not relate to DNA storage.
C: Division still needs a membrane. The right answer is: Exchange materials with its environment.
D: Cells still need ATP. The right answer is: Exchange materials with its environment.

Q367 · Easy · *codex, slides 166 to 171*

Which factor influences cell shape?

1. The colour of the cytoplasm
2. The number of ribosomes only
3. The age of the nucleolus
4. The rigidity of the membrane

✓ **Answer: D** — Membrane rigidity is a factor.

A: Colour is not a factor. The right answer is: The rigidity of the membrane.
B: Ribosome number is not named. The right answer is: The rigidity of the membrane.
C: Not named. The right answer is: The rigidity of the membrane.
D: Membrane rigidity is a factor.

Q368 · Medium · *codex, slides 166 to 171*

Which list names factors that determine cell size and shape?

1. Cytoplasm viscosity, neighbour pressure, membrane rigidity and function
2. Wavelength of light, numerical aperture and refractive index
3. Peptidoglycan, outer membrane and teichoic acid layers
4. Histones, nucleosomes and chromatin fibres in the nucleus

✓ **Answer: A** — These factors are listed in the lecture.

A: These factors are listed in the lecture.
B: These are microscope factors. The right answer is: Cytoplasm viscosity, neighbour pressure, membrane rigidity and function.
C: These are wall components. The right answer is: Cytoplasm viscosity, neighbour pressure, membrane rigidity and function.
D: These are chromatin components. The right answer is: Cytoplasm viscosity, neighbour pressure, membrane rigidity and function.

Q369 · Medium · *codex, slides 166 to 171*

Why are red blood cells not simply spherical?

1. An internal cytoskeleton shapes them
2. They contain a large central nucleus
3. They contain chloroplasts for photosynthesis
4. They are surrounded by a cellulose wall

✓ **Answer: A** — The cytoskeleton helps maintain the shape.

A: The cytoskeleton helps maintain the shape.
B: Red blood cells lack nuclei. The right answer is: An internal cytoskeleton shapes them.
C: They lack chloroplasts. The right answer is: An internal cytoskeleton shapes them.
D: They lack walls. The right answer is: An internal cytoskeleton shapes them.

Q370 · Medium · *codex, slides 166 to 171*

Which factor depends on neighbouring cells?

1. The rate of photosynthesis in the cell
2. The mechanical action of adjoining cells
3. The number of plasmids in the cell
4. The presence of pili on the surface

✓ **Answer: B** — Neighbours exert mechanical action on shape.

A: This is not a factor. The right answer is: The mechanical action of adjoining cells.
B: Neighbours exert mechanical action on shape.
C: Plasmids are not named. The right answer is: The mechanical action of adjoining cells.
D: Pili are not named for cell shape.

Q371 · Hard · *codex, slides 166 to 171*

A spherical cell doubles its diameter. What happens to its surface area-to-volume ratio?

1. It doubles
2. It stays the same
3. It halves
4. It rises fourfold

✓ **Answer: C** — Surface area rises fourfold and volume eightfold, so the ratio halves.

A: The ratio falls as size increases.
B: Surface area grows more slowly than volume.
C: Surface area rises fourfold and volume eightfold, so the ratio halves.
D: Surface area, not the ratio, rises fourfold.

The cytoskeleton: overview · Q372–383

Q372 · Easy · *codex, slides 174 to 183*

Which three kinds of fibres make up the cytoskeleton?

1. Cristae, grana and cisternae of organelles
2. Histones, nucleosomes and chromatin fibres
3. Pili, fimbriae and flagella of bacterial cells
4. Microtubules, microfilaments and intermediate filaments

✓ **Answer: D** — These are the three components.

A: These are organelle folds and stacks.
B: These are chromatin components. The right answer is: Microtubules, microfilaments and intermediate filaments.
C: These are bacterial appendages. The right answer is: Microtubules, microfilaments and intermediate filaments.
D: These are the three components.

Q373 · Easy · *codex, slides 174 to 183*

Microtubules are made from which protein?

1. Actin
2. Keratin
3. Histone
4. Tubulin

✓ **Answer: D** — Microtubules are made of tubulin.

A: Actin forms microfilaments. The right answer is: Tubulin.
B: Keratin-like proteins form intermediate filaments. The right answer is: Tubulin.
C: Histones are chromatin proteins. The right answer is: Tubulin.
D: Microtubules are made of tubulin.

Q374 · Easy · *codex, slides 174 to 183*

Microfilaments are made from which protein?

1. Tubulin
2. Actin
3. Vimentin
4. Collagen

✓ **Answer: B** — Microfilaments are made of actin.

A: Tubulin forms microtubules. The right answer is: Actin.
B: Microfilaments are made of actin.
C: Vimentin is an intermediate filament protein.
D: Collagen is an extracellular protein. The right answer is: Actin.

Q375 · Easy · *codex, slides 174 to 183*

Intermediate filament proteins are similar to which protein of hair?

1. Actin
2. Tubulin
3. Myosin
4. Keratin

✓ **Answer: D** — They are similar to keratin.

A: Actin forms microfilaments. The right answer is: Keratin.
B: Tubulin forms microtubules. The right answer is: Keratin.
C: Myosin is a motor protein. The right answer is: Keratin.
D: They are similar to keratin.

Q376 · Easy · *codex, slides 174 to 183*

What does the cytoskeleton act like in the cell?

1. A skeleton that supports its shape
2. A wall of peptidoglycan around it
3. A sac of digestive enzymes inside it
4. A storage vacuole for water

✓ **Answer: A** — It supports cell shape like a skeleton.

A: It supports cell shape like a skeleton.
B: That describes bacterial walls. The right answer is: A skeleton that supports its shape.
C: That describes lysosomes. The right answer is: A skeleton that supports its shape.
D: That describes vacuoles. The right answer is: A skeleton that supports its shape.

Q377 · Medium · *codex, slides 174 to 183*

How wide is a microfilament?

1. About 25 nm
2. About 10 nm
3. About 70 nm
4. About 7 nm

✓ **Answer: D** — Microfilaments are about 7 nm.

A: That is a microtubule. The right answer is: About 7 nm.
B: That is the intermediate filament range.
C: This is too large. The right answer is: About 7 nm.
D: Microfilaments are about 7 nm.

Q378 · Medium · *codex, slides 174 to 183*

What is the diameter of the tubes that form microtubules?

1. About 7 nm
2. About 12 nm
3. About 25 nm
4. About 250 nm

✓ **Answer: C** — Microtubules are about 25 nm.

A: That is a microfilament. The right answer is: About 25 nm.
B: That is the intermediate filament range.
C: Microtubules are about 25 nm.
D: This is far too large. The right answer is: About 25 nm.

Q379 · Medium · *codex, slides 174 to 183*

What is the diameter range of intermediate filaments?

1. 25 nm
2. 7 nm
3. 100 to 200 nm
4. 8 to 12 nm

✓ **Answer: D** — Intermediate filaments are 8 to 12 nm.

A: That is a microtubule. The right answer is: 8 to 12 nm.
B: That is a microfilament. The right answer is: 8 to 12 nm.
C: This is far too large. The right answer is: 8 to 12 nm.
D: Intermediate filaments are 8 to 12 nm.

Q380 · Medium · *codex, slides 174 to 183*

Which proteins form intermediate filaments?

1. Alpha and beta tubulin dimers
2. G-actin and F-actin monomers
3. Kinesin and dynein motor proteins
4. Lamins and cell-specific proteins

✓ **Answer: D** — These form intermediate filaments.

A: These form microtubules. The right answer is: Lamins and cell-specific proteins.
B: This forms microfilaments. The right answer is: Lamins and cell-specific proteins.
C: These are motor proteins. The right answer is: Lamins and cell-specific proteins.
D: These form intermediate filaments. It matches what the lecture slides state.

Q381 · Medium · *codex, slides 174 to 183*

Which two categories describe the roles of the cytoskeleton?

1. Digestive and photosynthetic
2. Structural and transport
3. Genetic and hereditary
4. Detoxifying and storing

✓ **Answer: B** — The cytoskeleton has structural and transport roles.

A: These are not the categories named.
B: The cytoskeleton has structural and transport roles.
C: These are not the categories named.
D: These are not the categories named.

Q382 · Hard · *codex, slides 174 to 183*

Which function of the cytoskeleton operates at the tissue level?

1. Muscle movement
2. Anchoring organelles
3. Chromosome movement
4. Vesicle movement

✓ **Answer: A** — Muscle movement is a tissue-level function.

A: Muscle movement is a tissue-level function.
B: This is subcellular. The right answer is: Muscle movement.
C: This is subcellular. The right answer is: Muscle movement.
D: This is subcellular. The right answer is: Muscle movement.

Q383 · Devil · *codex, slides 174 to 183*

Which order ranks the three filaments from thinnest to thickest?

1. Microfilaments, intermediate filaments, then microtubules
2. Microtubules, intermediate filaments, then microfilaments
3. Intermediate filaments, microfilaments, then microtubules
4. Microfilaments, microtubules, then intermediate filaments

✓ **Answer: A** — The diameters are 7 nm, 8 to 12 nm and 25 nm.

A: The diameters are 7 nm, 8 to 12 nm and 25 nm.
B: This is thickest to thinnest. The right answer is: Microfilaments, intermediate filaments, then microtubules.
C: Microfilaments are the thinnest. The right answer is: Microfilaments, intermediate filaments, then microtubules.
D: Intermediate filaments are thinner than microtubules.

Actin filaments · Q384–392

Q384 · Easy · *codex, slides 184 to 195*

What does G-actin stand for?

1. Gel actin
2. Globular actin
3. Granular actin
4. Golgi actin

> ✓ **Answer: B** — G-actin is globular actin.

A: This is not the meaning. The right answer is: Globular actin.
B: G-actin is globular actin. It matches what the lecture slides state.
C: This is not the meaning. The right answer is: Globular actin.
D: This is not the meaning. The right answer is: Globular actin.

Q385 · Easy · *codex, slides 184 to 195*

What does F-actin stand for?

1. Free actin
2. Fibrous actin
3. Filamentous actin
4. Fat actin

> ✓ **Answer: C** — F-actin is filamentous actin.

A: This is not the meaning. The right answer is: Filamentous actin.
B: This is not the term used.
C: F-actin is filamentous actin. It matches what the lecture slides state.
D: This is not the meaning. The right answer is: Filamentous actin.

Q386 · Easy · *codex, slides 184 to 195*

Actin filaments have which structural property?

1. A hollow core
2. Polarity
3. A double membrane
4. A nucleus

> ✓ **Answer: B** — Actin filaments have polarity.

A: Hollow tubes are microtubules. The right answer is: Polarity.
B: Actin filaments have polarity. It matches what the lecture slides state.
C: Filaments have no membrane. The right answer is: Polarity.
D: Filaments are not organelles. The right answer is: Polarity.

Q387 · Easy · *codex, slides 184 to 195*

Which nucleotide is bound to G-actin?

1. GTP
2. ATP
3. dATP
4. UTP

> ✓ **Answer: B** — G-actin binds ATP.

A: This is not the nucleotide named.
B: G-actin binds ATP. It matches what the lecture slides state.
C: Not named. The right answer is: ATP.
D: Not named. The right answer is: ATP.

Q388 · Medium · *codex, slides 184 to 195*

What does F-actin do to its bound ATP?

1. It makes more ATP for the cell
2. It hydrolyses it to ADP and Pi
3. It stores it as glycogen granules
4. It exports it through nuclear pores

> ✓ **Answer: B** — ATP is hydrolysed to ADP and Pi.

A: It consumes ATP. The right answer is: It hydrolyses it to ADP and Pi.
B: ATP is hydrolysed to ADP and Pi.
C: Not described. The right answer is: It hydrolyses it to ADP and Pi.
D: Not described. The right answer is: It hydrolyses it to ADP and Pi.

Q389 · Medium · *codex, slides 184 to 195*

Why does ADP not leave the actin filament?

1. The opening of the cleft is blocked
2. The filament contains no ATP at all
3. ADP is too large to leave it
4. The filament is made of lipid molecules

> ✓ **Answer: A** — The cleft opening is blocked.

A: The cleft opening is blocked.
B: The filament holds ADP. The right answer is: The opening of the cleft is blocked.
C: Size is not the reason given.
D: It is protein. The right answer is: The opening of the cleft is blocked.

Q390 · Medium · *codex, slides 184 to 195*

Why does free G-actin rebind ATP rather than ADP?

1. ATP outnumbers ADP in the cytosol
2. ADP cannot bind to actin at all
3. ATP is made inside the actin cleft
4. G-actin has no cleft to bind either

✓ **Answer: A** — ATP is more abundant than ADP.

A: ATP is more abundant than ADP.
B: ADP can bind but is less abundant.
C: It is not made there. The right answer is: ATP outnumbers ADP in the cytosol.
D: It has a cleft that binds nucleotide.

Q391 · Hard · *codex, slides 184 to 195*

Which statement describes actin monomer orientation?

1. The cleft faces the same end, called the minus end
2. Monomers orient randomly, so there is no polarity
3. Monomers orient the cleft toward the plus end of a microtubule
4. Monomers form a hollow tube with a lumen

✓ **Answer: A** — The cleft faces the minus end.

A: The cleft faces the minus end.
B: Filaments have polarity. The right answer is: The cleft faces the same end, called the minus end.
C: This is about actin, not microtubules.
D: That describes microtubules. The right answer is: The cleft faces the same end, called the minus end.

Q392 · Hard · *codex, slides 184 to 195*

Which sequence describes the actin cycle?

1. F-actin hydrolyses ATP, G-actin polymerises, and ATP is exchanged for ADP
2. G-actin hydrolyses ATP first, then it forms microtubules in the cell
3. F-actin releases ADP directly through its cleft
4. G-actin-ATP polymerises, F-actin hydrolyses ATP, and G-actin swaps ADP for ATP

✓ **Answer: D** — This is the cycle in the lecture.

A: The order is wrong. The right answer is: G-actin-ATP polymerises, F-actin hydrolyses ATP, and G-actin swaps ADP for ATP.
B: Actin does not form microtubules. The right answer is: G-actin-ATP polymerises, F-actin hydrolyses ATP, and G-actin swaps ADP for ATP.
C: The cleft opening is blocked. The right answer is: G-actin-ATP polymerises, F-actin hydrolyses ATP, and G-actin swaps ADP for ATP.
D: This is the cycle in the lecture.

Intermediate filaments · Q393–400

Q393 · Easy · *codex, slides 197 to 200*

Intermediate filaments are found in most what?

1. Plants and fungi only
2. Animals, not plants and fungi
3. Bacteria only
4. Viruses

✓ **Answer: B** — They are found in animals.

A: They are not in plants and fungi.
B: They are found in animals.
C: They are eukaryotic. The right answer is: Animals, not plants and fungi.
D: Viruses are not cells. The right answer is: Animals, not plants and fungi.

Q394 · Easy · *codex, slides 197 to 200*

What are the subunits of intermediate filaments?

1. Globular actin units
2. α-helical rods
3. Tubulin dimers
4. Plasmid circles

✓ **Answer: B** — α-helical rods assemble into the filaments.

A: These form microfilaments. The right answer is: α-helical rods.
B: α-helical rods assemble into the filaments.
C: These form microtubules. The right answer is: α-helical rods.
D: These are bacterial DNA. The right answer is: α-helical rods.

Q395 · Easy · *codex, slides 197 to 200*

Intermediate filaments resist which kind of force?

1. Stretching forces
2. Light forces
3. Osmotic forces only
4. Gravitational forces

✓ **Answer: A** — They resist stretching.

A: They resist stretching. It matches what the lecture slides state.
B: Not named. The right answer is: Stretching forces.
C: Not named. The right answer is: Stretching forces.
D: Not named. The right answer is: Stretching forces.

Q396 · Medium · *codex, slides 197 to 200*

Unlike microfilaments, intermediate filaments do not contribute to what?

1. Mechanical strength
2. Cell shape
3. Support of the membrane
4. Cell motility

✓ **Answer: D** — They do not contribute to motility.

A: They provide strength. The right answer is: Cell motility.
B: They help maintain shape. The right answer is: Cell motility.
C: They support the membrane. The right answer is: Cell motility.
D: They do not contribute to motility.

Q397 · Medium · *codex, slides 197 to 200*

Intermediate filaments provide mechanical support for what?

1. The nuclear pore complex only
2. The lysosome membrane around enzymes
3. The plasma membrane at cell contacts
4. The chloroplast thylakoid disks

✓ **Answer: C** — They support these contact sites.

A: Not named. The right answer is: The plasma membrane at cell contacts.
B: Not named. The right answer is: The plasma membrane at cell contacts.
C: They support these contact sites.
D: Not named. The right answer is: The plasma membrane at cell contacts.

Q398 · Medium · *codex, slides 197 to 200*

How stable are intermediate filaments after extraction with detergents and high salt?

1. Completely destroyed
2. Extremely stable
3. Converted to microtubules
4. Converted to actin

✓ **Answer: B** — They remain extremely stable.

A: They persist. The right answer is: Extremely stable.
B: They remain extremely stable. It matches what the lecture slides state.
C: Not described. The right answer is: Extremely stable.
D: Not described. The right answer is: Extremely stable.

Q399 · Hard · *codex, slides 197 to 200*

Which statement about intermediate filament diameter is correct?

1. They are larger than microtubules but smaller than microfilaments
2. They are thinner than microtubules but thicker than microfilaments
3. They are the same size as microtubules in cells
4. They are the thinnest of the three filaments in cells

✓ **Answer: B** — They are intermediate in size.

A: This reverses the order. The right answer is: They are thinner than microtubules but thicker than microfilaments.
B: They are intermediate in size.
C: Microtubules are thicker. The right answer is: They are thinner than microtubules but thicker than microfilaments.
D: Microfilaments are thinnest. The right answer is: They are thinner than microtubules but thicker than microfilaments.

Q400 · Devil · *codex, slides 197 to 200*

Which feature makes intermediate filaments suited to resisting stretch in skin?

1. Hollow tubes of tubulin give tracks for motor proteins
2. Thin globular actin chains drive muscle contraction
3. A double membrane gives physical protection
4. Ropelike α-helical filaments give tensile strength

✓ **Answer: D** — The rope-like structure provides strength.

A: That describes microtubules. The right answer is: Ropelike α-helical filaments give tensile strength.
B: That describes microfilaments. The right answer is: Ropelike α-helical filaments give tensile strength.
C: Filaments have no membrane. The right answer is: Ropelike α-helical filaments give tensile strength.
D: The rope-like structure provides strength.

Module 3 — Intermediate filament types → Parts of the compound microscope

slides 201 to 300 · 200 questions · 17 sections · bank: BIOL151_Question_Bank_Slides201-300.docx
Difficulty: 80 Easy · 80 Medium · 32 Hard · 8 Devil

Intermediate filament types · Q401–410

Q401 · Easy · *codex, slides 201 to 202*

Which group of intermediate filaments is found in the nucleus?

1. Keratins
2. Vimentin
3. Neurofilaments
4. Lamins

✓ **Answer: D** — Lamins are the intermediate filaments of the nucleus.

A: Keratins are found in epithelia. The right answer is: Lamins.
B: Vimentin is found in leukocytes and endothelial cells.
C: Neurofilaments are found in neuronal axons.
D: Lamins are the intermediate filaments of the nucleus.

Q402 · Easy · *codex, slides 201 to 202*

Which intermediate filament proteins are found in epithelia?

1. Lamins
2. Vimentin
3. Neurofilaments
4. Keratins (cytokeratins)

✓ **Answer: D** — Keratins are found in epithelial tissues.

A: Lamins are found in the nucleus.
B: Vimentin is found in mesenchymal cells.
C: Neurofilaments are found in neurons. The right answer is: Keratins (cytokeratins).
D: Keratins are found in epithelial tissues.

Q403 · Easy · *codex, slides 201 to 202*

Which type III intermediate filament protein is the most abundant type?

1. Keratin
2. Lamin
3. Vimentin
4. Neurofilament protein

✓ **Answer: C** — Vimentin is the most abundant type III protein.

A: Keratins belong to a different group.
B: Lamins belong to a different group.
C: Vimentin is the most abundant type III protein.
D: Neurofilaments belong to a different group.

Q404 · Easy · *codex, slides 201 to 202*

Which intermediate filaments are found in neuronal axons?

1. Lamins
2. Cytokeratins
3. Neurofilaments
4. Vimentin

✓ **Answer: C** — Neurofilaments are found in neuronal axons.

A: Lamins are found in the nucleus.
B: Cytokeratins are found in epithelia. The right answer is: Neurofilaments.
C: Neurofilaments are found in neuronal axons.
D: Vimentin is found in leukocytes and endothelial cells.

Q405 · Medium · *codex, slides 201 to 202*

Into how many groups are intermediate filaments broken down in the lecture?

1. Four
2. Two
3. Three
4. Six

✓ **Answer: A** — The lecture lists four groups.

A: The lecture lists four groups.
B: Two is too few; four groups are listed.
C: Three is too few; four groups are listed.
D: Six is too many; four groups are listed.

Q406 · Medium · *codex, slides 201 to 202*

Keratins form which hard epithelial structures?

1. Bone, cartilage and tendon
2. Blood, lymph and plasma
3. Muscle, heart and nerve
4. Nails, hair and wool

✓ **Answer: D** — Hard epithelial tissues include nails, hair and wool.

A: These are connective tissues. The right answer is: Nails, hair and wool.
B: These are fluid tissues. The right answer is: Nails, hair and wool.
C: These are not hard epithelial tissues.
D: Hard epithelial tissues include nails, hair and wool.

Q407 · Medium · *codex, slides 201 to 202*

In which cells is vimentin found?

1. Neurons, hepatocytes and sperm cells
2. Plant cells, fungal cells and bacteria
3. Leukocytes and endothelial cells
4. Osteocytes, platelets and red cells

✓ **Answer: C** — Vimentin is found in these cells.

A: These are not the cells named.
B: Intermediate filaments are not found in these.
C: Vimentin is found in these cells.
D: These are not the cells named.

Q408 · Medium · *codex, slides 201 to 202*

What do neurofilaments do in axons and dendrites?

1. They carry vesicles toward the plus end using ATP
2. They generate force for contraction with myosin
3. They nucleate new microtubules at the minus end
4. They reach the axon tips and give structural support

✓ **Answer: D** — Neurofilaments extend from the cell body and provide structural support.

A: That describes kinesin. The right answer is: They extend from the cell body to the tips and give structural support.
B: That describes actin and myosin. The right answer is: They extend from the cell body to the tips and give structural support.
C: That describes γ-tubulin. The right answer is: They extend from the cell body to the tips and give structural support.
D: Neurofilaments extend from the cell body and provide structural support.

Q409 · Hard · *codex, slides 201 to 202*

All of the following are groups of intermediate filaments EXCEPT which one?

1. Lamins
2. Keratins
3. Tubulins
4. Neurofilaments

✓ **Answer: C** — Correct choice.

A: Lamins are an intermediate filament group.
B: Keratins are an intermediate filament group.
C: Correct choice. Tubulins form microtubules, not intermediate filaments.
D: Neurofilaments are an intermediate filament group.

Q410 · Hard · *codex, slides 201 to 202*

Which pairing of filament group and location is correct?

1. Lamins: epithelia; keratins: axons; neurofilaments: nucleus
2. Lamins: axons; keratins: nucleus; neurofilaments: epithelia
3. Lamins: nucleus; keratins: epithelia; neurofilaments: axons
4. Lamins: epithelia; keratins: nucleus; neurofilaments: leukocytes

✓ **Answer: C** — This matches the lecture.

A: The locations are mixed up. The right answer is: Lamins: nucleus; keratins: epithelia; neurofilaments: axons.
B: The locations are mixed up. The right answer is: Lamins: nucleus; keratins: epithelia; neurofilaments: axons.
C: This matches the lecture. It matches what the lecture slides state.
D: The locations are mixed up. The right answer is: Lamins: nucleus; keratins: epithelia; neurofilaments: axons.

Intermediate filament assembly · Q411–415

Q411 · Easy · *codex, slide 204*

Intermediate filament assembly begins with a pair of helical monomers twisting into what?

1. Protofilaments of 13 units
2. Coiled-coil dimers
3. G-actin chains
4. Tubulin rings

✓ **Answer: B** — Two helical monomers form a coiled-coil dimer.

A: That describes microtubules. The right answer is: Coiled-coil dimers.
B: Two helical monomers form a coiled-coil dimer.
C: That describes microfilaments. The right answer is: Coiled-coil dimers.
D: That describes microtubule building blocks. The right answer is: Coiled-coil dimers.

Q412 · Easy · *codex, slide 204*

Is the basic assembly unit of an intermediate filament polarized?

1. Yes, it has a plus and minus end
2. Yes, it has a cis and trans face
3. Yes, it has a head and a tail like kinesin
4. No, it is a non-polarized unit

✓ **Answer: D** — The unit is non-polarized.

A: That describes microtubules and microfilaments. The right answer is: No, it is a non-polarized unit.
B: That describes the Golgi apparatus. The right answer is: No, it is a non-polarized unit.
C: That describes motor proteins. The right answer is: No, it is a non-polarized unit.
D: The unit is non-polarized. It matches what the lecture slides state.

Q413 · Medium · *codex, slide 204*

What forms when two coiled-coil dimers twist around each other?

1. A trimer
2. A protofilament
3. A nucleosome
4. A tetramer

> ✓ **Answer: D** — The result is a tetramer of two coiled-coil dimers.

A: Two dimers give a tetramer. The right answer is: A tetramer.
B: That describes microtubules. The right answer is: A tetramer.
C: That is a chromatin unit. The right answer is: A tetramer.
D: The result is a tetramer of two coiled-coil dimers.

Q414 · Medium · *codex, slide 204*

How do intermediate filaments differ from microfilaments in polarity?

1. Intermediate filaments are polarized, whereas microfilaments are not
2. Both are polarized in exactly the same way
3. They are non-polarized, but microfilaments are polarized
4. Both are non-polarized in all cells

> ✓ **Answer: C** — The lecture contrasts the two.

A: This reverses the two. The right answer is: Intermediate filaments are non-polarized, whereas microfilaments are polarized.
B: Intermediate filaments are non-polarized. The right answer is: Intermediate filaments are non-polarized, whereas microfilaments are polarized.
C: The lecture contrasts the two.
D: Microfilaments are polarized. The right answer is: Intermediate filaments are non-polarized, whereas microfilaments are polarized.

Q415 · Hard · *codex, slide 204*

Which sequence describes intermediate filament assembly?

1. Two tetramers form a dimer, which twists into helical monomers
2. Tubulin dimers form protofilaments, which form a 13-member tube
3. G-actin binds ATP, then polymerises into a polarized filament
4. Monomers form coiled-coil dimers, then two dimers form a tetramer

> ✓ **Answer: D** — This is the assembly sequence in the lecture.

A: The steps are reversed. The right answer is: Helical monomers form coiled-coil dimers, two dimers form a tetramer, giving a non-polarized unit.
B: That describes microtubules. The right answer is: Helical monomers form coiled-coil dimers, two dimers form a tetramer, giving a non-polarized unit.
C: That describes microfilaments. The right answer is: Helical monomers form coiled-coil dimers, two dimers form a tetramer, giving a non-polarized unit.
D: This is the assembly sequence in the lecture.

Diseases of intermediate filaments · Q416–425

Q416 · Easy · *codex, slide 205*

Which skin disease results from lack of normal bundles of keratin filaments?

1. Silicosis
2. Tay-Sachs disease
3. Epidermolysis bullosa simplex
4. Alzheimer's disease

✓ **Answer: C** — Lack of keratin bundles causes this blistering disease.

A: Silicosis is a lung disease from inhaled silica.
B: Tay-Sachs is a lysosomal disorder. The right answer is: Epidermolysis bullosa simplex.
C: Lack of keratin bundles causes this blistering disease.
D: Alzheimer's is a brain disease. The right answer is: Epidermolysis bullosa simplex.

Q417 · Easy · *codex, slide 205*

What forms in the skin of a person with epidermolysis bullosa simplex?

1. Blisters
2. Tumours
3. Scales of collagen
4. Pigment patches

✓ **Answer: A** — Blisters form because normal keratin bundles are lacking.

A: Blisters form because normal keratin bundles are lacking.
B: Tumours are not described. The right answer is: Blisters.
C: Collagen scales are not described. The right answer is: Blisters.
D: Pigment patches are not described. The right answer is: Blisters.

Q418 · Easy · *codex, slide 205*

What are the keratin inclusions seen in alcoholic liver cirrhosis called?

1. Barr bodies
2. Mallory bodies
3. Nissl bodies
4. Lamellar bodies

✓ **Answer: B** — Keratin filaments accumulate as Mallory bodies.

A: Barr bodies relate to the X chromosome.
B: Keratin filaments accumulate as Mallory bodies.
C: Nissl bodies are neuron structures. The right answer is: Mallory bodies.
D: Lamellar bodies are not the structures named.

Q419 · Easy · *codex, slide 205*

Changes in which filaments are linked to Alzheimer's disease on this slide?

1. Keratin filaments
2. Lamins
3. Actin filaments
4. Neurofilaments

> ✓ **Answer: D** — Changes in neurofilaments in the brain are described.

A: Keratins are linked to skin and liver disease.
B: Lamins are nuclear filaments. The right answer is: Neurofilaments.
C: Actin filaments are not named here.
D: Changes in neurofilaments in the brain are described.

Q420 · Medium · *codex, slide 205*

Which intermediate filament protein is defective in epidermolysis bullosa simplex?

1. Vimentin
2. Keratin
3. Lamin
4. Neurofilament protein

> ✓ **Answer: B** — Keratin filament bundles are lacking.

A: Vimentin is not named for this disease.
B: Keratin filament bundles are lacking.
C: Lamin is not named for this disease.
D: Neurofilaments relate to the brain disease.

Q421 · Medium · *codex, slide 205*

In which organ do Mallory bodies accumulate?

1. The brain
2. The liver
3. The skin
4. The lung

> ✓ **Answer: B** — Mallory bodies accumulate in the liver.

A: The brain is linked to neurofilament changes.
B: Mallory bodies accumulate in the liver.
C: The skin shows blisters in the keratin disease.
D: The lung is affected in silicosis.

Q422 · Medium · *codex, slide 205*

Which disease involves accumulation of keratin filaments into inclusions?

1. Epidermolysis bullosa simplex
2. Alcoholic liver cirrhosis
3. Alzheimer's disease
4. Black lung disease

✓ **Answer: B** — Keratin inclusions form in alcoholic cirrhosis.

A: That disease involves lack of normal keratin bundles.
B: Keratin inclusions form in alcoholic cirrhosis.
C: That disease involves changes in neurofilaments.
D: That disease follows inhaled coal dust.

Q423 · Medium · *codex, slide 205*

In which tissue do neurofilament changes occur in Alzheimer's disease?

1. The brain
2. The liver
3. The skin
4. The lung

✓ **Answer: A** — The changes occur within the brain.

A: The changes occur within the brain.
B: Mallory bodies occur in the liver.
C: Blisters occur in the skin disease.
D: The lung is involved in silicosis.

Q424 · Hard · *codex, slide 205*

A patient's skin blisters because normal keratin bundles are lacking. Which cellular function has failed?

1. Resistance to mechanical stress
2. Transport of vesicles along microtubules
3. Contraction by actin and myosin
4. Spindle formation during mitosis

✓ **Answer: A** — Intermediate filaments give tensile strength against mechanical stress.

A: Intermediate filaments give tensile strength against mechanical stress.
B: Microtubules and kinesin do that. The right answer is: Resistance to mechanical stress by intermediate filaments.
C: Actin and myosin do that. The right answer is: Resistance to mechanical stress by intermediate filaments.
D: Microtubules do that. The right answer is: Resistance to mechanical stress by intermediate filaments.

Q425 · Devil · *codex, slide 205*

Which statement correctly pairs each disease with its filament change?

1. Epidermolysis bullosa simplex: keratin inclusions; Alzheimer's: lack of keratin bundles; alcoholic cirrhosis: neurofilament changes
2. Epidermolysis bullosa simplex: neurofilament changes; Alzheimer's: keratin inclusions; alcoholic cirrhosis: lack of bundles
3. All three involve loss of lamins from the nucleus
4. Epidermolysis bullosa simplex: lack of keratin bundles; Alzheimer's: neurofilament changes; alcoholic cirrhosis: keratin inclusions

✓ **Answer: D** — Each pairing matches the lecture.

A: The pairings are mixed up. The right answer is: Epidermolysis bullosa simplex: lack of keratin bundles; Alzheimer's: neurofilament changes; alcoholic cirrhosis: keratin inclusions.

B: The pairings are mixed up. The right answer is: Epidermolysis bullosa simplex: lack of keratin bundles; Alzheimer's: neurofilament changes; alcoholic cirrhosis: keratin inclusions.

C: Lamins are not implicated on this slide.

D: Each pairing matches the lecture.

Microtubule structure · Q426–441

Q426 · Easy · *codex, slides 208, 209, 218, 219*

What is the approximate diameter of a microtubule?

1. About 7 nm
2. About 25 nm
3. About 12 nm
4. About 250 nm

✓ **Answer: B** — Microtubules are about 25 nm across.

A: That is a microfilament. The right answer is: About 25 nm.

B: Microtubules are about 25 nm across.

C: That is the intermediate filament range.

D: This is ten times too large.

Q427 · Easy · *codex, slides 208, 209, 218, 219*

What shape are microtubules?

1. Solid rods
2. Flat sheets
3. Hollow tubes
4. Branched cables

✓ **Answer: C** — Microtubules are hollow tubes of variable length.

A: They are hollow. The right answer is: Hollow tubes.

B: They are tubes. The right answer is: Hollow tubes.

C: Microtubules are hollow tubes of variable length.

D: They are linear tubes. The right answer is: Hollow tubes.

Q428 · Easy · *codex, slides 176, 182*

Which of the three cytoskeletal filaments is the widest?

1. Microtubules
2. Microfilaments
3. Intermediate filaments
4. Lamin filaments

✓ **Answer: A** — Microtubules, at about 25 nm, are the widest of the three filaments.

A: Microtubules, at about 25 nm, are the widest of the three filaments.
B: Microfilaments are only about 7 nm wide.
C: Intermediate filaments are 8 to 12 nm wide, thinner than microtubules.
D: Lamins are intermediate filaments, so they are thinner than microtubules.

Q429 · Easy · *codex, slides 208, 209, 218, 219*

Tubulin dimers consist of which two subunits?

1. Alpha and beta tubulin
2. Actin and myosin
3. Kinesin and dynein
4. Lamin A and lamin B

✓ **Answer: A** — Each dimer is an α and a β tubulin pair.

A: Each dimer is an α and a β tubulin pair.
B: These are muscle proteins. The right answer is: Alpha and beta tubulin.
C: These are motor proteins. The right answer is: Alpha and beta tubulin.
D: These are nuclear lamins. The right answer is: Alpha and beta tubulin.

Q430 · Easy · *codex, slides 208, 209, 218, 219*

How many protofilaments make up a microtubule?

1. Seven
2. Thirteen
3. Eight
4. Twenty-five

✓ **Answer: B** — A microtubule has thirteen protofilaments.

A: Seven is too few. The right answer is: Thirteen.
B: A microtubule has thirteen protofilaments.
C: Eight is too few. The right answer is: Thirteen.
D: 25 nm is the diameter, not the number.

Q431 · Easy · *codex, slides 208, 209, 218, 219*

Tubulin dimers joined end to end form a linear polymer called what?

1. A nucleosome
2. A tetramer
3. A protofilament
4. A cisterna

> ✓ **Answer: C** — The linear polymer is a protofilament.

A: That is a chromatin unit. The right answer is: A protofilament.
B: That describes intermediate filament assembly. The right answer is: A protofilament.
C: The linear polymer is a protofilament.
D: That is a Golgi sac. The right answer is: A protofilament.

Q432 · Medium · *codex, slides 208, 209, 218, 219*

How are the thirteen protofilaments arranged in a microtubule?

1. Wound as a single rope with no central duct
2. Stacked as flat disks like thylakoids
3. Twisted into coiled-coil dimers
4. In parallel, around a central duct

> ✓ **Answer: D** — They lie in parallel around a central duct.

A: The tube is hollow. The right answer is: In parallel, forming a circular tube with a duct down the middle.
B: They form a tube, not stacked disks.
C: That describes intermediate filaments. The right answer is: In parallel, forming a circular tube with a duct down the middle.
D: They lie in parallel around a central duct.

Q433 · Medium · *codex, slides 208, 209, 218, 219*

In humans, how long can axonal paths carrying cargo along microtubules be?

1. About a millimetre
2. About 25 nm
3. More than a metre
4. Exactly 7 micrometres

> ✓ **Answer: C** — Axons can exceed a metre in length.

A: This is far too short. The right answer is: More than a metre.
B: That is the tube diameter. The right answer is: More than a metre.
C: Axons can exceed a metre in length.
D: That is the size of a red blood cell.

Q434 · Medium · *codex, slides 208, 209, 218, 219*

What must exceed a critical level for microtubule assembly to occur?

1. The temperature of the cell
2. The number of motor proteins
3. The concentration of tubulin
4. The thickness of the cell wall

✓ **Answer: C** — Tubulin concentration must exceed a critical level.

A: Temperature is not the stated condition.
B: Motor proteins are not required for assembly.
C: Tubulin concentration must exceed a critical level.
D: This is unrelated. The right answer is: The concentration of tubulin molecules in solution.

Q435 · Medium · *codex, slides 208, 209, 218, 219*

What does it mean that tubulin building blocks are polar?

1. Their ends have different shapes
2. They carry equal charges at both ends
3. They dissolve only in water
4. They contain two identical halves

✓ **Answer: A** — This gives microtubules a plus and a minus end.

A: This gives microtubules a plus and a minus end.
B: Polarity means the ends differ. The right answer is: They have a different molecular configuration at each end.
C: This is not polarity. The right answer is: They have a different molecular configuration at each end.
D: The α and β halves differ.

Q436 · Medium · *codex, slides 208, 209, 218, 219*

What are the two ends of a microtubule called?

1. The cis end and the trans end
2. The head end and the tail end
3. The inner end and the outer end
4. The plus end and the minus end

✓ **Answer: D** — Microtubules have plus and minus ends.

A: These are Golgi faces. The right answer is: The plus end and the minus end.
B: These are not named. The right answer is: The plus end and the minus end.
C: These are not named. The right answer is: The plus end and the minus end.
D: Microtubules have plus and minus ends.

Q437 · Medium · *codex, slides 208, 209, 218, 219*

Which nucleotide is bound by tubulin in microtubule assembly?

1. ATP
2. UTP
3. cAMP
4. GTP

✓ **Answer: D** — GTP binds tubulin and drives growth and retraction.

A: ATP is bound by G-actin. The right answer is: GTP.
B: UTP is not named. The right answer is: GTP.
C: cAMP is a signal in pigment cells.
D: GTP binds tubulin and drives growth and retraction.

Q438 · Medium · *codex, slides 208, 209, 218, 219*

What is a tubulin dimer?

1. A pair of actin monomers
2. One alpha and one beta tubulin
3. Two coiled-coil keratin chains
4. A pair of kinesin heads

✓ **Answer: B** — The dimer is an α–β pair.

A: Actin forms microfilaments. The right answer is: A pair of tubulin molecules, one alpha and one beta.
B: The dimer is an α–β pair.
C: That describes intermediate filaments. The right answer is: A pair of tubulin molecules, one alpha and one beta.
D: That describes a motor protein. The right answer is: A pair of tubulin molecules, one alpha and one beta.

Q439 · Hard · *codex, slides 208, 209, 218, 219*

Which description of microtubule structure is correct?

1. A hollow tube of 13 parallel protofilaments
2. A solid rope of coiled-coil keratin dimers and tetramers
3. A polarized double helix of globular actin monomers
4. A stack of flat tubulin disks surrounded by a membrane

✓ **Answer: A** — This summarises the lecture.

A: This summarises the lecture. It matches what the lecture slides state.
B: That describes intermediate filaments. The right answer is: A hollow tube of 13 parallel protofilaments made of α and β tubulin dimers.
C: That describes microfilaments. The right answer is: A hollow tube of 13 parallel protofilaments made of α and β tubulin dimers.
D: Microtubules are hollow tubes without membranes.

Q440 · Hard · *codex, slides 208, 209, 218, 219*

All of the following are true of microtubules EXCEPT which one?

1. They are hollow tubes about 25 nm wide
2. They have thirteen protofilaments
3. They are made of actin monomers
4. They have a plus and a minus end

> ✓ **Answer: C** — Correct choice.

A: This is true. The right answer is: They are made of actin monomers.
B: This is true. The right answer is: They are made of actin monomers.
C: Correct choice. Microtubules are made of tubulin.
D: This is true. The right answer is: They are made of actin monomers.

Q441 · Hard · *codex, slides 208, 209, 218, 219*

A nerve cell must move a vesicle over more than a metre to the axon tip. Which structure provides the track?

1. Lamins
2. Keratin filaments
3. Microtubules
4. Mallory bodies

> ✓ **Answer: C** — Microtubules carry cargoes along axons.

A: Lamins line the nucleus. The right answer is: Microtubules.
B: Keratins are in epithelia. The right answer is: Microtubules.
C: Microtubules carry cargoes along axons.
D: These are keratin inclusions in liver cells.

Tubulin polymerisation and drugs · Q442–455

Q442 · Easy · *codex, slides 210 to 212, 220, 221*

Which drug acts as a microtubule stabiliser?

1. Colchicine
2. Taxol
3. Colcemid
4. Vincristine

> ✓ **Answer: B** — Taxol stabilises microtubules.

A: Colchicine inhibits polymerisation. The right answer is: Taxol.
B: Taxol stabilises microtubules. It matches what the lecture slides state.
C: Colcemid inhibits polymerisation. The right answer is: Taxol.
D: Vincristine inhibits assembly. The right answer is: Taxol.

Q443 · Easy · *codex, slides 210 to 212, 220, 221*

Which drugs inhibit microtubule polymerisation by binding the subunit?

1. Taxol and paclitaxel
2. Penicillin and lysozyme
3. Colchicine and colcemid
4. Catalase and urate oxidase

✓ **Answer: C** — Both bind the subunit and inhibit polymerisation.

A: Taxol stabilises microtubules. The right answer is: Colchicine and colcemid.
B: These act on bacterial walls. The right answer is: Colchicine and colcemid.
C: Both bind the subunit and inhibit polymerisation.
D: These are peroxisome enzymes. The right answer is: Colchicine and colcemid.

Q444 · Easy · *codex, slides 210 to 212, 220, 221*

Which type of tubulin nucleates microtubules at the minus end?

1. α-tubulin
2. β-tubulin
3. γ-tubulin
4. Actin

✓ **Answer: C** — γ-tubulin nucleates microtubules at the minus end.

A: α-tubulin is a dimer subunit. The right answer is: γ-tubulin.
B: β-tubulin is a dimer subunit. The right answer is: γ-tubulin.
C: γ-tubulin nucleates microtubules at the minus end.
D: Actin is not tubulin. The right answer is: γ-tubulin.

Q445 · Easy · *codex, slides 210 to 212, 220, 221*

Which nucleotide's binding, hydrolysis and release explain microtubule growth and retraction?

1. ATP
2. GTP
3. cAMP
4. UTP

✓ **Answer: B** — GTP binding, hydrolysis and release drive growth and retraction.

A: ATP is used by motor proteins and actin.
B: GTP binding, hydrolysis and release drive growth and retraction.
C: cAMP is a signal molecule. The right answer is: GTP.
D: UTP is not named. The right answer is: GTP.

Q446 · Easy · *codex, slides 210 to 212, 220, 221*

Which behaviour describes the alternating growth and shrinkage of microtubules?

1. Dynamic instability
2. Treadmilling of actin only
3. Autolysis
4. Binary fission

> ✓ **Answer: A** — Microtubules show dynamic instability.

A: Microtubules show dynamic instability. It matches what the lecture slides state.
B: Treadmilling is also shown but dynamic instability is the named behaviour.
C: Autolysis is recycling by lysosomes. The right answer is: Dynamic instability.
D: This is bacterial reproduction. The right answer is: Dynamic instability.

Q447 · Easy · *codex, slides 210 to 212, 220, 221*

What does colchicine do to microtubules?

1. It stabilises assembled microtubules
2. It inhibits their polymerisation
3. It converts them into actin filaments
4. It nucleates them at the minus end

> ✓ **Answer: B** — Colchicine inhibits assembly.

A: That describes taxol. The right answer is: It inhibits their polymerisation.
B: Colchicine inhibits assembly. It matches what the lecture slides state.
C: This does not occur. The right answer is: It inhibits their polymerisation.
D: That describes γ-tubulin. The right answer is: It inhibits their polymerisation.

Q448 · Medium · *codex, slides 210 to 212, 220, 221*

What does taxol do to microtubules?

1. It blocks their assembly by binding subunits
2. It stabilises them against disassembly
3. It cuts them into protofilaments
4. It builds them from actin

> ✓ **Answer: B** — Taxol inhibits disassembly.

A: That describes colchicine. The right answer is: It stabilises them against disassembly.
B: Taxol inhibits disassembly. It matches what the lecture slides state.
C: This is not described. The right answer is: It stabilises them against disassembly.
D: They are made of tubulin. The right answer is: It stabilises them against disassembly.

Q449 · Medium · *codex, slides 210 to 212, 220, 221*

Colcemid is listed alongside which drug as an inhibitor of polymerisation?

1. Colchicine
2. Taxol
3. Kinesin
4. Mallory

✓ **Answer: A** — Colchicine and colcemid inhibit polymerisation.

A: Colchicine and colcemid inhibit polymerisation.
B: Taxol is a stabiliser. The right answer is: Colchicine.
C: Kinesin is a motor protein. The right answer is: Colchicine.
D: Mallory bodies are not drugs. The right answer is: Colchicine.

Q450 · Medium · *codex, slides 210 to 212, 220, 221*

At which end of the microtubule does γ-tubulin nucleate growth?

1. The plus end
2. The middle of the tube
3. The minus end
4. The cell membrane

✓ **Answer: C** — γ-tubulin nucleates at the minus end.

A: The plus end is the growing end.
B: It nucleates at an end. The right answer is: The minus end.
C: γ-tubulin nucleates at the minus end.
D: The membrane caps microtubules. The right answer is: The minus end.

Q451 · Medium · *codex, slides 210 to 212, 220, 221*

Which statement describes the mechanism of microtubule growth and retraction?

1. Binding, hydrolysis and release of GTP
2. Binding, hydrolysis and release of ATP
3. Fusion of lysosomes with endosomes
4. Division of pre-existing peroxisomes

✓ **Answer: A** — GTP binding, hydrolysis and release is the mechanism.

A: GTP binding, hydrolysis and release is the mechanism.
B: ATP drives actin and motors. The right answer is: Binding, hydrolysis and release of GTP.
C: This is unrelated. The right answer is: Binding, hydrolysis and release of GTP.
D: This is unrelated. The right answer is: Binding, hydrolysis and release of GTP.

Q452 · Medium · *codex, slides 210 to 212, 220, 221*

Which processes are named as part of the mechanism of microtubule growth and retraction?

1. ATP hydrolysis alone with no capping
2. GTP binding and hydrolysis, plus capping
3. Methylation of keratin and capping at the nucleus
4. Digestion by hydrolases and capping at the Golgi

✓ **Answer: B** — These are listed in the lecture.

A: GTP is the nucleotide named. The right answer is: GTP binding and hydrolysis, plus capping at the cell membrane.
B: These are listed in the lecture.
C: This is not described. The right answer is: GTP binding and hydrolysis, plus capping at the cell membrane.
D: This is not described. The right answer is: GTP binding and hydrolysis, plus capping at the cell membrane.

Q453 · Hard · *codex, slides 210 to 212, 220, 221*

How do colchicine and taxol differ in their action?

1. Colchicine stabilises microtubules, while taxol blocks assembly
2. Both stabilise the assembled microtubules in cells
3. Colchicine blocks assembly, while taxol stabilises microtubules
4. Both depolymerise actin filaments in cells

✓ **Answer: C** — They act in opposite ways.

A: The actions are swapped. The right answer is: Colchicine binds subunits and blocks assembly, while taxol stabilises assembled microtubules.
B: Colchicine inhibits assembly. The right answer is: Colchicine binds subunits and blocks assembly, while taxol stabilises assembled microtubules.
C: They act in opposite ways.
D: They act on microtubules. The right answer is: Colchicine binds subunits and blocks assembly, while taxol stabilises assembled microtubules.

Q454 · Hard · *codex, slides 210 to 212, 220, 221*

Which pairing of drug and effect is correct?

1. Colchicine: stabilises microtubules; taxol: inhibits polymerisation
2. Colchicine: inhibits polymerisation; taxol: stabilises microtubules
3. Colchicine: nucleates at the minus end; taxol: cuts protofilaments
4. Colchicine: motor protein; taxol: tubulin subunit

✓ **Answer: B** — This matches the lecture.

A: The effects are swapped. The right answer is: Colchicine: inhibits polymerisation; taxol: stabilises microtubules.
B: This matches the lecture. It matches what the lecture slides state.
C: These are not their effects. The right answer is: Colchicine: inhibits polymerisation; taxol: stabilises microtubules.
D: Neither is a protein. The right answer is: Colchicine: inhibits polymerisation; taxol: stabilises microtubules.

Q455 · Devil · *codex, slides 210 to 212, 220, 221*

A drug locks microtubules so they cannot disassemble, and cells stall in mitosis. Which drug is this, and why do the cells stall?

1. Colchicine, because it stabilises spindle microtubules
2. Taxol, because it inhibits tubulin polymerisation
3. Taxol, because stabilised microtubules cannot shorten
4. Colchicine, because it inhibits the nuclear envelope

✓ **Answer: C** — Spindle fibres must grow and shorten to pull and position chromosomes.

A: Colchicine inhibits polymerisation. The right answer is: Taxol, because stabilised spindle microtubules cannot shorten to pull chromosomes.
B: Taxol inhibits disassembly. The right answer is: Taxol, because stabilised spindle microtubules cannot shorten to pull chromosomes.
C: Spindle fibres must grow and shorten to pull and position chromosomes.
D: Colchicine acts on microtubules. The right answer is: Taxol, because stabilised spindle microtubules cannot shorten to pull chromosomes.

Motor proteins · Q456–471

Q456 · Easy · *codex, slides 213 to 216, 224, 236*

Which motor protein moves toward the plus end of a microtubule?

1. Dynein
2. Tubulin
3. Kinesin
4. Keratin

✓ **Answer: C** — Kinesin moves toward the plus end.

A: Dynein moves toward the minus end.
B: Tubulin is not a motor protein.
C: Kinesin moves toward the plus end.
D: Keratin is not a motor protein.

Q457 · Easy · *codex, slides 213 to 216, 224, 236*

Which motor protein moves toward the minus end of a microtubule?

1. Kinesin
2. Actin
3. Dynein
4. Vimentin

✓ **Answer: C** — Dynein moves toward the minus end.

A: Kinesin moves toward the plus end.
B: Actin is not a motor protein.
C: Dynein moves toward the minus end.
D: Vimentin is an intermediate filament protein.

Q458 · Easy · *codex, slides 213 to 216, 224, 236*

Which three motor proteins are shown in the lecture?

1. Kinesin, myosin and dynein
2. Tubulin, actin and keratin
3. Lamin, vimentin and keratin
4. Catalase, urate oxidase and amylase

✓ **Answer: A** — These three are shown.

A: These three are shown. It matches what the lecture slides state.
B: These are filament proteins. The right answer is: Kinesin, myosin and dynein.
C: These are intermediate filament proteins. The right answer is: Kinesin, myosin and dynein.
D: These are enzymes. The right answer is: Kinesin, myosin and dynein.

Q459 · Easy · *codex, slides 213 to 216, 224, 236*

On which side of a microtubule do motor proteins travel?

1. Along the outside
2. Along the inside
3. Through the central duct
4. Only at the minus end

✓ **Answer: A** — They travel along the outside, not inside.

A: They travel along the outside, not inside.
B: They do not travel along the inside.
C: They travel on the outside. The right answer is: Along the outside.
D: They travel along the length. The right answer is: Along the outside.

Q460 · Easy · *codex, slides 213 to 216, 224, 236*

Which molecule do motor proteins use as fuel?

1. ATP
2. GTP only
3. cAMP
4. Glycogen

✓ **Answer: A** — Motor proteins hydrolyse ATP as they move.

A: Motor proteins hydrolyse ATP as they move.
B: GTP drives tubulin assembly. The right answer is: ATP.
C: cAMP is a signal. The right answer is: ATP.
D: Glycogen is a storage carbohydrate. The right answer is: ATP.

Q461 · Easy · *codex, slides 213 to 216, 224, 236*

Each motor protein has a motor domain and what other region?

1. A stalk
2. A nucleus
3. A cell wall
4. A thylakoid

✓ **Answer: A** — Motor proteins have a motor domain and a stalk.

A: Motor proteins have a motor domain and a stalk.
B: Proteins do not contain nuclei. The right answer is: A stalk.
C: Proteins do not have walls. The right answer is: A stalk.
D: Thylakoids are in chloroplasts. The right answer is: A stalk.

Q462 · Medium · *codex, slides 213 to 216, 224, 236*

Besides microtubules, which other filaments are used as trackways by motor proteins?

1. Lamin filaments
2. Actin filaments
3. Keratin filaments
4. Neurofilaments

✓ **Answer: B** — Actin filaments are also used as trackways.

A: Lamins form the nuclear lamina. The right answer is: Actin filaments.
B: Actin filaments are also used as trackways.
C: Keratins give mechanical strength. The right answer is: Actin filaments.
D: Neurofilaments support axons. The right answer is: Actin filaments.

Q463 · Medium · *codex, slides 213 to 216, 224, 236*

In pigment cells, kinesin and dynein move pigment in response to which signal?

1. cAMP
2. GTP
3. Mallory bodies
4. Tau protein

✓ **Answer: A** — The lecture links this movement to cAMP.

A: The lecture links this movement to cAMP.
B: GTP drives microtubule assembly. The right answer is: cAMP.
C: These are inclusions in liver cells.
D: Tau is a microtubule associated protein.

Q464 · Medium · *codex, slides 213 to 216, 224, 236*

Do motor proteins of different models all move in the same direction along microtubules?

1. Yes, all of them move toward the plus end
2. Yes, all of them move toward the minus end
3. No, they travel in different directions
4. No, they do not move along microtubules

✓ **Answer: C** — Kinesin and dynein travel in opposite directions.

A: Dynein moves toward the minus end.
B: Kinesin moves toward the plus end.
C: Kinesin and dynein travel in opposite directions.
D: They are motor proteins that move.

Q465 · Medium · *codex, slides 213 to 216, 224, 236*

How many models of motor proteins does the lecture list?

1. Two
2. Three
3. Five
4. Eight

✓ **Answer: B** — Motor proteins come in three models.

A: Two is too few. The right answer is: Three.
B: Motor proteins come in three models.
C: Five is too many. The right answer is: Three.
D: Eight is too many. The right answer is: Three.

Q466 · Medium · *codex, slides 213 to 216, 224, 236*

What can link microtubules and actin filaments as trackways?

1. Phosphodiester bonds
2. Peptidoglycan strands
3. Proteins that bridge the two
4. Cellulose fibres

✓ **Answer: C** — Proteins can link microtubules and actin filaments.

A: These link nucleotides. The right answer is: Proteins that bridge the two.
B: These are bacterial wall polymers. The right answer is: Proteins that bridge the two.
C: Proteins can link microtubules and actin filaments.
D: These are plant wall fibres. The right answer is: Proteins that bridge the two.

Q467 · Medium · *codex, slides 213 to 216, 224, 236*

All of the following are motor proteins EXCEPT which one?

1. Tubulin
2. Kinesin
3. Dynein
4. Myosin

> ✓ **Answer: A** — Correct choice.

A: Correct choice. Tubulin is a structural subunit, not a motor protein.
B: Kinesin is a motor protein. The right answer is: Tubulin.
C: Dynein is a motor protein. The right answer is: Tubulin.
D: Myosin is a motor protein. The right answer is: Tubulin.

Q468 · Medium · *codex, slides 213 to 216, 224, 236*

Which statement about motor protein structure is correct?

1. Only kinesin has a motor domain
2. Motor proteins have no associated polypeptides
3. Motor proteins are made entirely of lipid
4. All three have a motor domain and a stalk

> ✓ **Answer: D** — The lecture shows this shared layout.

A: All three have one. The right answer is: Kinesin, myosin and dynein each have a motor domain and a stalk.
B: They have associated polypeptides. The right answer is: Kinesin, myosin and dynein each have a motor domain and a stalk.
C: They are proteins. The right answer is: Kinesin, myosin and dynein each have a motor domain and a stalk.
D: The lecture shows this shared layout.

Q469 · Hard · *codex, slides 213 to 216, 224, 236*

Which statement correctly matches motor proteins with direction on microtubules?

1. Kinesin moves to the plus end, dynein to the minus end
2. Kinesin moves toward the minus end, and dynein toward the plus end
3. Both move toward the plus end of the tube
4. Both move toward the minus end of the tube

> ✓ **Answer: A** — These are the directions given.

A: These are the directions given.
B: The directions are swapped. The right answer is: Kinesin moves toward the plus end, and dynein toward the minus end.
C: Dynein moves toward the minus end.
D: Kinesin moves toward the plus end.

Q470 · Hard · *codex, slides 213 to 216, 224, 236*

A neuron must send a vesicle out to the axon tip and return old material. Which motors suit these two trips?

1. Dynein outward and kinesin back to the nucleus
2. Lamins outward and keratin back again
3. Kinesin outward, dynein back toward the cell body
4. Tubulin outward and actin back again

✓ **Answer: C** — The two motors move in opposite directions.

A: The directions are reversed. The right answer is: Kinesin outward toward the plus end, and dynein back toward the minus end.
B: These are not motors. The right answer is: Kinesin outward toward the plus end, and dynein back toward the minus end.
C: The two motors move in opposite directions.
D: These are filament subunits, not motors.

Q471 · Devil · *codex, slides 213 to 216, 224, 236*

A drug blocks dynein only. Which axonal transport is most affected?

1. Movement of cargo back toward the cell body
2. Movement of cargo toward the plus end, out to the axon tip
3. Assembly of microtubules by GTP
4. Formation of keratin tetramers

✓ **Answer: A** — Dynein moves cargo toward the minus end.

A: Dynein moves cargo toward the minus end.
B: Kinesin handles that direction. The right answer is: Movement of cargo toward the minus end, back toward the cell body.
C: This is not dynein's role. The right answer is: Movement of cargo toward the minus end, back toward the cell body.
D: This is not dynein's role. The right answer is: Movement of cargo toward the minus end, back toward the cell body.

Microtubule systems and functions · Q472–485

Q472 · Easy · *codex, slides 217, 225 to 227*

Which structure organises the microtubules of an interphase cell?

1. The centrosome
2. The nucleolus
3. The Golgi apparatus
4. The peroxisome

✓ **Answer: A** — The centrosome is the microtubule organizing centre in interphase.

A: The centrosome is the microtubule organizing centre in interphase.
B: The nucleolus makes ribosomal subunits. The right answer is: The centrosome.
C: The Golgi packages materials. The right answer is: The centrosome.
D: Peroxisomes oxidise toxic substances. The right answer is: The centrosome.

Q473 · Easy · *codex, slides 217, 225 to 227*

Microtubules are the central structural supports of which two structures?

1. Microvilli and desmosomes
2. Cilia and flagella
3. Nuclear pores and lamins
4. Plasmodesmata and walls

✓ **Answer: B** — Microtubules support cilia and flagella.

A: Microvilli are supported by actin. The right answer is: Cilia and flagella.
B: Microtubules support cilia and flagella.
C: These are nuclear features. The right answer is: Cilia and flagella.
D: These are plant structures. The right answer is: Cilia and flagella.

Q474 · Easy · *codex, slides 217, 225 to 227*

What do microtubules move during cell division?

1. Chromosomes
2. Ribosomes
3. Lysosomes
4. Plasmids

✓ **Answer: A** — Microtubules move chromosomes during cell division.

A: Microtubules move chromosomes during cell division.
B: Ribosomes are not moved by spindle microtubules.
C: Lysosomes are not the main cargo of the spindle.
D: Plasmids are bacterial DNA circles. The right answer is: Chromosomes.

Q475 · Easy · *codex, slides 217, 225 to 227*

What do cilia in the lungs sweep along?

1. Air bubbles trapped in plasma
2. Collagen fibres from fibroblasts
3. Silica crystals only
4. Mucus carrying trapped debris

✓ **Answer: D** — Cilia sweep mucus carrying trapped debris from the lungs.

A: This is not described. The right answer is: Mucus carrying trapped debris.
B: This is not described. The right answer is: Mucus carrying trapped debris.
C: Mucus carries the debris, not only silica.
D: Cilia sweep mucus carrying trapped debris from the lungs.

Q476 · Easy · *codex, slides 217, 225 to 227*

What anchors a cilium or flagellum at the cell?

1. A centriole-free nucleus
2. A basal body
3. A plasmodesma
4. A glycocalyx

✓ **Answer: B** — The basal body anchors cilia and flagella.

A: The nucleus does not anchor them.
B: The basal body anchors cilia and flagella.
C: This is a plant junction. The right answer is: A basal body.
D: This is a bacterial surface coat.

Q477 · Easy · *codex, slides 217, 225 to 227*

What kind of movement does a flagellum have?

1. Sliding like a piston
2. Rolling like a wheel
3. Rotation of the nucleus
4. Undulatory movement

✓ **Answer: D** — A flagellum has an undulatory movement.

A: This is not described. The right answer is: Undulatory movement.
B: This is not described. The right answer is: Undulatory movement.
C: This is not described. The right answer is: Undulatory movement.
D: A flagellum has an undulatory movement.

Q478 · Medium · *codex, slides 217, 225 to 227*

Relative to the flagellum's axis, in which direction is force generated?

1. At right angles to the axis
2. Only at the tip, away from the axis
3. Opposite to its movement
4. Parallel to the axis

✓ **Answer: D** — Force is generated parallel to the flagellum's axis.

A: The lecture says parallel. The right answer is: Parallel to the axis.
B: The lecture says parallel. The right answer is: Parallel to the axis.
C: The lecture says parallel. The right answer is: Parallel to the axis.
D: Force is generated parallel to the flagellum's axis.

Q479 · Medium · *codex, slides 217, 225 to 227*

What do microtubules guide as tracks?

1. Ribosomal subunits across the nuclear pores
2. Motor proteins carrying organelles
3. Peptidoglycan across the cell wall
4. Hydrogen peroxide into the peroxisome

✓ **Answer: B** — Motor proteins carry organelles along microtubule tracks.

A: This is not described. The right answer is: Motor proteins carrying organelles to their destinations.
B: Motor proteins carry organelles along microtubule tracks.
C: This is not described. The right answer is: Motor proteins carrying organelles to their destinations.
D: This is not described. The right answer is: Motor proteins carrying organelles to their destinations.

Q480 · Medium · *codex, slides 217, 225 to 227*

Which microtubule system appears in a dividing cell?

1. The basal body
2. The mitotic spindle
3. The centrosome in interphase
4. The nuclear lamina

✓ **Answer: B** — The mitotic system forms the spindle.

A: This anchors cilia. The right answer is: The mitotic spindle.
B: The mitotic system forms the spindle.
C: This is the interphase system. The right answer is: The mitotic spindle.
D: This is made of lamins. The right answer is: The mitotic spindle.

Q481 · Medium · *codex, slides 217, 225 to 227*

How do cilia and flagella move unicellular organisms?

1. By pumping protons across membranes
2. By digesting food in lysosomes
3. By propelling water past the organism
4. By contracting actin rings

✓ **Answer: C** — They propel water past the organism.

A: This is not described. The right answer is: By propelling water past the organism.
B: This is not described. The right answer is: By propelling water past the organism.
C: They propel water past the organism.
D: This is not described. The right answer is: By propelling water past the organism.

Q482 · Medium · *codex, slides 217, 225 to 227*

Microtubules take part in all of the following EXCEPT which one?

1. Moving chromosomes during division
2. Supporting cilia and flagella
3. Guiding vesicle transport
4. Resisting stretching forces

✓ **Answer: D** — Correct choice.

A: Microtubules do this. The right answer is: Resisting stretching forces as the main support.
B: Microtubules do this. The right answer is: Resisting stretching forces as the main support.
C: Microtubules do this. The right answer is: Resisting stretching forces as the main support.
D: Correct choice. Intermediate filaments resist stretching.

Q483 · Hard · *codex, slides 217, 225 to 227*

Which pairing of structure and role is correct?

1. Centrosome: anchors cilia; basal body: moves chromosomes; spindle: organises interphase microtubules
2. Centrosome: organises interphase microtubules; basal body: anchors cilia; spindle: moves chromosomes
3. Centrosome: makes ribosomes; basal body: stores calcium; spindle: digests debris
4. Centrosome: resists stretch; basal body: carries vesicles; spindle: nucleates actin

✓ **Answer: B** — Each pairing is right.

A: The roles are mixed up. The right answer is: Centrosome: organises interphase microtubules; basal body: anchors cilia; spindle: moves chromosomes.
B: Each pairing is right. It matches what the lecture slides state.
C: These are not their roles. The right answer is: Centrosome: organises interphase microtubules; basal body: anchors cilia; spindle: moves chromosomes.
D: These are not their roles. The right answer is: Centrosome: organises interphase microtubules; basal body: anchors cilia; spindle: moves chromosomes.

Q484 · Hard · *codex, slides 217, 225 to 227*

A smoker's airway cilia stop beating. What is the direct consequence?

1. Chromosomes fail to separate in lung cells
2. Lung cells lose their intermediate filaments
3. Alveolar lysosomes stop making enzymes
4. Mucus and trapped debris are not swept out

✓ **Answer: D** — Ciliary sweeping removes mucus and debris.

A: Cilia are not the spindle. The right answer is: Mucus carrying trapped debris is no longer swept out of the lungs.
B: Cilia are built on microtubules. The right answer is: Mucus carrying trapped debris is no longer swept out of the lungs.
C: This is not the direct result.
D: Ciliary sweeping removes mucus and debris.

Q485 · Devil · *codex, slides 217, 225 to 227*

Which statement correctly contrasts anchored cilia with a free-swimming flagellate?

1. Anchored cilia move fluid, whereas flagella propel the organism
2. Anchored cilia propel the organism, whereas flagella move fluid over a surface
3. Both are supported by actin filaments only
4. Neither of them contains microtubules

✓ **Answer: A** — Anchoring makes the fluid move instead of the cell.

A: Anchoring makes the fluid move instead of the cell.
B: The roles are reversed. The right answer is: Anchored cilia move fluid over the surface, whereas flagella propel the organism through water.
C: Both are supported by microtubules. The right answer is: Anchored cilia move fluid over the surface, whereas flagella propel the organism through water.
D: Both have microtubule supports. The right answer is: Anchored cilia move fluid over the surface, whereas flagella propel the organism through water.

Microtubules and Alzheimer's disease · Q486–495

Q486 · Easy · *codex, slides 228 to 230*

Which protein is a microtubule associated protein found in nerve cells?

1. Keratin
2. Catalase
3. Tau protein
4. Histone

✓ **Answer: C** — Tau is a MAP in nerve cells.

A: Keratin is an intermediate filament protein.
B: Catalase is a peroxisome enzyme. The right answer is: Tau protein.
C: Tau is a MAP in nerve cells.
D: Histones are chromatin proteins. The right answer is: Tau protein.

Q487 · Easy · *codex, slides 228 to 230*

Where are MAPs attached on a healthy microtubule?

1. On the outside of the microtubule
2. Inside the central duct of the tube
3. Only at the minus end of the tube
4. Within the nuclear pore complex

✓ **Answer: A** — MAPs attach to the outside of microtubules.

A: MAPs attach to the outside of microtubules.
B: They attach to the outside. The right answer is: On the outside of the microtubule.
C: They attach along the outside. The right answer is: On the outside of the microtubule.
D: They are not in the pore.

Q488 · Easy · *codex, slides 228 to 230*

What is lost from axons in Alzheimer's disease?

1. Mitochondria
2. Lysosomes
3. Ribosomes
4. Microtubules

✓ **Answer: D** — Microtubules are lost from the axons.

A: They are not named as lost.
B: They are not named as lost.
C: They are not named as lost.
D: Microtubules are lost from the axons.

Q489 · Easy · *codex, slides 228 to 230*

What increases in nerve cells in Alzheimer's disease?

1. Keratin bundles
2. Colchicine crystals
3. Lamin sheets
4. Unorganised tangles of tau

✓ **Answer: D** — Unorganised tangles increase as microtubules are lost.

A: Keratin is linked to skin and liver disease.
B: Colchicine is a drug. The right answer is: Unorganised tangles of tau.
C: Lamins line the nucleus. The right answer is: Unorganised tangles of tau.
D: Unorganised tangles increase as microtubules are lost.

Q490 · Medium · *codex, slides 228 to 230*

What do MAPs do for microtubules in healthy cells?

1. They dissolve them and increase flexibility
2. They convert them into actin filaments
3. They regulate them and increase their stability
4. They nucleate them at the minus end

✓ **Answer: C** — These are the effects listed.

A: MAPs increase stability. The right answer is: They regulate them and increase stability and stiffness but reduce flexibility.
B: This does not occur. The right answer is: They regulate them and increase stability and stiffness but reduce flexibility.
C: These are the effects listed.
D: That is γ-tubulin's role. The right answer is: They regulate them and increase stability and stiffness but reduce flexibility.

Q491 · Medium · *codex, slides 228 to 230*

Which transport service is lost when axonal microtubules are lost?

1. Transport across the nuclear pores
2. Transport of oxygen in blood
3. Transport of ATP into mitochondria
4. Transport up and down the nerve axon

✓ **Answer: D** — The transport service up and down the axon is lost.

A: This is not the axon service.
B: This is not related. The right answer is: Transport up and down the nerve axon.
C: This is not related. The right answer is: Transport up and down the nerve axon.
D: The transport service up and down the axon is lost.

Q492 · Medium · *codex, slides 228 to 230*

What happens to a nerve cell without movement of biochemicals and organelles along its axon?

1. The cell gains extra microtubules
2. The cell turns into a muscle cell
3. The nerve cell loses function
4. The axon becomes a cilium

✓ **Answer: C** — Without transport the neuron loses function.

A: Microtubules are lost. The right answer is: The nerve cell loses function.
B: This is not described. The right answer is: The nerve cell loses function.
C: Without transport the neuron loses function.
D: This is not described. The right answer is: The nerve cell loses function.

Q493 · Medium · *codex, slides 228 to 230*

What does the lecture say about the causes of microtubule loss and increased tau?

1. They are fully explained by silica
2. They are caused by keratin defects
3. They are not yet known
4. They are caused by taxol

✓ **Answer: C** — The causes are not yet known.

A: Silica relates to silicosis. The right answer is: They are not yet known.
B: Keratin is linked to skin disease.
C: The causes are not yet known.
D: Taxol is a drug that stabilises microtubules.

Q494 · Hard · *codex, slides 228 to 230*

Which statement about tau is correct?

1. Tau forms the wall of microtubules from α and β subunits
2. Tau is a motor protein that walks toward the minus end
3. Tau nucleates microtubules at the centrosome
4. Tau attaches to the outside of microtubules and stabilises them

✓ **Answer: D** — This matches the lecture.

A: Tubulin forms the wall. The right answer is: Tau attaches to the outside of microtubules, regulating them and adding stability and stiffness.
B: Dynein does that. The right answer is: Tau attaches to the outside of microtubules, regulating them and adding stability and stiffness.
C: γ-tubulin nucleates microtubules. The right answer is: Tau attaches to the outside of microtubules, regulating them and adding stability and stiffness.
D: This matches the lecture. It matches what the lecture slides state.

Q495 · Hard · *codex, slides 228 to 230*

Why does loss of axonal microtubules impair a neuron?

1. The nucleus can no longer divide normally
2. Intermediate filaments cannot assemble at all
3. Keratin cannot form liver inclusions
4. Cargo can no longer be moved along the axon

✓ **Answer: D** — Microtubule tracks carry the cargo.

A: Neurons are not impaired this way.
B: This is not the reason. The right answer is: Biochemicals and organelles can no longer be moved along the axon.
C: This is not the reason. The right answer is: Biochemicals and organelles can no longer be moved along the axon.
D: Microtubule tracks carry the cargo.

Microtubules and cancer treatment · Q496–509

Q496 · Easy · *codex, slides 231 to 234*

Which drug locks microtubules by inhibiting their disassembly?

1. Colchicine
2. Taxol
3. Nocodazole
4. Vincristine

✓ **Answer: B** — Taxol inhibits microtubule disassembly.

A: Colchicine inhibits assembly. The right answer is: Taxol.
B: Taxol inhibits microtubule disassembly. It matches what the lecture slides state.
C: Nocodazole inhibits assembly. The right answer is: Taxol.
D: Vincristine inhibits assembly. The right answer is: Taxol.

Q497 · Easy · *codex, slides 231 to 234*

Which drug has been used in cancer chemotherapy, according to the lecture?

1. Penicillin
2. Lysozyme
3. Catalase
4. Vincristine

✓ **Answer: D** — Vincristine has particularly been used in chemotherapy.

A: Penicillin acts on bacterial walls. The right answer is: Vincristine.
B: Lysozyme is an enzyme. The right answer is: Vincristine.
C: Catalase is a peroxisome enzyme. The right answer is: Vincristine.
D: Vincristine has particularly been used in chemotherapy.

Q498 · Easy · *codex, slides 231 to 234*

Cancer is best described as what?

1. Failure of cells to divide
2. Abnormal proliferation of cells
3. Loss of the cell wall
4. Collapse of the Golgi apparatus

✓ **Answer: B** — Cancer is uncontrolled cell division.

A: Cancer involves too much division. The right answer is: Abnormal proliferation of cells.
B: Cancer is uncontrolled cell division.
C: This is not cancer. The right answer is: Abnormal proliferation of cells.
D: This is not cancer. The right answer is: Abnormal proliferation of cells.

Q499 · Easy · *codex, slides 231 to 234*

Which structures pull chromosomes apart during mitosis?

1. Spindle fibres
2. Mallory bodies
3. Cilia
4. Lamins

✓ **Answer: A** — Spindle fibres align, pull and position chromosomes.

A: Spindle fibres align, pull and position chromosomes.
B: These are keratin inclusions. The right answer is: Spindle fibres.
C: Cilia move fluid. The right answer is: Spindle fibres.
D: Lamins line the nucleus. The right answer is: Spindle fibres.

Q500 · Easy · *codex, slides 231 to 234*

Which phase of the cell cycle is named as one where microtubules play a vital role?

1. The nucleolar phase
2. The Golgi phase
3. M-phase
4. The stationary phase of bacteria

✓ **Answer: C** — Microtubules are important during M-phase.

A: This is not a cell cycle phase.
B: This is not a cell cycle phase.
C: Microtubules are important during M-phase.
D: This is not the phase named.

Q501 · Medium · *codex, slides 231 to 234*

Besides being effective, what must an anticancer drug avoid?

1. Binding any protein at all
2. Disrupting non-cancerous cells
3. Acting on dividing cells
4. Entering the bloodstream

✓ **Answer: B** — It should have minimal effects on normal cells.

A: This is not the stated requirement.
B: It should have minimal effects on normal cells.
C: It must act on dividing cells.
D: It must be deliverable to the tumour.

Q502 · Medium · *codex, slides 231 to 234*

What does taxol do to a cell's microtubules?

1. It dissolves them into tubulin
2. It locks them so they become static
3. It cuts them at the minus end
4. It converts them into actin

✓ **Answer: B** — Taxol locks microtubules and they become static.

A: That describes depolymerisation drugs. The right answer is: It locks them so they become static.
B: Taxol locks microtubules and they become static.
C: This is not described. The right answer is: It locks them so they become static.
D: This does not occur. The right answer is: It locks them so they become static.

Q503 · Medium · *codex, slides 231 to 234*

Which drugs inhibit microtubule assembly by blocking polymerisation and promoting depolymerisation?

1. Taxol, paclitaxel and docetaxel
2. Kinesin, dynein and myosin motors
3. Colchicine, nocodazole and vincristine
4. Catalase, urate oxidase and amylase

✓ **Answer: C** — These three inhibit assembly.

A: Taxol stabilises microtubules. The right answer is: Colchicine, nocodazole and vincristine.
B: These are motor proteins. The right answer is: Colchicine, nocodazole and vincristine.
C: These three inhibit assembly. It matches what the lecture slides state.
D: These are enzymes. The right answer is: Colchicine, nocodazole and vincristine.

Q504 · Medium · *codex, slides 231 to 234*

What do spindle fibres do during mitosis?

1. They digest the nuclear envelope entirely
2. They align, pull and position chromosomes
3. They synthesise new ribosomes in the cell
4. They pump protons into lysosomes

✓ **Answer: B** — These are the spindle's actions.

A: This is not described. The right answer is: They align, pull and position chromosomes.
B: These are the spindle's actions.
C: This is not described. The right answer is: They align, pull and position chromosomes.
D: This is not described. The right answer is: They align, pull and position chromosomes.

Q505 · Medium · *codex, slides 231 to 234*

Which two strategies could target microtubules to stop cancer cell division?

1. Disrupt assembly or stabilise assembled microtubules
2. Disrupt keratin assembly or stabilise lamins
3. Block the Golgi or stabilise the nucleolus
4. Starve the cell or stabilise the capsule

✓ **Answer: A** — These are the two options in the lecture.

A: These are the two options in the lecture.
B: These are not microtubule strategies. The right answer is: Disrupt microtubule assembly or stabilise assembled microtubules.
C: These are not named. The right answer is: Disrupt microtubule assembly or stabilise assembled microtubules.
D: These are not named. The right answer is: Disrupt microtubule assembly or stabilise assembled microtubules.

Q506 · Medium · *codex, slides 231 to 234*

Which drug is listed with colchicine and vincristine as an inhibitor of microtubule assembly?

1. Taxol
2. Penicillin
3. Lysozyme
4. Nocodazole

> ✓ **Answer: D** — Nocodazole inhibits assembly like colchicine and vincristine.

A: Taxol stabilises assembled microtubules. The right answer is: Nocodazole.
B: Penicillin acts on bacterial walls. The right answer is: Nocodazole.
C: Lysozyme is an enzyme. The right answer is: Nocodazole.
D: Nocodazole inhibits assembly like colchicine and vincristine.

Q507 · Hard · *codex, slides 231 to 234*

How do taxol and vincristine differ?

1. Taxol blocks polymerisation, while vincristine stabilises microtubules
2. Both stabilise microtubules in cells
3. Both inhibit actin filaments in cells
4. Taxol stabilises microtubules, vincristine blocks assembly

> ✓ **Answer: D** — They act in opposite ways.

A: The actions are swapped. The right answer is: Taxol stabilises microtubules, while vincristine blocks polymerisation and promotes depolymerisation.
B: Vincristine inhibits assembly. The right answer is: Taxol stabilises microtubules, while vincristine blocks polymerisation and promotes depolymerisation.
C: They act on microtubules. The right answer is: Taxol stabilises microtubules, while vincristine blocks polymerisation and promotes depolymerisation.
D: They act in opposite ways.

Q508 · Hard · *codex, slides 231 to 234*

All of the following are microtubule-targeting drugs EXCEPT which one?

1. Taxol
2. Penicillin
3. Vincristine
4. Nocodazole

> ✓ **Answer: B** — Correct choice.

A: Taxol stabilises microtubules. The right answer is: Penicillin.
B: Correct choice. Penicillin acts on bacterial walls.
C: Vincristine inhibits microtubule assembly. The right answer is: Penicillin.
D: Nocodazole inhibits microtubule assembly. The right answer is: Penicillin.

Q509 · Devil · *codex, slides 231 to 234*

Why can drugs acting on microtubules stop a cancer cell from dividing?

1. Spindle microtubules must grow and shorten, so blocking either halts division
2. Microtubules make the cell wall, so blocking them stops wall formation
3. Microtubules copy DNA, so blocking them stops replication
4. Microtubules make ribosomes, so blocking them stops translation

✓ **Answer: A** — Both growth and shortening are needed.

A: Both growth and shortening are needed.
B: Microtubules do not make walls. The right answer is: Spindle microtubules must grow and shorten to pull chromosomes, so blocking either process halts division.
C: They do not copy DNA. The right answer is: Spindle microtubules must grow and shorten to pull chromosomes, so blocking either process halts division.
D: They do not make ribosomes. The right answer is: Spindle microtubules must grow and shorten to pull chromosomes, so blocking either process halts division.

Comparing the three filaments · Q510–519

Q510 · Easy · *codex, slides 206, 229, 235*

Which cytoskeletal filament provides tensile strength?

1. Intermediate filaments
2. Microtubules
3. Microfilaments
4. Actin monomers

✓ **Answer: A** — Intermediate filaments give tensile strength.

A: Intermediate filaments give tensile strength.
B: Microtubules are tracks and spindle fibres.
C: Microfilaments drive movement and contraction. The right answer is: Intermediate filaments.
D: These are not a filament. The right answer is: Intermediate filaments.

Q511 · Easy · *codex, slides 206, 229, 235*

Which protein is common in the intermediate filaments of epithelial cells?

1. Actin
2. Keratin
3. Tubulin
4. Myosin

✓ **Answer: B** — Keratin is common in epithelial intermediate filaments.

A: Actin forms microfilaments. The right answer is: Keratin.
B: Keratin is common in epithelial intermediate filaments.
C: Tubulin forms microtubules. The right answer is: Keratin.
D: Myosin is a motor protein. The right answer is: Keratin.

Q512 · Easy · *codex, slides 206, 229, 235*

Which structure is the main microtubule-organizing centre in animal cells?

1. The Golgi apparatus
2. The nucleus
3. The endoplasmic reticulum
4. The centrosome

✓ **Answer: D** — The centrosome is the main MTOC.

A: The Golgi packages materials. The right answer is: The centrosome.
B: The nucleus holds the DNA. The right answer is: The centrosome.
C: The ER makes lipids and packages proteins.
D: The centrosome is the main MTOC.

Q513 · Easy · *codex, slides 206, 229, 235*

Microtubules are primarily composed of which dimers?

1. Actin and myosin
2. α- and β-tubulin
3. Keratin and vimentin
4. Lamin A and B

✓ **Answer: B** — Microtubules are made of α- and β-tubulin dimers.

A: These are muscle proteins. The right answer is: α- and β-tubulin.
B: Microtubules are made of α- and β-tubulin dimers.
C: These form intermediate filaments. The right answer is: α- and β-tubulin.
D: These form the nuclear lamina. The right answer is: α- and β-tubulin.

Q514 · Medium · *codex, slides 206, 229, 235*

What is the main function of intermediate filaments?

1. To enable cell movement
2. To resist mechanical stress
3. To transport vesicles
4. To separate chromosomes

✓ **Answer: B** — They provide strength against mechanical stress.

A: Actin enables movement. The right answer is: To resist mechanical stress.
B: They provide strength against mechanical stress.
C: Microtubule motors transport vesicles. The right answer is: To resist mechanical stress.
D: Spindle microtubules do that. The right answer is: To resist mechanical stress.

Q515 · Medium · *codex, slides 206, 229, 235*

What is a key function of microtubules?

1. Chromosome movement during mitosis
2. Muscle contraction in muscle cells
3. Cell surface tension control
4. Protein folding in the cytosol

✓ **Answer: A** — Microtubules form the spindle.

A: Microtubules form the spindle. It matches what the lecture slides state.
B: Actin and myosin do that. The right answer is: Chromosome movement during mitosis.
C: This is not a microtubule job.
D: This is not a microtubule job.

Q516 · Medium · *codex, slides 206, 229, 235*

Intermediate filaments differ from actin filaments and microtubules because they do what?

1. Provide tensile strength
2. Are made of tubulin
3. Are highly dynamic
4. Require ATP for motor movement

✓ **Answer: A** — Tensile strength is their distinguishing role.

A: Tensile strength is their distinguishing role.
B: Microtubules are made of tubulin. The right answer is: Provide tensile strength.
C: Microtubules and actin are more dynamic.
D: They are not motor tracks. The right answer is: Provide tensile strength.

Q517 · Medium · *codex, slides 206, 229, 235*

Which cytoskeletal filament is used for muscle contraction and cell movement?

1. Actin filaments
2. Intermediate filaments
3. Microtubules
4. Lamins

✓ **Answer: A** — Actin filaments drive movement and contraction.

A: Actin filaments drive movement and contraction.
B: They give tensile strength. The right answer is: Actin filaments.
C: They form tracks and the spindle.
D: They line the nucleus. The right answer is: Actin filaments.

Q518 · Hard · *codex, slides 206, 229, 235*

Which row correctly matches each filament with its protein and main role?

1. Microfilaments: tubulin, strength; intermediate filaments: actin, spindle; microtubules: keratin, movement
2. Microfilaments: keratin, spindle; intermediate filaments: tubulin, movement; microtubules: actin, strength
3. Microfilaments: actin, movement; intermediate: keratin, strength; microtubules: tubulin, transport
4. All three filaments are made of actin and drive contraction

✓ **Answer: C** — Each row is right.

A: The rows are mixed up. The right answer is: Microfilaments: actin, movement; intermediate filaments: keratin, strength; microtubules: tubulin, transport and spindle.

B: The rows are mixed up. The right answer is: Microfilaments: actin, movement; intermediate filaments: keratin, strength; microtubules: tubulin, transport and spindle.

C: Each row is right. It matches what the lecture slides state.

D: They are made of different proteins.

Q519 · Devil · *codex, slides 206, 229, 235*

One drug disrupts mitosis, a second weakens skin strength and a third stops muscle contraction. Which filaments do they target, in that order?

1. Actin filaments, microtubules and intermediate filaments
2. Microtubules, intermediate filaments and actin filaments
3. Intermediate filaments, actin filaments and microtubules
4. Microtubules, actin filaments and intermediate filaments

✓ **Answer: B** — Spindle, strength and contraction map to these filaments.

A: The order is wrong. The right answer is: Microtubules, intermediate filaments and actin filaments.

B: Spindle, strength and contraction map to these filaments.

C: The order is wrong. The right answer is: Microtubules, intermediate filaments and actin filaments.

D: The second and third are swapped.

Units of measurement · Q520–529

Q520 · Easy · *codex, slides 240 to 246*

How many micrometres are there in a millimetre?

1. 1,000
2. 10
3. 100
4. 10,000

✓ **Answer: A** — 1,000 µm equal 1 mm.

A: 1,000 µm equal 1 mm.

B: The lecture slide printing 10 µm is a typo; the value is 1,000.

C: This is ten times too few.

D: This is ten times too many.

Q521 · Easy · *codex, slide 245*

A nanometre is equal to which part of a metre?

1. 10^{-6} m
2. 10^{-9} m
3. 10^{-3} m
4. 10^{-10} m

✓ **Answer: B** — A nanometre is 0.000000001 m, written 10^{-9} m.

A: This is a micrometre, which is 1,000 times larger than a nanometre.
B: A nanometre is 0.000000001 m, written 10^{-9} m.
C: This is a millimetre, much larger than a nanometre.
D: This is an angstrom, which equals 0.1 nanometre.

Q522 · Easy · *codex, slide 240*

What is the smallest object the unaided human eye can distinguish?

1. About 1 µm (0.001 mm)
2. About 10 µm (0.01 mm)
3. About 1 mm (1,000 µm)
4. About 0.1 mm (100 µm)

✓ **Answer: D** — The unaided eye cannot distinguish objects smaller than about 0.1 mm.

A: This is far below what the unaided eye can resolve; a microscope is needed.
B: This is still ten times smaller than the limit of the unaided eye.
C: The eye can see smaller objects than this, down to about 0.1 mm.
D: The unaided eye cannot distinguish objects smaller than about 0.1 mm.

Q523 · Easy · *codex, slide 246*

How many angstroms (Å) make up 1 nanometre?

1. 0.1 Å
2. 10 Å
3. 100 Å
4. 1,000 Å

✓ **Answer: B** — 10 Å equal 1 nm, since 1 Å is 0.1 nm.

A: This reverses the relationship; the angstrom is the smaller unit.
B: 10 Å equal 1 nm, since 1 Å is 0.1 nm.
C: This is ten times too many; 1 nm is only 10 Å.
D: This is the number of nanometres in a micrometre, not angstroms in a nanometre.

Q524 · Medium · *codex, slides 240 to 246*

Convert 1 µm into nanometres.

1. 10
2. 100
3. 1,000
4. 1,000,000

> ✓ **Answer: C** — 1,000 nm equal 1 µm.

A: This is far too few. The right answer is: 1,000.
B: This is ten times too few.
C: 1,000 nm equal 1 µm.
D: This is 1,000 times too many.

Q525 · Medium · *codex, slides 240 to 246*

A structure is 0.5 µm wide. What is its width in nanometres?

1. 500 nm
2. 50 nm
3. 5 nm
4. 5,000 nm

> ✓ **Answer: A** — 0.5 µm times 1,000 gives 500 nm.

A: 0.5 µm times 1,000 gives 500 nm.
B: This slips a factor of ten.
C: This slips a factor of 100.
D: This slips a factor of ten the other way.

Q526 · Medium · *codex, slides 240 to 246*

A micrometre equals how many metres?

1. 10^{-6} m
2. 10^{-3} m
3. 10^{-9} m
4. 10^{-10} m

> ✓ **Answer: A** — A micrometre is 0.000001 m.

A: A micrometre is 0.000001 m.
B: This is a millimetre. The right answer is: 10^{-6} m.
C: This is a nanometre. The right answer is: 10^{-6} m.
D: This is an angstrom. The right answer is: 10^{-6} m.

Q527 · Medium · *codex, slides 240 to 246*

Old texts sometimes used the angstrom, which was compared with the diameter of what?

1. A red blood cell
2. A hydrogen atom
3. A bacterium
4. A mitochondrion

✓ **Answer: B** — The angstrom is about the diameter of a hydrogen atom.

A: A red blood cell is about 7 µm.
B: The angstrom is about the diameter of a hydrogen atom.
C: A bacterium is thousands of angstroms.
D: A mitochondrion is far larger. The right answer is: A hydrogen atom.

Q528 · Hard · *codex, slides 240 to 246*

A structure is 50 Å wide. How many nanometres is this?

1. 50 nm
2. 0.5 nm
3. 5 nm
4. 500 nm

✓ **Answer: C** — 10 Å equal 1 nm, so 50 Å is 5 nm.

A: This ignores the conversion. The right answer is: 5 nm.
B: This divides by 100. The right answer is: 5 nm.
C: 10 Å equal 1 nm, so 50 Å is 5 nm.
D: This multiplies by ten. The right answer is: 5 nm.

Q529 · Hard · *codex, slides 240 to 246*

A cell measures 0.1 mm across. How many nanometres is this?

1. 1,000 nm
2. 100,000 nm
3. 10,000 nm
4. 1,000,000 nm

✓ **Answer: B** — 0.1 mm is 100 µm, which is 100,000 nm.

A: This is 1 µm. The right answer is: 100,000 nm.
B: 0.1 mm is 100 µm, which is 100,000 nm.
C: This slips a factor of ten.
D: This is 1 mm. The right answer is: 100,000 nm.

Simple microscopes · Q530–539

Q530 · Easy · *codex, slides 249 to 254*

Which two devices are well-known examples of simple microscopes?

1. Magnifying glasses and loupes
2. Electron microscopes and loupes
3. Compound microscopes and stereo microscopes
4. Phase contrast microscopes and magnifying glasses

✓ **Answer: A** — These are the two well-known examples.

A: These are the two well-known examples.
B: Electron microscopes are not simple microscopes.
C: These use multiple lenses. The right answer is: Magnifying glasses and loupes.
D: Phase contrast microscopes are compound instruments.

Q531 · Easy · *codex, slides 249 to 254*

How are modern simple microscopes usually used?

1. Fixed to a bench with a condenser lens
2. Housed in a vacuum column with coils
3. Cooled with liquid nitrogen at night
4. Hand held, for field work or quick viewing

✓ **Answer: D** — They are designed to be hand held.

A: That describes a compound microscope. The right answer is: Hand held, for field work or quick viewing.
B: That describes an electron microscope. The right answer is: Hand held, for field work or quick viewing.
C: This is not described. The right answer is: Hand held, for field work or quick viewing.
D: They are designed to be hand held.

Q532 · Easy · *codex, slide 252*

Which description defines a simple microscope?

1. A microscope that uses an objective and an eyepiece lens
2. A microscope that forms its image with a beam of electrons
3. A microscope that uses only a single lens
4. A microscope that views opaque objects through two light paths

✓ **Answer: C** — A simple microscope has only one lens, as in a magnifying glass or loupe.

A: That describes a compound microscope, which has a series of lenses.
B: That describes an electron microscope, not a simple light microscope.
C: A simple microscope has only one lens, as in a magnifying glass or loupe.
D: That describes a dissecting (stereo) microscope.

Q533 · Easy · *codex, slide 253*

How does a loupe differ from an ordinary magnifying glass?

1. It has two lenses, an objective and an eyepiece, set in a tube
2. It uses an electron beam to enlarge very small details
3. It has no attached handle, and its lens sits in a protective housing
4. It must be clamped to a stage and focused with a coarse knob

✓ **Answer: C** — A loupe has no attached handle and its lenses sit in an opaque cylinder or housing.

A: A loupe is still a simple microscope with a single focusing lens.
B: A loupe is a light device and does not use electrons.
C: A loupe has no attached handle and its lenses sit in an opaque cylinder or housing.
D: A loupe is a small hand-held device and has no stage or focusing knobs.

Q534 · Medium · *codex, slides 249 to 254*

How many lenses did the user of a historical simple microscope look through?

1. Only one
2. Two
3. Three
4. A series of lenses

✓ **Answer: A** — The user had only one lens.

A: The user had only one lens.
B: That describes a compound microscope. The right answer is: Only one.
C: That describes a compound microscope. The right answer is: Only one.
D: That describes a compound microscope. The right answer is: Only one.

Q535 · Medium · *codex, slides 249 to 254*

What do the lecture's two types of light microscope consist of?

1. Phase and dark-field microscopes
2. Simple microscopes and compound microscopes
3. Electron and ultraviolet microscopes
4. Scanning and transmission microscopes

✓ **Answer: B** — These are the two types.

A: These are techniques of the compound type.
B: These are the two types.
C: These are not the two types named.
D: These are electron microscopes. The right answer is: Simple microscopes and compound microscopes.

Q536 · Medium · *codex, slides 249 to 254*

What do simple microscopes lack compared with compound microscopes?

1. A lens of any kind
2. A light source of any kind
3. A way of magnifying objects
4. A series of lenses

✓ **Answer: D** — Compound microscopes use a series of lenses.

A: Simple microscopes have one lens. The right answer is: A series of lenses.
B: They use ambient or other light.
C: They magnify with one lens. The right answer is: A series of lenses.
D: Compound microscopes use a series of lenses.

Q537 · Medium · *codex, slides 249 to 254*

Historical simple microscope designs resembled modern microscopes in which way?

1. They used the same electron beams
2. They had the same series of lenses
3. They produced three-dimensional images
4. Their mounts looked like modern mounts

✓ **Answer: D** — Mounts resembled those used with modern microscopes.

A: They did not use electrons. The right answer is: Their mounts looked similar to modern microscope mounts.
B: They had only one lens. The right answer is: Their mounts looked similar to modern microscope mounts.
C: This is a stereo microscope feature.
D: Mounts resembled those used with modern microscopes.

Q538 · Hard · *codex, slides 249 to 254*

All of the following are true of simple microscopes EXCEPT which one?

1. They have only one lens
2. A loupe is an example
3. Modern versions are usually hand held
4. They use two lenses in series

✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: They use an objective and an eyepiece in series.
B: This is true. The right answer is: They use an objective and an eyepiece in series.
C: This is true. The right answer is: They use an objective and an eyepiece in series.
D: Correct choice. That describes compound microscopes.

Q539 · Hard · *codex, slides 249 to 254*

A geologist wants to inspect a rock quickly in the field. Which instrument fits best?

1. A hand-held simple microscope such as a loupe
2. A bench compound microscope with a condenser
3. A transmission electron microscope
4. A stereo microscope with two eyepieces on a stand

✓ **Answer: A** — Simple microscopes are designed for field work.

A: Simple microscopes are designed for field work.
B: That is not suited to field work.
C: This needs a vacuum and ultrathin sections.
D: It is a bench instrument. The right answer is: A hand-held simple microscope such as a loupe.

Spherical aberration · Q540–555

Q540 · Easy · *codex, slides 255 to 270*

How many inherent optical defects are associated with simple microscopes?

1. Two
2. One
3. Three
4. Four

✓ **Answer: A** — Spherical and chromatic aberration are the two defects.

A: Spherical and chromatic aberration are the two defects.
B: There are two defects. The right answer is: Two.
C: There are two defects. The right answer is: Two.
D: There are two defects. The right answer is: Two.

Q541 · Easy · *codex, slides 255 to 270*

Which defect forms blurred images because light rays are not brought to a simultaneous focus?

1. Chromatic aberration
2. Parfocal error
3. Airy disc
4. Spherical aberration

✓ **Answer: D** — This is spherical aberration.

A: That is a colour defect. The right answer is: Spherical aberration.
B: This is not an aberration. The right answer is: Spherical aberration.
C: This is a diffraction pattern. The right answer is: Spherical aberration.
D: This is spherical aberration. It matches what the lecture slides state.

Q542 · Easy · *codex, slides 255 to 270*

Spherical aberration can affect which two image qualities?

1. Resolution and clarity
2. Colour and brightness
3. Magnification and working distance
4. Contrast and polarity

✓ **Answer: A** — It affects resolution and clarity.

A: It affects resolution and clarity.
B: These are not the stated effects.
C: These are not the stated effects.
D: These are not the stated effects.

Q543 · Easy · *codex, slides 255 to 270*

Which lens shape is the best choice for focusing parallel rays to a single point?

1. Biconcave
2. Concavo-convex
3. Flat glass plate
4. Plano-convex

✓ **Answer: D** — Plano-convex lenses focus parallel rays to a single point.

A: A biconcave lens diverges rays. The right answer is: Plano-convex.
B: This is not the named best choice.
C: A flat plate does not focus light.
D: Plano-convex lenses focus parallel rays to a single point.

Q544 · Easy · *codex, slides 255 to 270*

Which lens fills the space between the specimen and the lens with a medium of the same refractive index?

1. A plano-convex lens
2. An aspherical lens
3. An achromatic doublet
4. An oil immersion lens

✓ **Answer: D** — Oil immersion removes the refractive index mismatch.

A: This is a lens shape. The right answer is: An oil immersion lens.
B: This changes the lens surface. The right answer is: An oil immersion lens.
C: This corrects colour. The right answer is: An oil immersion lens.
D: Oil immersion removes the refractive index mismatch.

Q545 · Easy · *codex, slides 255 to 270*

What does aspherical mean?

1. Non-spherical
2. Perfectly spherical
3. Coloured
4. Opaque

✓ **Answer: A** — An aspherical surface is not spherical.

A: An aspherical surface is not spherical.
B: That is a spherical surface. The right answer is: Non-spherical.
C: This is unrelated. The right answer is: Non-spherical.
D: This is unrelated. The right answer is: Non-spherical.

Q546 · Easy · *codex, slides 255 to 270*

Rays passing near a lens's horizontal axis are refracted how, compared with rays near its edge?

1. Less
2. More
3. The same amount
4. Not at all

✓ **Answer: A** — Rays near the axis are refracted less than rays near the edge.

A: Rays near the axis are refracted less than rays near the edge.
B: Edge rays are refracted more. The right answer is: Less.
C: If they were equal there would be no aberration.
D: They are refracted. The right answer is: Less.

Q547 · Medium · *codex, slides 255 to 270*

Where do rays near the edge of a lens focus relative to rays near its axis?

1. At exactly the same point of the axis
2. Behind the eyepiece of the microscope
3. Inside the specimen on the slide
4. At different points along the optical axis

✓ **Answer: D** — They end up in different spots across the optical axis.

A: That would mean no aberration. The right answer is: At different points along the optical axis.
B: This is not described. The right answer is: At different points along the optical axis.
C: This is not described. The right answer is: At different points along the optical axis.
D: They end up in different spots across the optical axis.

Q548 · Medium · *codex, slides 255 to 270*

What does an aspherical lens surface do?

1. Converges rays to a single focus
2. Splits white light into colours
3. Blocks the outer rays of light
4. Adds immersion oil to the gap

✓ **Answer: A** — Its curvature brings rays to one focal point.

A: Its curvature brings rays to one focal point.
B: That describes dispersion. The right answer is: Converges light rays into a single focal point.
C: That describes an opaque coating. The right answer is: Converges light rays into a single focal point.
D: That describes oil immersion. The right answer is: Converges light rays into a single focal point.

Q549 · Medium · *codex, slides 255 to 270*

Why do materials of different refractive index between specimen and lens worsen spherical aberration?

1. They absorb all the blue light
2. They bend rays at different angles
3. They make the lens heavier
4. They change the colour of the specimen

✓ **Answer: B** — Repeated bending at different angles causes the problem.

A: This is not described. The right answer is: They bend the light rays repeatedly at different angles.
B: Repeated bending at different angles causes the problem.
C: This is not described. The right answer is: They bend the light rays repeatedly at different angles.
D: This is not described. The right answer is: They bend the light rays repeatedly at different angles.

Q550 · Medium · *codex, slides 255 to 270*

What does coating the periphery of a lens with opaque material do?

1. It blocks the outer rays
2. It adds colour correction
3. It fills the gap with oil
4. It focuses rays at infinity

✓ **Answer: A** — Edge rays are removed.

A: Edge rays are removed. It matches what the lecture slides state.
B: That describes an achromat. The right answer is: It blocks the outer rays that cause the aberration.
C: That describes oil immersion. The right answer is: It blocks the outer rays that cause the aberration.
D: This is not described. The right answer is: It blocks the outer rays that cause the aberration.

Q551 · Medium · *codex, slides 255 to 270*

Why does the plano-convex shape minimise spherical aberration?

1. It is perfectly symmetrical about its axis
2. It removes all colours from the image
3. It is made of crown glass only
4. Its asymmetry suits unequal distances

✓ **Answer: D** — The asymmetry minimises aberration in that case.

A: It is asymmetrical. The right answer is: Its asymmetry helps when object and image are at unequal distances.
B: That is not its effect. The right answer is: Its asymmetry helps when object and image are at unequal distances.
C: The lecture credits its shape. The right answer is: Its asymmetry helps when object and image are at unequal distances.
D: The asymmetry minimises aberration in that case.

Q552 · Medium · *codex, slides 255, 258*

Which description matches spherical aberration?

1. Different colours of light focus at different positions, giving colour fringes
2. The specimen stays in focus when the objective is changed to another power
3. Rays near the lens edge focus at different points from rays near the axis, blurring the image
4. Only scattered light enters the objective, giving a bright image on a dark background

✓ **Answer: C** — Rays are not brought to a simultaneous focus, so the image is blurred.

A: That describes chromatic aberration, caused by dispersion.
B: That describes parfocal objectives, not an aberration.
C: Rays are not brought to a simultaneous focus, so the image is blurred.
D: That describes dark-field illumination, not spherical aberration.

Q553 · Hard · *codex, slides 255 to 270*

In which situation is a plano-convex lens optimal?

1. The object touches the lens and the rays diverge
2. The object and image are at equal distances
3. Object at infinity, image a focused point
4. The light is white and the lens is thick

✓ **Answer: C** — This is the optimum case.

A: This is not the optimum. The right answer is: The object is at infinity, parallel rays enter, and the image is a focused point.
B: The lens suits unequal distances. The right answer is: The object is at infinity, parallel rays enter, and the image is a focused point.
C: This is the optimum case.
D: This is not the stated optimum.

Q554 · Hard · *codex, slides 255 to 270*

Which two measures reduce spherical aberration by matching refractive indices and by blocking edge rays?

1. An achromatic doublet and oil immersion
2. Oil immersion and an opaque coating on the periphery
3. An aspherical surface and a crown–flint pair
4. A plano-convex lens and a colour filter

✓ **Answer: B** — These are the two measures.

A: The doublet corrects chromatic aberration. The right answer is: Oil immersion and an opaque coating on the periphery.
B: These are the two measures.
C: The pair corrects chromatic aberration. The right answer is: Oil immersion and an opaque coating on the periphery.
D: A colour filter is not described.

Q555 · Hard · *codex, slides 266, 267, 280*

All of the following reduce spherical aberration EXCEPT which one?

1. Using a specialised aspherical lens surface curved to converge rays
2. Coating the periphery of the lens with opaque material
3. Bonding crown glass and flint glass into an achromatic doublet
4. Using oil immersion so one refractive index fills the gap

✓ **Answer: C** — Correct choice.

A: This reduces spherical aberration by converging rays to one focal point.
B: This blocks the outer rays that cause spherical aberration.
C: Correct choice. An achromatic doublet corrects chromatic aberration, not spherical aberration.
D: This removes the repeated bending of rays between materials, reducing spherical aberration.

Chromatic aberration · Q556–569

Q556 · Easy · *codex, slides 273 to 285*

Chromatic aberration is also known as what?

1. Colour fringing, or purple fringing
2. Spherical fringing, or oil fringing
3. Airy fringing, or ring fringing
4. Parfocal fringing, or focus fringing

✓ **Answer: A** — These are alternative names.

A: These are alternative names. It matches what the lecture slides state.
B: This is not a term used.
C: This is not the term used.
D: This is not a term used.

Q557 · Easy · *codex, slides 273 to 285*

What causes chromatic aberration?

1. Dirt on the lens surface
2. The size of the stage plate
3. Dispersion of the lens material
4. A damaged illuminator bulb

✓ **Answer: C** — Dispersion varies refractive index with wavelength.

A: This is not the cause. The right answer is: Dispersion of the lens material.
B: This is not the cause. The right answer is: Dispersion of the lens material.
C: Dispersion varies refractive index with wavelength.
D: This is not the cause. The right answer is: Dispersion of the lens material.

Q558 · Easy · *codex, slides 273 to 285*

How does chromatic aberration appear in an image?

1. As a grey haze across the centre
2. As a bright dot with rings
3. As a black circle at the edge
4. As fringes of colour around the image

✓ **Answer: D** — Colour fringes appear around the image.

A: This is not described. The right answer is: As fringes of colour around the image.
B: This describes an Airy disc. The right answer is: As fringes of colour around the image.
C: This is not described. The right answer is: As fringes of colour around the image.
D: Colour fringes appear around the image.

Q559 · Easy · *codex, slides 273 to 285*

Which lens combination is used to reduce chromatic aberration?

1. An aspherical singlet
2. An oil film
3. An achromatic doublet
4. A coated periphery

✓ **Answer: C** — An achromat bonds two materials of differing dispersion.

A: This reduces spherical aberration. The right answer is: An achromatic doublet.
B: This reduces spherical aberration. The right answer is: An achromatic doublet.
C: An achromat bonds two materials of differing dispersion.
D: This reduces spherical aberration. The right answer is: An achromatic doublet.

Q560 · Easy · *codex, slides 273 to 285*

What are bonded together in an achromatic doublet?

1. Two identical glass pieces together
2. A lens and an opaque ring around it
3. A lens and a mirror below it
4. Two materials with differing dispersion

✓ **Answer: D** — They form a single lens.

A: They must differ in dispersion. The right answer is: Two materials with differing dispersion.
B: This is not a doublet. The right answer is: Two materials with differing dispersion.
C: This is not a doublet. The right answer is: Two materials with differing dispersion.
D: They form a single lens.

Q561 · Medium · *codex, slides 273 to 285*

What varies with wavelength to cause chromatic aberration?

1. The thickness of the slide
2. The number of lenses
3. The refractive index of the glass
4. The working distance of the eyepiece

✓ **Answer: C** — Focal length varies with wavelength.

A: This does not vary with wavelength.
B: This does not vary with wavelength.
C: Focal length varies with wavelength.
D: This does not vary with wavelength.

Q562 · Medium · *codex, slides 273 to 285*

Does an achromatic doublet correct chromatic aberration perfectly?

1. Yes, it removes all colour error
2. No, it makes it much worse
3. No, it reduces it over a range
4. Yes, but only for blue light

✓ **Answer: C** — It does not give perfect correction.

A: The lecture says it is not perfect.
B: It reduces the aberration. The right answer is: No, it reduces it over a certain range of wavelengths.
C: It does not give perfect correction.
D: It reduces error over a range.

Q563 · Medium · *codex, slides 273 to 285*

Which edge colours can appear with chromatic aberration?

1. Only black and white fringes
2. Only grey and brown fringes
3. Only infrared and ultraviolet
4. Red, green, blue, yellow or purple

✓ **Answer: D** — These coloured edges can appear.

A: Coloured edges appear. The right answer is: Red, green, blue, yellow, purple and magenta.
B: Coloured edges appear. The right answer is: Red, green, blue, yellow, purple and magenta.
C: These are not visible colours. The right answer is: Red, green, blue, yellow, purple and magenta.
D: These coloured edges can appear.

Q564 · Medium · *codex, slides 273 to 285*

What is a simple way to partly correct residual chromatic aberration after the image is taken?

1. Add immersion oil to the image
2. Scale the red, green and blue channels
3. Coat the edge of the image in black
4. Double the magnification afterwards

✓ **Answer: B** — This is the simple after-the-fact fix.

A: This is not a digital fix.
B: This is the simple after-the-fact fix.
C: This is not described. The right answer is: Scale the red, green and blue channels independently.
D: This is not described. The right answer is: Scale the red, green and blue channels independently.

Q565 · Medium · *codex, slides 263, 273 to 275, 258*

Which of these is NOT a feature of chromatic aberration?

1. Rays near the lens axis are refracted less than rays near the periphery
2. Coloured fringes appear around the edges of the image
3. Dispersion in the glass makes focal length vary with wavelength
4. Different colours of light are focused at different positions

✓ **Answer: A** — Correct choice.

A: Correct choice. This describes spherical aberration, not chromatic aberration.
B: This is true; chromatic aberration shows as colour fringes.
C: This is true; chromatic aberration comes from dispersion of the lens material.
D: This is true; wavelengths fail to reach a common focus.

Q566 · Medium · *codex, slides 280, 282*

Which pair of materials, bonded together as an achromatic doublet, reduces chromatic aberration?

1. Quartz glass and fused silica
2. Crown glass and flint glass
3. Crown glass and fused quartz
4. Flint glass and clear plastic

✓ **Answer: B** — Crown and flint glass, with differing dispersion, are bonded to reduce chromatic aberration.

A: Quartz is used for UV lenses, not as the pair in an achromatic doublet.
B: Crown and flint glass, with differing dispersion, are bonded to reduce chromatic aberration.
C: Quartz is not the partner of crown glass in an achromatic doublet.
D: Plastic is not the second material in a standard achromatic doublet.

Q567 · Hard · *codex, slides 273 to 285*

Which statement about correcting chromatic aberration is correct?

1. Crown and flint glass bonded as a doublet remove it completely at all wavelengths
2. Oil immersion removes it by matching refractive indices
3. An opaque coating on the lens edge removes it
4. A crown–flint doublet reduces it over a range, not perfectly

✓ **Answer: D** — This matches the lecture.

A: The correction is not perfect. The right answer is: Crown and flint glass bonded as a doublet reduce it over a range of wavelengths, but not perfectly.
B: Oil immersion reduces spherical aberration. The right answer is: Crown and flint glass bonded as a doublet reduce it over a range of wavelengths, but not perfectly.
C: That reduces spherical aberration. The right answer is: Crown and flint glass bonded as a doublet reduce it over a range of wavelengths, but not perfectly.
D: This matches the lecture. It matches what the lecture slides state.

Q568 · Hard · *codex, slides 258, 263, 273 to 282*

Which statements describe chromatic aberration? I. Colour fringes appear near the edges of the image. II. Rays near the lens axis are refracted less than rays at the periphery. III. Focal length varies with the wavelength of light because of dispersion. IV. It can be reduced by combining different kinds of glass.

1. I and II only
2. I, III and IV only
3. II, III and IV only
4. I, II and IV only

✓ **Answer: B** — Statements I, III and IV describe chromatic aberration; statement II describes spherical aberration.

A: Statement II describes spherical aberration, so it cannot be part of the answer.
B: Statements I, III and IV describe chromatic aberration; statement II describes spherical aberration.
C: This leaves out statement I and wrongly includes statement II.
D: This wrongly includes statement II and leaves out statement III.

Q569 · Devil · *codex, slides 273 to 285*

A photograph shows purple fringes at high-contrast edges. Which cause and fix fit?

1. Dispersion in the glass, fixed by multi-glass lens systems
2. Different refractive indices in the gap, fixed by oil immersion
3. Rays near the axis refracting less, fixed by an aspherical lens
4. Poor working distance, fixed by moving the stage

✓ **Answer: A** — Both are described in the lecture.

A: Both are described in the lecture.
B: That describes spherical aberration. The right answer is: Dispersion in the glass, fixed by multi-glass lens systems or by scaling the colour channels.
C: That describes spherical aberration. The right answer is: Dispersion in the glass, fixed by multi-glass lens systems or by scaling the colour channels.
D: This is not the cause. The right answer is: Dispersion in the glass, fixed by multi-glass lens systems or by scaling the colour channels.

Light and the electromagnetic spectrum · Q570–577

Q570 · Easy · *codex, slides 286 to 288*

Light is what kind of radiation?

1. Sound radiation
2. Ionic radiation
3. Thermal particles
4. Electromagnetic radiation

✓ **Answer: D** — Light is electromagnetic radiation.

A: Sound is a mechanical wave. The right answer is: Electromagnetic radiation.
B: This is not a radiation type.
C: This is not the definition. The right answer is: Electromagnetic radiation.
D: Light is electromagnetic radiation. It matches what the lecture slides state.

Q571 · Easy · *codex, slides 286 to 288*

Which elementary particle defines light?

1. The photon
2. The electron
3. The proton
4. The neutron

✓ **Answer: A** — The photon defines light.

A: The photon defines light. It matches what the lecture slides state.
B: The electron is a charged particle.
C: The proton is a nuclear particle.
D: The neutron is a nuclear particle.

Q572 · Easy · *codex, slides 286 to 288*

Between which wavelengths does visible light lie, according to the lecture?

1. 100 nm and 300 nm
2. 700 nm and 1000 nm
3. 200 nm and 600 nm
4. 400 nm and 700 nm

✓ **Answer: D** — Visible light lies between 400 and 700 nm.

A: This is ultraviolet. The right answer is: 400 nm and 700 nm.
B: This is infrared. The right answer is: 400 nm and 700 nm.
C: This is not the visible range.
D: Visible light lies between 400 and 700 nm.

Q573 · Medium · *codex, slides 286 to 288*

What does the mnemonic ROYGBIV list?

1. The lens aberrations listed
2. The parts of the microscope
3. The colours of the visible spectrum
4. The types of light microscope

✓ **Answer: C** — It lists red to violet.

A: This is not what it lists.
B: This is not what it lists.
C: It lists red to violet.
D: This is not what it lists.

Q574 · Medium · *codex, slides 286 to 288*

What does light microscopy refer to?

1. Any microscope using electron beams
2. Any microscope that uses visible light
3. Any microscope using sound waves
4. Any microscope using X-rays

✓ **Answer: B** — This is the definition in the lecture.

A: That is electron microscopy. The right answer is: Any microscope that uses visible light to observe specimens.
B: This is the definition in the lecture.
C: This is not light microscopy. The right answer is: Any microscope that uses visible light to observe specimens.
D: This is not light microscopy. The right answer is: Any microscope that uses visible light to observe specimens.

Q575 · Medium · *codex, slides 286 to 288*

Lens curvature and composition are designed to minimise what?

1. Distortion of image shapes and colours
2. Magnification of the specimen image
3. The wavelength of visible light
4. The working distance of the stage

✓ **Answer: A** — Lenses are designed to minimise this distortion.

A: Lenses are designed to minimise this distortion.
B: Lenses are meant to magnify. The right answer is: Distortion of image shapes and colours.
C: Lens design does not change wavelength.
D: This is not the aim. The right answer is: Distortion of image shapes and colours.

Q576 · Hard · *codex, slides 286 to 288*

Which statement about visible light is correct?

1. It is the whole electromagnetic spectrum
2. It is particulate matter without waves
3. It has wavelengths of 100 to 300 nm
4. It is part of the electromagnetic spectrum

✓ **Answer: D** — Visible light is a small part of the spectrum.

A: It is only part of the spectrum.
B: Light is electromagnetic radiation. The right answer is: It is only the visible part of electromagnetic radiation, with wavelengths of 400 to 700 nm.
C: That is ultraviolet. The right answer is: It is only the visible part of electromagnetic radiation, with wavelengths of 400 to 700 nm.
D: Visible light is a small part of the spectrum.

Q577 · Hard · *codex, slides 286 to 288*

All of the following describe light EXCEPT which one?

1. Its elementary particle is the electron
2. It is electromagnetic radiation
3. Its visible range is 400 to 700 nm
4. Its elementary particle is the photon

✓ **Answer: A** — Correct choice.

A: Correct choice. The photon is its elementary particle.
B: This is true. The right answer is: Its elementary particle is the electron.
C: This is true. The right answer is: Its elementary particle is the electron.
D: This is true. The right answer is: Its elementary particle is the electron.

Types of light microscope · Q578–585

Q578 · Easy · *codex, slides 289 to 290*

How many basic types of light microscope does the lecture describe in this section?

1. Three, including electron
2. One, the compound only
3. Two, compound and dissecting
4. Five, including confocal

✓ **Answer: C** — Compound and dissecting microscopes are the two.

A: Electron microscopes are not light microscopes.
B: Two types are described. The right answer is: Two, compound and dissecting.
C: Compound and dissecting microscopes are the two.
D: Only two basic types are described.

Q579 · Easy · *codex, slides 289 to 290*

Which light microscope needs specimens sliced thinly enough for light to pass through?

1. The dissecting microscope
2. The loupe
3. The compound microscope
4. The magnifying glass

✓ **Answer: C** — Compound microscopes need thin specimens.

A: It views opaque specimens. The right answer is: The compound microscope.
B: It views objects directly. The right answer is: The compound microscope.
C: Compound microscopes need thin specimens.
D: It views objects directly. The right answer is: The compound microscope.

Q580 · Easy · *codex, slides 289 to 290*

Which light microscope permits opaque specimens to be viewed?

1. The compound microscope
2. The transmission electron microscope
3. The dissecting (stereo) microscope
4. The ultraviolet microscope

✓ **Answer: C** — It permits opaque specimens to be viewed.

A: It needs thin specimens. The right answer is: The dissecting (stereo) microscope.
B: It is not a light microscope.
C: It permits opaque specimens to be viewed.
D: It is not described here. The right answer is: The dissecting (stereo) microscope.

Q581 · Easy · *codex, slides 289 to 290*

What is another name for the stereo microscope?

1. The compound microscope
2. The dissecting microscope
3. The simple microscope
4. The scanning microscope

✓ **Answer: B** — It is also called the dissecting or stereoscopic microscope.

A: It is a different type. The right answer is: The dissecting microscope.
B: It is also called the dissecting or stereoscopic microscope.
C: It is a different type. The right answer is: The dissecting microscope.
D: It is not a light microscope.

Q582 · Medium · *codex, slides 289 to 290*

What kind of light does a dissecting microscope typically use?

1. Light reflected from the surface
2. Light transmitted through a thin section
3. A beam of electrons
4. Ultraviolet laser light

✓ **Answer: A** — It typically uses reflected light.

A: It typically uses reflected light.
B: That describes a compound microscope. The right answer is: Light reflected from the surface of the object.
C: That describes electron microscopy. The right answer is: Light reflected from the surface of the object.
D: This is not described. The right answer is: Light reflected from the surface of the object.

Q583 · Medium · *codex, slides 289 to 290*

How does the stereo microscope produce a three-dimensional view?

1. A single lens flips the image upside down
2. An opaque disc blocks the centre of the beam
3. Oil fills the gap under the lens
4. Two optical paths give each eye its own view

✓ **Answer: D** — Two objectives and eyepieces give different angles.

A: This is not the mechanism. The right answer is: Two optical paths give slightly different viewing angles to the left and right eyes.
B: That describes dark-field illumination. The right answer is: Two optical paths give slightly different viewing angles to the left and right eyes.
C: That describes oil immersion. The right answer is: Two optical paths give slightly different viewing angles to the left and right eyes.
D: Two objectives and eyepieces give different angles.

Q584 · Medium · *codex, slides 289, 290, 308*

Which statement about the dissecting (stereo) microscope is NOT true?

1. It gives a three-dimensional view using two optical paths
2. It needs specimens cut thin enough for light to pass through
3. It typically uses light reflected from the specimen surface
4. It permits viewing of opaque specimens at low magnification

✓ **Answer: B** — Correct choice.

A: This is true; two objectives and eyepieces give slightly different views to each eye.
B: Correct choice. Thin sections are needed for compound microscopes; dissecting microscopes view opaque specimens.
C: This is true; reflected light lets it view opaque objects.
D: This is true; most dissecting microscopes magnify up to about 30×.

Q585 · Hard · *codex, slides 289 to 290*

Which microscope would you choose to examine the surface of an insect, and why?

1. A compound microscope, because it needs a thick opaque specimen
2. A loupe on a stage, because it has two optical paths
3. A compound microscope, because it gives a stereo view
4. A dissecting microscope, because it views opaque specimens in 3D

✓ **Answer: D** — It suits opaque specimens.

A: Compound microscopes need thin sections. The right answer is: A dissecting microscope, because it uses reflected light for opaque specimens in three dimensions.
B: A loupe has a single lens.
C: It does not use two optical paths.
D: It suits opaque specimens. It matches what the lecture slides state.

Parts of the compound microscope · Q586–600

Q586 · Easy · *codex, slides 293 to 300*

Which part holds the eyepiece and connects it to the objective?

1. The arm
2. The body tube
3. The stage
4. The condenser

✓ **Answer: B** — The body tube holds the eyepiece and connects it to the objective.

A: The arm supports the tube and connects it to the base.
B: The body tube holds the eyepiece and connects it to the objective.
C: The stage holds the slide. The right answer is: The body tube.
D: The condenser focuses light. The right answer is: The body tube.

Q587 · Easy · *codex, slides 293 to 300*

Which part is the flat surface on which the slide is placed?

1. The base
2. The diaphragm
3. The eyepiece
4. The stage

✓ **Answer: D** — The stage is the flat surface that holds the slide.

A: The base supports the microscope. The right answer is: The stage.
B: The diaphragm controls light. The right answer is: The stage.
C: The eyepiece is the lens at the top.
D: The stage is the flat surface that holds the slide.

Q588 · Easy · *codex, slide 298*

What is the function of the condenser lens in a compound microscope?

1. It collects light from the illuminator and focuses it on the specimen
2. It magnifies the image of the specimen for the observer's eye
3. It controls the amount of light by opening and closing an iris
4. It holds the slide in position over the stage aperture

✓ **Answer: A** — The condenser collects light and focuses it on the specimen, giving a sharper image.

A: The condenser collects light and focuses it on the specimen, giving a sharper image.
B: Magnifying the specimen is the job of the objective and eyepiece lenses.
C: That is the job of the diaphragm, not the condenser lens.
D: Slide clips on the stage hold the slide; the condenser only focuses light.

Q589 · Easy · *codex, slide 297*

Which part controls the amount of light reaching the specimen?

1. The revolving nosepiece, also called the turret
2. The coarse adjustment knob on the arm
3. The diaphragm, also called the iris
4. The body tube joining eyepiece and objective

✓ **Answer: C** — The diaphragm (iris) controls the amount of light reaching the specimen.

A: The nosepiece holds and rotates the objective lenses; it does not control light.
B: The coarse knob moves the specimen to approximate focus.
C: The diaphragm (iris) controls the amount of light reaching the specimen.
D: The body tube holds the eyepiece and connects it to the objective.

Q590 · Easy · *codex, slides 294, 297*

A 10× eyepiece is used with a 45× objective lens. What is the total magnification?

1. 55×
2. 4,500×
3. 450×
4. 0.45×

✓ **Answer: C** — Total magnification is eyepiece power times objective power, so 10 × 45 = 450×.

A: This adds the two powers; magnifications multiply instead.
B: This is ten times too large, from a slip in the multiplication.
C: Total magnification is eyepiece power times objective power, so 10 × 45 = 450×.
D: This divides instead of multiplying and gives an image smaller than the specimen.

Q591 · Easy · *codex, slide 295*

Which part supports the body tube, connects it to the base and is used to carry the microscope?

1. The stage
2. The condenser
3. The arm
4. The turret

✓ **Answer: C** — The arm supports the tube, connects it to the base and is held when carrying.

A: The stage is the flat surface on which the slide is placed.
B: The condenser focuses light on the specimen and does not support the tube.
C: The arm supports the tube, connects it to the base and is held when carrying.
D: The turret holds and rotates the objective lenses.

Q592 · Medium · *codex, slides 293 to 300*

Why is the low power objective used first when viewing a slide?

1. It gives the highest resolution of detail
2. Its short length avoids breaking the slide
3. It uses far less light than the others
4. It needs no focusing

✓ **Answer: B** — The short objective protects the slide.

A: The high power objective gives finer detail.
B: The short objective protects the slide.
C: This is not the stated reason.
D: It still needs focusing. The right answer is: Its short length avoids ramming into and breaking the slide.

Q593 · Medium · *codex, slides 293 to 300*

What power do eyepieces usually have?

1. 4× or 6×
2. 40× or 100×
3. 1000× or 2000×
4. 10× or 15×

✓ **Answer: D** — Eyepieces are usually 10× or 15×.

A: This is too low. The right answer is: 10× or 15×.
B: These are objective powers. The right answer is: 10× or 15×.
C: These are too high for an eyepiece.
D: Eyepieces are usually 10× or 15×.

Q594 · Medium · *codex, slides 293 to 300*

What does the revolving nosepiece do?

1. It focuses the light on the specimen below
2. It holds the objectives and rotates them
3. It controls the amount of light entering
4. It switches the illuminator off

✓ **Answer: B** — This is the role of the nosepiece.

A: That is the condenser. The right answer is: It holds two or more objectives and rotates to change power.
B: This is the role of the nosepiece.
C: That is the diaphragm. The right answer is: It holds two or more objectives and rotates to change power.
D: That is the power switch. The right answer is: It holds two or more objectives and rotates to change power.

Q595 · Medium · *codex, slides 293 to 300*

Which three objective powers are usual in a standard microscope?

1. 2×, 5× and 8×
2. 10×, 40× and 100×
3. 15×, 50× and 500×
4. 20×, 30× and 60×

✓ **Answer: B** — These are the usual three objectives.

A: These are not the usual three.
B: These are the usual three objectives.
C: These are not the usual three.
D: These are not the usual three.

Q596 · Medium · *codex, slides 293 to 300*

What are the dimensions of a typical glass slide?

1. 25 × 50 mm and 10 mm thick
2. 75 × 26 mm and about 1 mm thick
3. 100 × 50 mm and 5 mm thick
4. 10 × 10 mm and 0.1 mm thick

✓ **Answer: B** — This is the typical size and thickness.

A: This is not the typical size.
B: This is the typical size and thickness.
C: This is not the typical size.
D: This is not the typical size.

Q597 · Medium · *codex, slides 293 to 300*

What is the cover slip for?

1. It magnifies the specimen image
2. It controls the amount of light
3. It holds the slide on the stage
4. It stops the specimen spilling

✓ **Answer: D** — It keeps the specimen in place.

A: It does not magnify. The right answer is: It covers the specimen so it does not spill on the slide.
B: That is the diaphragm. The right answer is: It covers the specimen so it does not spill on the slide.
C: Clips hold the slide. The right answer is: It covers the specimen so it does not spill on the slide.
D: It keeps the specimen in place.

Q598 · Hard · *codex, slides 293 to 300*

Which sequence correctly follows light through a standard transmitted-light compound microscope?

1. Eyepiece, objective, specimen, condenser, illuminator
2. Illuminator, objective, condenser, eyepiece, specimen
3. Condenser, illuminator, eyepiece, specimen, objective
4. Illuminator, condenser, specimen, objective, eyepiece

✓ **Answer: D** — Light passes in this order to the eye.

A: This is the reverse of the path.
B: The condenser comes before the specimen.
C: The order is wrong. The right answer is: Illuminator, condenser, specimen, objective, eyepiece.
D: Light passes in this order to the eye.

Q599 · Hard · *codex, slides 293 to 300*

All of the following are involved in controlling or focusing the light reaching the specimen EXCEPT which one?

1. The diaphragm
2. The revolving nosepiece
3. The condenser lens
4. The illuminator

✓ **Answer: B** — Correct choice.

A: It controls the amount of light.
B: Correct choice. The nosepiece holds the objectives.
C: It collects and focuses light. The right answer is: The revolving nosepiece.
D: It is the light source. The right answer is: The revolving nosepiece.

Q600 · Devil · *codex, slides 293 to 300*

A student sees a dim, blurry image with the bulb on, the high power objective selected and the condenser removed. Which change most directly sharpens the image?

1. Replacing the cover slip, which magnifies the specimen
2. Switching off the illuminator to reduce glare
3. Replacing the condenser, which focuses light on the specimen
4. Moving the arm to the other side of the base

✓ **Answer: C** — A condenser gives a sharper, clearer image.

A: Cover slips do not magnify. The right answer is: Replacing the condenser, which collects and focuses light on the specimen.
B: This removes the light. The right answer is: Replacing the condenser, which collects and focuses light on the specimen.
C: A condenser gives a sharper, clearer image.
D: This does not change the light path.

Module 4 — Coarse and fine adjustment → Fluorescence microscopy

slides 301 to 400 · 200 questions · 14 sections · bank: BIOL151_Question_Bank_Slides301-400.docx
Difficulty: 80 Easy · 79 Medium · 33 Hard · 8 Devil

Coarse and fine adjustment · Q601–608

Q601 · Easy · *codex, slides 301 to 304*

Which knob moves the specimen to bring the slide to approximate focus?

1. The fine adjustment knob
2. The coarse adjustment knob
3. The condenser knob
4. The diaphragm lever

✓ **Answer: B** — The coarse knob moves the specimen toward approximate focus.

A: The fine knob brings the specimen into sharp focus.
B: The coarse knob moves the specimen toward approximate focus.
C: The condenser focuses light. The right answer is: The coarse adjustment knob.
D: The diaphragm controls the amount of light.

Q602 · Easy · *codex, slides 301 to 304*

Which knob brings the specimen into sharp final focus?

1. The coarse adjustment knob
2. The nosepiece
3. The fine adjustment knob
4. The power switch

✓ **Answer: C** — The fine knob gives sharp focus.

A: The coarse knob gives approximate focus.
B: The nosepiece holds the objectives. The right answer is: The fine adjustment knob.
C: The fine knob gives sharp focus.
D: The switch controls the lamp. The right answer is: The fine adjustment knob.

Q603 · Easy · *codex, slides 301 to 304*

Where is the coarse adjustment knob located?

1. On the eyepiece
2. On the stage aperture
3. On the illuminator lamp
4. On the arm of the microscope

✓ **Answer: D** — It is present on the arm.

A: The eyepiece is the top lens.
B: The aperture is a hole in the stage.
C: The illuminator is the light source.
D: It is present on the arm.

Q604 · Easy · *codex, slides 301 to 304*

What should be done carefully when focusing?

1. Switching off the illuminator lamp
2. Moving and adjusting the coarse knob
3. Removing the coverslip first
4. Rotating the eyepiece tube

✓ **Answer: B** — The lecture says the coarse adjustment must be moved carefully.

A: This is not the stated care.
B: The lecture says the coarse adjustment must be moved carefully.
C: This is not the stated care.
D: This is not the stated care.

Q605 · Medium · *codex, slides 301 to 304*

How is the fine adjustment knob related to the coarse adjustment knob?

1. It is a sub part of the coarse knob system
2. It is a separate unit on the base
3. It is the same knob used for light control
4. It is a part of the objective lens

✓ **Answer: A** — The fine knob is described as a sub part of the coarse knob.

A: The fine knob is described as a sub part of the coarse knob.
B: It is not described this way.
C: The diaphragm controls light. The right answer is: It is a sub part of the coarse knob system.
D: It is not part of the lens.

Q606 · Medium · *codex, slides 301 to 304*

What does the coarse knob do to the slide?

1. It rotates the objective turret
2. It dims the lamp slowly
3. It stains the specimen lightly
4. It moves it to bring it into focus

✓ **Answer: D** — The knob moves the specimen to focus.

A: The nosepiece does that. The right answer is: It moves it back and forth to bring it into focus.
B: This is not the role. The right answer is: It moves it back and forth to bring it into focus.
C: This is not the role. The right answer is: It moves it back and forth to bring it into focus.
D: The knob moves the specimen to focus.

Q607 · Medium · *codex, slides 301 to 304*

After finding a roughly focused image, which knob should a student use first, and then to finish?

1. Fine knob first, then coarse knob
2. Condenser first, then diaphragm
3. Coarse knob first, then fine knob
4. Nosepiece first, then base

✓ **Answer: C** — Coarse gives approximate focus and fine gives sharp focus.

A: The order is reversed. The right answer is: Coarse knob first, then fine knob.
B: These control light, not focus. The right answer is: Coarse knob first, then fine knob.
C: Coarse gives approximate focus and fine gives sharp focus.
D: These do not focus. The right answer is: Coarse knob first, then fine knob.

Q608 · Hard · *codex, slides 301 to 304*

An image is roughly in focus but still blurry. Which step best improves it?

1. Turning the coarse adjustment knob fully
2. Removing the condenser lens
3. Switching to the dissecting microscope
4. Turning the fine adjustment knob slightly

✓ **Answer: D** — The fine knob brings the specimen into sharp focus.

A: Large coarse moves risk losing the image.
B: This reduces light and focus quality.
C: This is unrelated to a focusing error.
D: The fine knob brings the specimen into sharp focus.

Functions of the microscope · Q609–616

Q609 · Easy · *codex, slides 305 to 307*

Which two functions does microscopy serve?

1. Fixation and staining
2. Magnification and resolution
3. Heating and cooling
4. Sectioning and embedding

✓ **Answer: B** — Microscopy serves magnification and improved resolution.

A: These are specimen preparation steps. The right answer is: Magnification and resolution.
B: Microscopy serves magnification and improved resolution.
C: These are not the functions. The right answer is: Magnification and resolution.
D: These are preparation steps. The right answer is: Magnification and resolution.

Q610 · Easy · *codex, slides 305 to 307*

Resolution is the rendering of two objects as what?

1. A single blurred spot
2. The same colour
3. A larger image
4. Separate entities

✓ **Answer: D** — Resolution renders two objects as separate entities.

A: That is the failure of resolution.
B: Colour is not resolution. The right answer is: Separate entities.
C: That is magnification. The right answer is: Separate entities.
D: Resolution renders two objects as separate entities.

Q611 · Easy · *codex, slides 305 to 307*

What is enlargement of the specimen image called?

1. Resolution
2. Magnification
3. Contrast
4. Aperture

✓ **Answer: B** — Enlargement is magnification.

A: Resolution is detail. The right answer is: Magnification.
B: Enlargement is magnification. It matches what the lecture slides state.
C: Contrast is difference in brightness. The right answer is: Magnification.
D: Aperture is the opening for light.

Q612 · Medium · *codex, slides 305 to 307*

What is the use of increasing magnification without better detail?

1. Great, since larger is clearer
2. Little or none
3. Equal to improving resolution
4. Useful only for dissecting microscopes

✓ **Answer: B** — It is of little or no use.

A: Larger images need detail to be useful.
B: It is of little or no use.
C: It is not equal. The right answer is: Little or none.
D: It is not tied to the type.

Q613 · Medium · *codex, slides 305 to 307*

What are the two basic aims of all microscopes?

1. To stain the specimen and to preserve it
2. To magnify and to show greater detail
3. To heat the specimen and to dry it
4. To section the specimen and to embed it

✓ **Answer: B** — These are the two aims.

A: These are preparation aims. The right answer is: To magnify the specimen and to display it in greater detail.
B: These are the two aims.
C: These are not aims. The right answer is: To magnify the specimen and to display it in greater detail.
D: These are preparation aims. The right answer is: To magnify the specimen and to display it in greater detail.

Q614 · Hard · *codex, slides 305 to 307*

Why are magnification and resolution described as interdependent?

1. Resolution always equals magnification
2. Magnification replaces the need for resolution
3. Each is of little use without the other
4. Resolution works only in dissecting microscopes

✓ **Answer: C** — The aims depend on each other.

A: They are different quantities. The right answer is: Magnifying without improving detail is of little use, and detail needs enough magnification.
B: It cannot replace it. The right answer is: Magnifying without improving detail is of little use, and detail needs enough magnification.
C: The aims depend on each other.
D: It applies to all microscopes. The right answer is: Magnifying without improving detail is of little use, and detail needs enough magnification.

Q615 · Hard · *codex, slides 305 to 307*

All of the following are aims of microscopes EXCEPT which one?

1. Magnifying the specimen
2. Displaying greater detail
3. Improving resolution
4. Digesting the specimen

✓ **Answer: D** — Correct choice.

A: This is an aim. The right answer is: Digesting the specimen.
B: This is an aim. The right answer is: Digesting the specimen.
C: This is an aim. The right answer is: Digesting the specimen.
D: Correct choice. Digestion is not an aim of microscopy.

Q616 · Devil · *codex, slides 305 to 307*

A student doubles the magnification and the image becomes bigger but no more detailed. What does this show?

1. The microscope has no condenser
2. Extra magnification alone adds little
3. The specimen has been fixed
4. The wavelength has become shorter

✓ **Answer: B** — This is empty magnification.

A: This is not shown. The right answer is: Extra magnification without improved resolution is of little value.
B: This is empty magnification. It matches what the lecture slides state.
C: This is not shown. The right answer is: Extra magnification without improved resolution is of little value.
D: This is not shown. The right answer is: Extra magnification without improved resolution is of little value.

Magnification and focal length · Q617–630

Q617 · Easy · *codex, slides 308 to 310*

What is the usual magnification range of an ordinary class microscope?

1. 25× to 1500×
2. 1× to 10×
3. 250× to 15,000×
4. 2000× to 20,000×

✓ **Answer: A** — The ordinary class microscope magnifies 25× to 1500×.

A: The ordinary class microscope magnifies 25× to 1500×.
B: This is far too low. The right answer is: 25× to 1500×.
C: This is ten times too high.
D: This is too high. The right answer is: 25× to 1500×.

Q618 · Easy · *codex, slides 308 to 310*

Up to what magnification do most dissecting microscopes magnify?

1. 300×
2. 3×
3. 3000×
4. 30×

✓ **Answer: D** — Most dissecting microscopes magnify up to 30×.

A: This is ten times too high.
B: This is too low. The right answer is: 30×.
C: This is far too high. The right answer is: 30×.
D: Most dissecting microscopes magnify up to 30×.

Q619 · Easy · *codex, slides 308 to 310*

What useful magnification can some compound microscopes reach with the oil immersion lens?

1. 200×
2. 2000×
3. 20,000×
4. 20×

✓ **Answer: B** — Some reach a useful 2000× with oil.

A: This is ten times too low.
B: Some reach a useful 2000× with oil.
C: This is ten times too high.
D: This is far too low. The right answer is: 2000×.

Q620 · Easy · *codex, slides 308 to 310*

The magnification of an optical system depends on what?

1. The colour of the glass slide
2. Focal length and the lens arrangement
3. The thickness of the metal stage
4. The size of the lamp housing

✓ **Answer: B** — Both focal length and arrangement matter.

A: This is irrelevant. The right answer is: The focal length of the lenses and their arrangement.
B: Both focal length and arrangement matter.
C: This is irrelevant. The right answer is: The focal length of the lenses and their arrangement.
D: This is irrelevant. The right answer is: The focal length of the lenses and their arrangement.

Q621 · Easy · *codex, slides 308 to 310*

Focal length is the distance over which what are brought to a focus?

1. Scattered rays
2. Diverging rays
3. Parallel rays
4. Reflected rays

✓ **Answer: C** — Parallel rays are brought to a focus over the focal length.

A: These are not the definition. The right answer is: Parallel rays.
B: These are not the definition. The right answer is: Parallel rays.
C: Parallel rays are brought to a focus over the focal length.
D: These are not the definition. The right answer is: Parallel rays.

Q622 · Easy · *codex, slide 308*

The ratio of the length of the final image to the length of the specimen is called what?

1. Resolution
2. Contrast
3. Specimen stage
4. Magnification

✓ **Answer: D** — Magnification is the ratio of the final image length to the specimen length.

A: Resolution is the ability to render two objects as separate, not an image size ratio.
B: Contrast is the difference in brightness between specimen and background.
C: The specimen stage is the platform that holds the slide, not a ratio.
D: Magnification is the ratio of the final image length to the specimen length.

Q623 · Medium · *codex, slides 308 to 310*

Magnification above what value is considered empty for compound microscopes?

1. Above 2000×
2. Above 25×
3. Above 100×
4. Above 1500× only

✓ **Answer: A** — Beyond 2000× resolution no longer improves.

A: Beyond 2000× resolution no longer improves.
B: This is the lower limit of the range.
C: This is not the limit. The right answer is: Above 2000×.
D: The empty limit is stated as 2000×.

Q624 · Medium · *codex, slides 308 to 310*

What does focal length measure?

1. How bright the lamp bulb is
2. How strongly light is converged
3. How thick the specimen slice is
4. How fast the stage moves up

✓ **Answer: B** — Focal length measures how strongly light is converged.

A: This is not what it measures.
B: Focal length measures how strongly light is converged.
C: This is not what it measures.
D: This is not what it measures.

Q625 · Medium · *codex, slides 308 to 310*

Which statement about magnification is NOT true?

1. It is the ratio of image length to specimen length
2. It always improves resolution
3. It depends on the focal length of the lenses
4. It is called empty above 2000× for compound microscopes

✓ **Answer: B** — Correct choice.

A: This is true. The right answer is: It always improves resolution.
B: Correct choice. Magnification beyond a point does not improve resolution.
C: This is true. The right answer is: It always improves resolution.
D: This is true. The right answer is: It always improves resolution.

Q626 · Medium · *codex, slides 308, 317*

A student draws an ant 8 cm long, and its real length is 2 mm. What is the magnification of the drawing?

1. 4×
2. 40×
3. 400×
4. 0.025×

✓ **Answer: B** — 8 cm is 80 mm, and 80 mm divided by 2 mm gives 40×.

A: This treats 8 cm as 8 mm and forgets to convert centimetres to millimetres.
B: 8 cm is 80 mm, and 80 mm divided by 2 mm gives 40×.
C: This slips a factor of ten when converting centimetres to millimetres.
D: This inverts the ratio by dividing the real size by the drawing size.

Q627 · Medium · *codex, slide 309*

What does a shorter focal length mean for a lens?

1. Lower optical power, because it bends rays less sharply
2. No change in optical power, because only aperture matters
3. Greater optical power, because it bends rays more sharply
4. A longer working distance, because rays focus farther away

✓ **Answer: C** — A shorter focal length gives greater optical power by bringing rays to a focus over a shorter distance.

A: This is reversed; a longer focal length bends rays less sharply.
B: Optical power depends on how strongly the lens converges light, which relates to focal length.
C: A shorter focal length gives greater optical power by bringing rays to a focus over a shorter distance.
D: A shorter focal length brings rays to a focus over a shorter distance.

Q628 · Medium · *codex, slide 308*

Why is magnification beyond about 2000× in a compound light microscope called empty?

1. The illuminator cannot supply enough light above that value
2. The working distance becomes zero once that value is reached
3. Resolution stops improving, so no extra detail appears
4. The image becomes inverted and can no longer be focused

✓ **Answer: C** — Past about 2000× resolution does not improve, so the image is bigger but shows no more detail.

A: The limit is about resolution, not about the amount of light.
B: Working distance falls with magnification but is not what makes it empty.
C: Past about 2000× resolution does not improve, so the image is bigger but shows no more detail.
D: Inversion is unrelated to empty magnification.

Q629 · Hard · *codex, slides 308, 347*

A red blood cell is 7 µm wide. What is the width of its image at a total magnification of 450×?

1. 3.15 mm
2. 0.315 mm
3. 31.5 mm
4. 3.15 µm

✓ **Answer: A** — 7 µm × 450 = 3,150 µm, which is 3.15 mm.

A: 7 µm × 450 = 3,150 µm, which is 3.15 mm.
B: This slips a factor of ten when converting micrometres to millimetres.
C: This is ten times too large after converting micrometres to millimetres.
D: This forgets to convert 3,150 µm to millimetres and also mislabels the unit.

Q630 · Devil · *codex, slides 308 to 310*

A student uses a 20× eyepiece with a 100× oil objective. What is the total magnification, and how does it compare with the useful limit?

1. 200×, well below the useful limit
2. 120×, well below the useful limit
3. 2000×, at the useful limit for oil immersion
4. 20,000×, far beyond the useful limit

✓ **Answer: C** — 20 × 100 = 2000×, the useful limit.

A: This slips a factor of ten.
B: This adds the powers. The right answer is: 2000×, at the useful limit for oil immersion.
C: 20 × 100 = 2000×, the useful limit.
D: This slips a factor of ten.

Working distance and parfocal objectives · Q631–644

Q631 · Easy · *codex, slides 311 to 316*

How long is the working distance at low magnification?

1. Zero
2. Relatively long
3. Exactly 1 mm
4. Equal to the focal length

✓ **Answer: B** — Working distance is relatively long at low magnification.

A: Oil lenses have almost none. The right answer is: Relatively long.
B: Working distance is relatively long at low magnification.
C: This is not stated. The right answer is: Relatively long.
D: This is not stated. The right answer is: Relatively long.

Q632 · Easy · *codex, slides 311 to 316*

What happens to working distance as magnification increases?

1. It increases
2. It stays constant
3. It decreases considerably
4. It doubles

✓ **Answer: C** — Working distance falls considerably.

A: It decreases. The right answer is: It decreases considerably.
B: It changes. The right answer is: It decreases considerably.
C: Working distance falls considerably. It matches what the lecture slides state.
D: It decreases. The right answer is: It decreases considerably.

Q633 · Easy · *codex, slides 311 to 316*

Which lenses practically touch the specimen?

1. Low-power objectives
2. Eyepiece lenses
3. Condenser lenses
4. Oil immersion lenses

✓ **Answer: D** — Oil immersion lenses practically touch the specimen.

A: These have long working distance. The right answer is: Oil immersion lenses.
B: These are far from the specimen.
C: These lie below the stage. The right answer is: Oil immersion lenses.
D: Oil immersion lenses practically touch the specimen.

Q634 · Easy · *codex, slides 311 to 316*

Parfocal objectives can be changed with what?

1. Complete refocusing each time
2. A change of illuminator
3. A change of slide
4. Minimal or no refocusing

✓ **Answer: D** — Parfocal objectives need little or no refocusing.

A: That is the opposite. The right answer is: Minimal or no refocusing.
B: This is not related. The right answer is: Minimal or no refocusing.
C: This is not related. The right answer is: Minimal or no refocusing.
D: Parfocal objectives need little or no refocusing.

Q635 · Easy · *codex, slides 311 to 316*

If a parfocal microscope is switched from 10× to 40×, what happens to the object?

1. It stays in focus
2. It disappears
3. It turns upside down
4. It changes colour

✓ **Answer: A** — It stays in focus.

A: It stays in focus. It matches what the lecture slides state.
B: It stays in focus. The right answer is: It stays in focus.
C: This is not described. The right answer is: It stays in focus.
D: This is not described. The right answer is: It stays in focus.

Q636 · Medium · *codex, slides 311 to 316*

In most compound microscopes, how is the lens moved to increase magnification?

1. Farther away from the specimen
2. Sideways across the whole stage
3. Physically closer to the specimen
4. Up into the narrow body tube

✓ **Answer: C** — The lens is moved closer to the specimen.

A: This is the opposite. The right answer is: Physically closer to the specimen.
B: This is not described. The right answer is: Physically closer to the specimen.
C: The lens is moved closer to the specimen.
D: This is not described. The right answer is: Physically closer to the specimen.

Q637 · Medium · *codex, slides 311 to 316*

What does parfocalling objectives do?

1. Removes the need for a stage
2. Makes all objectives the same power
3. Adjusts each objective to stay in focus
4. Shortens the working distance to zero

✓ **Answer: C** — Parfocalling aligns the objectives' focus.

A: This is not the effect. The right answer is: Adjusts each objective so it stays in relative focus with the others.
B: It does not change power. The right answer is: Adjusts each objective so it stays in relative focus with the others.
C: Parfocalling aligns the objectives' focus.
D: This is not the effect. The right answer is: Adjusts each objective so it stays in relative focus with the others.

Q638 · Medium · *codex, slides 311 to 316*

Why should users be aware of working distance changes with magnification?

1. To increase the lamp brightness
2. To change the immersion oil often
3. To reduce the staining time needed
4. To prevent damage to the lens and slides

✓ **Answer: D** — Short distances risk damage.

A: This is not the reason. The right answer is: To prevent damage to specimens and especially the lens.
B: This is not the reason. The right answer is: To prevent damage to specimens and especially the lens.
C: This is not the reason. The right answer is: To prevent damage to specimens and especially the lens.
D: Short distances risk damage. It matches what the lecture slides state.

Q639 · Medium · *codex, slides 311 to 316*

How large is the focus error in parfocal objectives?

1. There is some, but it is insignificant
2. None at all in any microscope
3. So large it needs refocusing always
4. Always larger at low power

✓ **Answer: A** — There is inevitably some small error.

A: There is inevitably some small error.
B: Some error is inevitable. The right answer is: There is some, but small enough to be insignificant.
C: It is small. The right answer is: There is some, but small enough to be insignificant.
D: This is not stated. The right answer is: There is some, but small enough to be insignificant.

Q640 · Medium · *codex, slides 311, 316*

All of the following are true about working distance EXCEPT which one?

1. It is relatively long when the objective has low magnification
2. It decreases considerably as the magnification is increased
3. It is the distance between the eyepiece and the objective lens
4. Oil immersion objectives practically touch the specimen

✓ **Answer: C** — Correct choice.

A: This is true; working distance is relatively long at low magnification.
B: This is true; higher power objectives sit closer to the specimen.
C: Correct choice. Working distance is the distance between the objective lens and the specimen, so this statement is false.
D: This is true; oil immersion lenses have almost no working distance.

Q641 · Medium · *codex, slides 313, 314*

What does it mean when a microscope's objectives are described as parfocal?

1. The specimen stays in focus when the objective is changed to another magnification
2. The specimen stays in focus when the working distance is changed
3. The specimen stays in focus when the slide is shifted sideways
4. The specimen stays in focus when an opaque disc is placed in the diaphragm

✓ **Answer: A** — Parfocal objectives stay in focus, with little or no refocusing, when magnification is changed.

A: Parfocal objectives stay in focus, with little or no refocusing, when magnification is changed.
B: Working distance changes with magnification; parfocal describes keeping focus across objectives.
C: Moving the slide is unrelated to parfocal objectives.
D: An opaque disc relates to dark-field illumination, not parfocal objectives.

Q642 · Hard · *codex, slides 311 to 316*

Which statement distinguishes working distance from parfocal distance?

1. Working distance is the eyepiece-to-objective gap, while parfocal is the specimen thickness
2. Both describe the distance between condenser and lamp
3. Working distance is objective-to-specimen, parfocal means staying in focus
4. Working distance is the focal length, while parfocal is magnification

✓ **Answer: C** — These are different ideas.

A: These are not the definitions. The right answer is: Working distance is the objective-to-specimen gap, while parfocal objectives stay in focus when changed.
B: This is not the definition. The right answer is: Working distance is the objective-to-specimen gap, while parfocal objectives stay in focus when changed.
C: These are different ideas. It matches what the lecture slides state.
D: These are not the definitions. The right answer is: Working distance is the objective-to-specimen gap, while parfocal objectives stay in focus when changed.

Q643 · Hard · *codex, slides 311 to 316*

A student switches from a 40× objective to the 100× oil lens and sees the slide nearly touching the lens. Which fact explains this?

1. Parfocal objectives increase the working distance at high power
2. Working distance falls at high power, and oil lenses nearly touch
3. The condenser moved far away from the stage
4. The fine knob doubles the working distance of the lens

✓ **Answer: B** — The oil lens has almost no working distance.

A: Working distance decreases. The right answer is: Working distance decreases with magnification, and oil lenses practically touch the specimen.
B: The oil lens has almost no working distance.
C: This is not the cause. The right answer is: Working distance decreases with magnification, and oil lenses practically touch the specimen.
D: This is not the cause. The right answer is: Working distance decreases with magnification, and oil lenses practically touch the specimen.

Q644 · Hard · *codex, slides 311, 313, 316*

A student focuses sharply at 10×, then moves to the 40× objective and the 100× oil lens, using only the coarse knob. Why is this risky?

1. Parfocal objectives lose focus entirely at higher power, so the image is destroyed for good
2. Working distance increases sharply at high power, so the slide may fall off the stage
3. Working distance falls considerably and the oil lens nearly touches the specimen, so lens or slide may be damaged
4. Chromatic aberration increases with the coarse knob, so the colours are permanently lost

✓ **Answer: C** — Working distance decreases with magnification, and oil immersion lenses practically touch the specimen.

A: Parfocal objectives stay close to focus, and loss of focus would not damage anything.
B: Working distance decreases, not increases, as magnification rises.
C: Working distance decreases with magnification, and oil immersion lenses practically touch the specimen.
D: The coarse knob changes focus; it does not cause chromatic aberration or permanent loss.

Magnification versus resolution · Q645–660

Q645 · Easy · *codex, slides 317 to 325*

Magnification enlarges what about the specimen?

1. Its appearance, not its physical size
2. Its physical size permanently in the cell
3. Its refractive index in the lens
4. Its wavelength of light

✓ **Answer: A** — Magnification enlarges appearance, not physical size.

A: Magnification enlarges appearance, not physical size.
B: The specimen's size does not change.
C: This is not enlarged. The right answer is: Its appearance only, not its physical size.
D: This is not enlarged. The right answer is: Its appearance only, not its physical size.

Q646 · Easy · *codex, slides 317 to 325*

Which term describes the ability of an imaging system to show detail?

1. Magnification
2. Resolution
3. Contrast
4. Aperture

✓ **Answer: B** — Resolution describes the ability to show detail.

A: Magnification only enlarges. The right answer is: Resolution.
B: Resolution describes the ability to show detail.
C: Contrast is a brightness difference. The right answer is: Resolution.
D: Aperture is an opening. The right answer is: Resolution.

Q647 · Easy · *codex, slides 317 to 325*

Which term is often confused with magnification?

1. Resolution
2. Fixation
3. Parfocal
4. Dispersion

✓ **Answer: A** — Resolution is often confused with magnification.

A: Resolution is often confused with magnification.
B: Fixation is preparation. The right answer is: Resolution.
C: Parfocal refers to focus staying constant.
D: Dispersion causes chromatic aberration. The right answer is: Resolution.

Q648 · Easy · *codex, slides 317 to 325*

What effect limits a microscope's ability to resolve fine details?

1. Evaporation
2. Absorption by glass
3. Diffraction
4. Gravity

✓ **Answer: C** — Diffraction limits resolution.

A: This is not the limit. The right answer is: Diffraction.
B: This is not the stated limit.
C: Diffraction limits resolution. It matches what the lecture slides state.
D: This is not the stated limit.

Q649 · Easy · *codex, slides 317 to 325*

Two micrographs at the same magnification differ in clarity. What differs?

1. Magnification
2. Slide length
3. Resolution
4. Eyepiece colour

✓ **Answer: C** — Resolution differs while magnification is the same.

A: They have the same magnification. The right answer is: Resolution.
B: This is not the difference. The right answer is: Resolution.
C: Resolution differs while magnification is the same.
D: This is not the difference. The right answer is: Resolution.

Q650 · Easy · *codex, slides 317 to 325*

What is the finite limit beyond which separate points cannot be resolved called?

1. The resolution limit
2. The focal limit
3. The working limit
4. The parfocal limit

✓ **Answer: A** — This is the resolution limit.

A: This is the resolution limit.
B: This is not a term used.
C: This is not a term used.
D: This is not a term used.

Q651 · Medium · *codex, slides 317 to 325*

Which do microbiologists depend on more, magnification or resolution?

1. Resolution, to tell microbes apart
2. Magnification, to make microbes large
3. Neither one of them
4. Working distance of the lens

✓ **Answer: A** — They depend on resolution to see differences.

A: They depend on resolution to see differences.
B: Resolution gives the detail. The right answer is: Resolution, to tell microbes or their parts apart.
C: They depend on resolution. The right answer is: Resolution, to tell microbes or their parts apart.
D: This is not the stated answer.

Q652 · Medium · *codex, slides 317 to 325*

Resolving power is the ability to distinguish between two closely spaced what?

1. Cover slips
2. Condensers
3. Airy disks
4. Eyepieces

✓ **Answer: C** — Resolving power is the ability to distinguish adjacent Airy disks.

A: These are not the stated objects.
B: These are not the stated objects.
C: Resolving power is the ability to distinguish adjacent Airy disks.
D: These are not the stated objects.

Q653 · Medium · *codex, slides 317 to 325*

Which three factors affect the size of diffraction patterns?

1. Slide thickness, stage size and lamp power
2. Wavelength, refractive index and numerical aperture
3. Fixative, stain and embedding medium
4. Magnification, working distance and parfocal distance

✓ **Answer: B** — These are the three listed.

A: These are not the factors. The right answer is: Wavelength, refractive index and numerical aperture.
B: These are the three listed.
C: These are preparation factors. The right answer is: Wavelength, refractive index and numerical aperture.
D: These are not the factors. The right answer is: Wavelength, refractive index and numerical aperture.

Q654 · Medium · *codex, slides 317 to 325*

Why must a viewer first magnify to a point where resolution becomes relevant?

1. Resolution is created by the eyepiece colour
2. Magnification replaces the lens aperture
3. Detail needs enough enlargement first
4. Staining can only occur above 1000×

✓ **Answer: C** — Enlargement must reach the point where detail matters.

A: This is not the reason. The right answer is: Details can only be distinguished once the image is enlarged enough.
B: This is not the reason. The right answer is: Details can only be distinguished once the image is enlarged enough.
C: Enlargement must reach the point where detail matters.
D: This is not the reason. The right answer is: Details can only be distinguished once the image is enlarged enough.

Q655 · Medium · *codex, slides 317 to 325*

What happens as two small specimens are moved closer and closer together?

1. They become brighter and larger
2. They turn into a single new cell
3. They can no longer be seen as distinct
4. They always stay distinct however close

✓ **Answer: C** — Beyond the resolution limit they merge.

A: This is not described. The right answer is: They eventually can no longer be seen as distinct.
B: This is not described. The right answer is: They eventually can no longer be seen as distinct.
C: Beyond the resolution limit they merge.
D: They cannot be resolved below the limit.

Q656 · Medium · *codex, slide 322*

At very high magnification with transmitted light, point objects appear as fuzzy discs ringed by diffraction rings. What are these discs called?

1. Deflected electrons
2. Airy discs
3. Cones of light
4. Positive phase rings

✓ **Answer: B** — Point objects appear as fuzzy Airy discs surrounded by diffraction rings.

A: Electrons belong to electron microscopy and are not seen as discs in light microscopy.
B: Point objects appear as fuzzy Airy discs surrounded by diffraction rings.
C: A cone of light describes the light entering the objective, not the discs seen.
D: Phase rings belong to phase-contrast microscopy.

Q657 · Hard · *codex, slides 317 to 325*

The right micrograph shows more detail at the same magnification as the left. Why?

1. It has higher resolution
2. It has a higher magnification
3. It has a longer working distance
4. It is stained with heavy metal

✓ **Answer: A** — Higher resolution gives more detail at the same magnification.

A: Higher resolution gives more detail at the same magnification.
B: The magnifications are equal. The right answer is: It has higher resolution.
C: This is not the reason. The right answer is: It has higher resolution.
D: This is not the reason. The right answer is: It has higher resolution.

Q658 · Hard · *codex, slides 317 to 325*

Two points lie 100 nm apart, and the microscope's limit of resolution is 240 nm. What happens?

1. They appear as two because magnification is high
2. They appear as two because 100 is smaller than 240
3. They disappear because of diffraction rings
4. They appear as one because they are closer than the limit

✓ **Answer: D** — 100 nm is below the 240 nm limit.

A: Magnification does not overcome the limit.
B: A distance below the limit is not resolved.
C: They appear unresolved, not absent. The right answer is: They appear as one because they are closer than the limit.
D: 100 nm is below the 240 nm limit.

Q659 · Hard · *codex, slides 317 to 325*

All of the following affect the extent of diffraction patterns EXCEPT which one?

1. The wavelength of light
2. The refractive index of the lens materials
3. The thickness of the glass slide
4. The numerical aperture

✓ **Answer: C** — Correct choice.

A: This is a listed factor. The right answer is: The thickness of the glass slide.
B: This is a listed factor. The right answer is: The thickness of the glass slide.
C: Correct choice. It is not a listed factor.
D: This is a listed factor. The right answer is: The thickness of the glass slide.

Q660 · Devil · *codex, slides 317 to 325*

A student says raising magnification alone will separate two structures 100 nm apart in a light microscope with a 240 nm limit. How should this be judged?

1. It is right, because enough magnification always separates them
2. It is wrong, since resolution sets the limit and 100 nm is below 240 nm
3. It is right, because Airy discs shrink with magnification
4. It is wrong only if the stage is perfectly flat

✓ **Answer: B** — Resolution limits separation.

A: Magnification cannot beat the resolution limit.
B: Resolution limits separation. It matches what the lecture slides state.
C: Airy discs do not do this.
D: This is irrelevant. The right answer is: It is wrong, because resolution rather than magnification sets the limit, and 100 nm is below 240 nm.

Parameters that affect resolution · Q661–670

Q661 · Easy · *codex, slides 326 to 330*

Which colour gives better resolution, blue or red light?

1. Blue light, because its wavelength is shorter
2. Red light, because its wavelength is longer
3. Both are the same, as wavelength is irrelevant
4. Neither, because colour has no effect

✓ **Answer: A** — Shorter wavelength gives better resolution.

A: Shorter wavelength gives better resolution.
B: Longer wavelengths give poorer resolution. The right answer is: Blue light, because its wavelength is shorter.
C: They differ. The right answer is: Blue light, because its wavelength is shorter.
D: Wavelength matters. The right answer is: Blue light, because its wavelength is shorter.

Q662 · Easy · *codex, slides 326 to 330*

Which illumination method optimises light distribution?

1. Köhler illumination
2. Oil illumination
3. Parfocal illumination
4. Spherical illumination

✓ **Answer: A** — Köhler illumination optimises light distribution.

A: Köhler illumination optimises light distribution.
B: This is not the term. The right answer is: Köhler illumination.
C: This is not the term. The right answer is: Köhler illumination.
D: This is not the term. The right answer is: Köhler illumination.

Q663 · Easy · *codex, slides 326 to 330*

Which high-quality lenses minimise distortions and improve resolution?

1. Plan apochromats
2. Simple plano lenses
3. Opaque lenses
4. Dispersive lenses

✓ **Answer: A** — Plan apochromatic lenses minimise distortions.

A: Plan apochromatic lenses minimise distortions.
B: These are not named. The right answer is: Plan apochromats.
C: These are not named. The right answer is: Plan apochromats.
D: These are not named. The right answer is: Plan apochromats.

Q664 · Easy · *codex, slides 326 to 330*

About what refractive index does immersion oil have?

1. 1.51
2. 1.00
3. 0.51
4. 5.1

> ✓ **Answer: A** — Immersion oil has n of about 1.51.

A: Immersion oil has n of about 1.51.
B: This is the value for air.
C: This is too low. The right answer is: 1.51.
D: This is too high. The right answer is: 1.51.

Q665 · Medium · *codex, slides 326 to 330*

Blue light has about what wavelength in the lecture?

1. About 700 nm
2. About 450 nm
3. About 180 nm
4. About 1500 nm

> ✓ **Answer: B** — Blue light is about 450 nm.

A: This is red light. The right answer is: About 450 nm.
B: Blue light is about 450 nm.
C: This is ultraviolet. The right answer is: About 450 nm.
D: This is infrared. The right answer is: About 450 nm.

Q666 · Medium · *codex, slides 326 to 330*

In the lecture, red light lies at about what wavelength?

1. About 700 nm
2. About 450 nm
3. About 200 nm
4. About 1000 nm

> ✓ **Answer: A** — Red light is about 700 nm.

A: Red light is about 700 nm.
B: This is blue light. The right answer is: About 700 nm.
C: This is ultraviolet. The right answer is: About 700 nm.
D: This is infrared. The right answer is: About 700 nm.

Q667 · Medium · *codex, slides 326 to 330*

Why do some microscopes use ultraviolet light?

1. It is much brighter than white light
2. It stains the specimen automatically
3. It removes the need for all lenses
4. Its wavelength is shorter than visible

✓ **Answer: D** — UV has a shorter wavelength.

A: This is not the reason. The right answer is: Its shorter wavelength gives even greater resolution.
B: This is not the reason. The right answer is: Its shorter wavelength gives even greater resolution.
C: This is not the reason. The right answer is: Its shorter wavelength gives even greater resolution.
D: UV has a shorter wavelength.

Q668 · Medium · *codex, slides 326 to 330*

What do lens aberrations do to image quality?

1. They increase resolution
2. They improve contrast always
3. They shorten the working distance
4. They reduce clarity

✓ **Answer: D** — Aberrations reduce clarity.

A: They reduce clarity. The right answer is: They reduce clarity.
B: This is not stated. The right answer is: They reduce clarity.
C: This is not stated. The right answer is: They reduce clarity.
D: Aberrations reduce clarity. It matches what the lecture slides state.

Q669 · Hard · *codex, slides 326 to 330*

Which list names the factors that affect resolution?

1. Wavelength, NA, optical quality, illumination, contrast and medium index
2. Slide thickness, stage size, lamp colour and arm length
3. Fixative, stain, embedding, sectioning and mounting
4. Magnification, working distance, parfocal distance and focal length

✓ **Answer: A** — These are the factors in the lecture.

A: These are the factors in the lecture.
B: These are not the factors. The right answer is: Wavelength, numerical aperture, optical quality, illumination and contrast, refractive index of the medium.
C: These are preparation factors. The right answer is: Wavelength, numerical aperture, optical quality, illumination and contrast, refractive index of the medium.
D: These are not the factors. The right answer is: Wavelength, numerical aperture, optical quality, illumination and contrast, refractive index of the medium.

Q670 · Hard · *codex, slides 326 to 330*

All of the following affect the resolution of a light microscope EXCEPT which one?

1. The wavelength of light
2. The numerical aperture
3. The medium's refractive index
4. The colour of the slide label

> ✓ **Answer: D** — Correct choice.

A: It affects resolution. The right answer is: The colour of the slide label.
B: It affects resolution. The right answer is: The colour of the slide label.
C: It affects resolution. The right answer is: The colour of the slide label.
D: Correct choice. It has no effect.

Numerical aperture · Q671–690

Q671 · Easy · *codex, slides 331 to 339*

What is the equation for numerical aperture?

1. NA = n(sin μ)
2. NA = n / sin μ
3. NA = sin μ / n
4. NA = n(cos μ)

> ✓ **Answer: A** — NA equals n times sin μ.

A: NA equals n times sin μ.
B: This divides instead of multiplying. The right answer is: NA = n(sin μ).
C: This divides sin μ by n.
D: The equation uses sine. The right answer is: NA = n(sin μ).

Q672 · Easy · *codex, slides 331 to 339*

What does n stand for in the numerical aperture equation?

1. The number of lenses
2. The wavelength of light
3. The medium's refractive index
4. The magnification

> ✓ **Answer: C** — n is the refractive index.

A: This is not the meaning. The right answer is: The refractive index of the medium.
B: Wavelength is λ. The right answer is: The refractive index of the medium.
C: n is the refractive index.
D: This is not the meaning. The right answer is: The refractive index of the medium.

Q673 · Easy · *codex, slides 331 to 339*

What is the refractive index of air in the NA equation?

1. 1.00
2. 1.51
3. 0.50
4. 2.00

✓ **Answer: A** — Air has a refractive index of 1.00.

A: Air has a refractive index of 1.00.
B: This is the value for oil.
C: This is too low. The right answer is: 1.00.
D: This is too high. The right answer is: 1.00.

Q674 · Easy · *codex, slides 331 to 339*

What refractive index do specialised immersion oils reach?

1. About 1.51
2. About 1.00
3. About 3.0
4. About 0.5

✓ **Answer: A** — Immersion oils reach about 1.51.

A: Immersion oils reach about 1.51.
B: This is the value for air.
C: This is too high. The right answer is: About 1.51.
D: This is too low. The right answer is: About 1.51.

Q675 · Easy · *codex, slides 331 to 339*

What is the maximum value of the angle μ?

1. 45°
2. 90°
3. 180°
4. 30°

✓ **Answer: B** — The maximum value is 90°.

A: This is not the maximum. The right answer is: 90°.
B: The maximum value is 90°.
C: This is not the maximum. The right answer is: 90°.
D: This is not the maximum. The right answer is: 90°.

Q676 · Easy · *codex, slides 331 to 339*

What is the value of sin 90°?

1. 1
2. 0
3. 0.5
4. 90

✓ **Answer: A** — The sine of 90° is 1.

A: The sine of 90° is 1.
B: The sine of 0° is 0.
C: The sine of 30° is 0.5.
D: The sine function does not return 90.

Q677 · Easy · *codex, slides 331 to 339*

A lens with a larger NA can do what?

1. Visualise coarser detail with a dimmer image
2. Increase the working distance only
3. See finer detail with a brighter image
4. Remove the need for light

✓ **Answer: C** — A larger NA gives finer detail and brightness.

A: This is the opposite. The right answer is: Visualise finer detail and give a brighter image.
B: This is not the effect. The right answer is: Visualise finer detail and give a brighter image.
C: A larger NA gives finer detail and brightness.
D: This is not the effect. The right answer is: Visualise finer detail and give a brighter image.

Q678 · Easy · *codex, slides 331 to 339*

What does μ represent in the NA equation?

1. The full angular aperture
2. The wavelength of light
3. The refractive index
4. Half of the angular aperture

✓ **Answer: D** — μ is one-half the angular aperture.

A: μ is half of it. The right answer is: Half of the angular aperture.
B: Wavelength is λ. The right answer is: Half of the angular aperture.
C: The index is n. The right answer is: Half of the angular aperture.
D: μ is one-half the angular aperture.

Q679 · Medium · *codex, slides 331 to 339*

What shape is the cone of image-forming light entering the objective?

1. A flat sheet
2. A cylinder
3. An inverted cone
4. A sphere

> ✓ **Answer: C** — Light enters in an inverted cone.

A: It is a cone. The right answer is: An inverted cone.
B: It is a cone. The right answer is: An inverted cone.
C: Light enters in an inverted cone.
D: It is a cone. The right answer is: An inverted cone.

Q680 · Medium · *codex, slides 331 to 339*

What is the practical upper limit of NA for dry objectives?

1. About 1.51
2. About 2.5
3. About 0.1
4. About 0.95

> ✓ **Answer: D** — Dry objectives rarely exceed 0.95.

A: This is for oil. The right answer is: About 0.95.
B: This is too high. The right answer is: About 0.95.
C: This is too low. The right answer is: About 0.95.
D: Dry objectives rarely exceed 0.95.

Q681 · Medium · *codex, slides 331 to 339*

Which factor is the limit for achieving NA above 1.0?

1. The colour of the lens
2. The medium's refractive index
3. The size of the stage
4. The thickness of the slide

> ✓ **Answer: B** — The refractive index limits NA.

A: This is not the limit. The right answer is: The refractive index of the medium.
B: The refractive index limits NA.
C: This is not the limit. The right answer is: The refractive index of the medium.
D: This is not the limit. The right answer is: The refractive index of the medium.

Q682 · Medium · *codex, slides 331 to 339*

How is a working NA greater than 1.0 achieved?

1. By using a much thicker cover slip
2. By raising the medium's index
3. By dimming the lamp a little
4. By using a much longer eyepiece

✓ **Answer: B** — A denser medium raises NA.

A: This does not raise NA. The right answer is: By increasing the refractive index of the medium, as with oil, water or glycerin.
B: A denser medium raises NA.
C: This does not raise NA. The right answer is: By increasing the refractive index of the medium, as with oil, water or glycerin.
D: This does not raise NA. The right answer is: By increasing the refractive index of the medium, as with oil, water or glycerin.

Q683 · Medium · *codex, slides 331 to 339*

How does NA relate to aberration correction in objectives?

1. Corrected objectives have smaller NA
2. NA is unrelated to correction
3. Highly corrected objectives have larger NA
4. Only uncorrected objectives reach 1.0

✓ **Answer: C** — Correction allows larger NA.

A: They have larger NA. The right answer is: Highly corrected objectives tend to have much larger NA.
B: The lecture links them. The right answer is: Highly corrected objectives tend to have much larger NA.
C: Correction allows larger NA. It matches what the lecture slides state.
D: This is not stated. The right answer is: Highly corrected objectives tend to have much larger NA.

Q684 · Medium · *codex, slides 331 to 339*

What is the NA of a 10× plan apochromat objective in the lecture table?

1. 0.25
2. 0.45
3. 0.30
4. 0.95

✓ **Answer: B** — The 10× plan apochromat has NA 0.45.

A: This is the plan achromat. The right answer is: 0.45.
B: The 10× plan apochromat has NA 0.45.
C: This is the plan fluorite. The right answer is: 0.45.
D: This is the 40× plan apochromat.

Q685 · Medium · *codex, slides 331 to 339*

What is the NA of the 40× oil objective in the table?

1. 0.65
2. 0.95
3. 1.3
4. 2.5

> ✓ **Answer: C** — The 40× oil objective has NA 1.3.

A: This is the 40× plan achromat.
B: This is the dry apochromat. The right answer is: 1.3.
C: The 40× oil objective has NA 1.3.
D: This is too high. The right answer is: 1.3.

Q686 · Medium · *codex, slides 331 to 339*

What happens to NA as the angle μ rises from 7° to 60° in air?

1. It falls from 0.87 to 0.12
2. It stays fixed at about 1.0
3. It rises from about 0.12 to 0.87
4. It rises from about 1.0 to 2.0

> ✓ **Answer: C** — NA rises from 0.12 to 0.87.

A: It rises. The right answer is: It rises from about 0.12 to 0.87.
B: It rises with the angle. The right answer is: It rises from about 0.12 to 0.87.
C: NA rises from 0.12 to 0.87.
D: The values are 0.12 to 0.87.

Q687 · Hard · *codex, slides 331 to 339*

What is the NA of a dry objective (air, n = 1.00) whose angle μ is 30°?

1. 0.50
2. 0.30
3. 1.00
4. 0.87

> ✓ **Answer: A** — NA = 1.00 × sin 30° = 0.50.

A: NA = 1.00 × sin 30° = 0.50.
B: This uses the angle as a decimal.
C: This ignores the sine. The right answer is: 0.50.
D: This is sin 60°. The right answer is: 0.50.

Q688 · Hard · *codex, slides 331 to 339*

Why can an air objective not exceed an NA of 1.0?

1. Air blocks all rays above 1.0
2. The lens glass melts above 1.0
3. The eyepiece cannot read above 1.0
4. n is 1.00 and sin μ never exceeds 1

✓ **Answer: D** — n = 1.00 and sin μ ≤ 1 cap NA at 1.0.

A: This is not the reason. The right answer is: The refractive index is 1.00 and sin μ never exceeds 1.
B: This is not the reason. The right answer is: The refractive index is 1.00 and sin μ never exceeds 1.
C: This is not the reason. The right answer is: The refractive index is 1.00 and sin μ never exceeds 1.
D: n = 1.00 and sin μ ≤ 1 cap NA at 1.0.

Q689 · Hard · *codex, slides 331 to 339*

Which objective in the table has the highest NA among dry 40× lenses?

1. Plan apochromat, NA 0.95
2. Plan achromat, NA 0.65
3. Plan fluorite, NA 0.75
4. Plan apochromat, NA 1.3

✓ **Answer: A** — The plan apochromat has NA 0.95.

A: The plan apochromat has NA 0.95.
B: This is lower. The right answer is: Plan apochromat, NA 0.95.
C: This is lower. The right answer is: Plan apochromat, NA 0.95.
D: The 1.3 value is for the oil lens.

Q690 · Devil · *codex, slides 331 to 339*

An oil objective has n = 1.51 and μ = 60°. What is its NA?

1. About 0.87
2. About 1.51
3. About 2.60
4. About 1.31

✓ **Answer: D** — 1.51 × sin 60° ≈ 1.31.

A: This ignores the oil index. The right answer is: About 1.31.
B: This ignores the angle. The right answer is: About 1.31.
C: This is not the product. The right answer is: About 1.31.
D: 1.51 × sin 60° ≈ 1.31.

Refractive index and immersion oil · Q691–702

Q691 · Easy · *codex, slides 329, 341, 342*

Which medium lies between low-power objectives and the specimen in a conventional microscope?

1. Oil
2. Water
3. Glycerol
4. Air

✓ **Answer: D** — The medium is air.

A: Oil is used with high-power immersion objectives.
B: Water is not the conventional medium.
C: Glycerol is not the conventional medium.
D: The medium is air. It matches what the lecture slides state.

Q692 · Easy · *codex, slides 329, 341, 342*

What refractive index does air have in the conventional microscope?

1. 1.5
2. 0.5
3. 2
4. 1

✓ **Answer: D** — Air has a refractive index of 1.

A: This is the value for oil and glass.
B: This is too low. The right answer is: 1.
C: This is too high. The right answer is: 1.
D: Air has a refractive index of 1.

Q693 · Easy · *codex, slides 329, 341, 342*

About what refractive index do immersion oils used with glass-covered slides have?

1. About 1.00
2. About 3.00
3. About 0.50
4. About 1.50

✓ **Answer: D** — The optimum value is about 1.50.

A: This is the value for air.
B: This is too high. The right answer is: About 1.50.
C: This is too low. The right answer is: About 1.50.
D: The optimum value is about 1.50.

Q694 · Easy · *codex, slides 329, 341, 342*

Which objectives use air as the medium, according to the lecture?

1. Only the ×100 objectives
2. Only the dissecting lenses
3. None of the objectives
4. The low power ones, below ×100

✓ **Answer: D** — Objectives below ×100 use air.

A: These use oil. The right answer is: The low power ones, below ×100.
B: This is not stated. The right answer is: The low power ones, below ×100.
C: The low power ones use air.
D: Objectives below ×100 use air.

Q695 · Easy · *codex, slides 329, 341, 342*

What does using immersion oil do to the numerical aperture?

1. It decreases it
2. It sets it to zero
3. It increases it
4. It has no effect

✓ **Answer: C** — The oil increases NA.

A: NA increases. The right answer is: It increases it.
B: NA increases. The right answer is: It increases it.
C: The oil increases NA. It matches what the lecture slides state.
D: NA increases. The right answer is: It increases it.

Q696 · Medium · *codex, slides 329, 341, 342*

Why do fewer light rays get lost with immersion oil?

1. The oil absorbs the stray rays
2. The oil blocks the outer rays
3. The oil makes the lens bigger
4. Less light is lost to refraction

✓ **Answer: D** — Fewer rays are lost due to refraction.

A: This is not the reason. The right answer is: Less light is lost due to refraction between slide and lens.
B: This is not the reason. The right answer is: Less light is lost due to refraction between slide and lens.
C: This is not the reason. The right answer is: Less light is lost due to refraction between slide and lens.
D: Fewer rays are lost due to refraction.

Q697 · Medium · *codex, slides 329, 341, 342*

What is the refractive index of the coverslip and glass slide in the lecture figure?

1. 1.0
2. 0.5
3. 3.0
4. 1.5

✓ **Answer: D** — They are shown as n = 1.5.

A: This is air. The right answer is: 1.5.
B: This is too low. The right answer is: 1.5.
C: This is too high. The right answer is: 1.5.
D: They are shown as n = 1.5.

Q698 · Medium · *codex, slides 329, 341, 342*

How does immersion oil improve resolution?

1. It shortens the wavelength of the light
2. It raises NA and fewer rays are lost
3. It increases the magnification of the eyepiece
4. It stains the specimen lightly

✓ **Answer: B** — Higher NA means better resolution.

A: It does not change wavelength. The right answer is: It raises NA and lets fewer rays be lost, so resolution is improved.
B: Higher NA means better resolution.
C: It does not change the eyepiece.
D: It does not stain. The right answer is: It raises NA and lets fewer rays be lost, so resolution is improved.

Q699 · Medium · *codex, slides 329, 341, 342*

How does the refractive index of immersion oil compare with air?

1. It is lower
2. It is the same
3. It is zero for most samples
4. It is higher

✓ **Answer: D** — Oil is about 1.5 and air is 1.0.

A: Oil is higher. The right answer is: It is higher.
B: They differ. The right answer is: It is higher.
C: It is not zero. The right answer is: It is higher.
D: Oil is about 1.5 and air is 1.0.

Q700 · Medium · *codex, slides 329, 341, 342*

Which materials in the lecture figure have a refractive index of 1.5?

1. Air, the coverslip and the glass slide
2. Oil, the coverslip and the glass slide
3. Air and the oil immersion only
4. Only the glass slide itself

✓ **Answer: B** — All three are shown at n = 1.5.

A: Air is 1.0. The right answer is: Oil, the coverslip and the glass slide.
B: All three are shown at n = 1.5.
C: Air is 1.0. The right answer is: Oil, the coverslip and the glass slide.
D: The oil and coverslip also have 1.5.

Q701 · Hard · *codex, slides 329, 341, 342*

Why is the refractive index of the immersion oil matched to that of the glass?

1. Light is not bent away, so more rays enter
2. The oil then shortens the light wavelength
3. The oil then acts as a kind of stain
4. The oil then reduces the NA of the lens

✓ **Answer: A** — Matching the index avoids refraction losses.

A: Matching the index avoids refraction losses.
B: It does not change wavelength. The right answer is: Light then passes through without being bent away, so more rays reach the lens.
C: It is not a stain. The right answer is: Light then passes through without being bent away, so more rays reach the lens.
D: It increases NA. The right answer is: Light then passes through without being bent away, so more rays reach the lens.

Q702 · Hard · *codex, slides 329, 341, 342*

A dry 100× lens gives a poor image. Which change best improves it?

1. Switching to red light instead
2. Removing the condenser lens fully
3. Adding immersion oil
4. Dimming the lamp further

✓ **Answer: C** — Oil raises NA and cuts refraction losses.

A: Red light has a longer wavelength.
B: This reduces light. The right answer is: Adding immersion oil between the lens and the cover glass.
C: Oil raises NA and cuts refraction losses.
D: This does not help resolution. The right answer is: Adding immersion oil between the lens and the cover glass.

Wavelength and the limit of resolution · Q703–720

Q703 · Easy · *codex, slides 343 to 349*

What is the formula for the limit of resolution?

1. r = 0.61 NA / λ
2. r = 0.61λ / NA
3. r = λ × NA
4. r = NA / 0.61λ

✓ **Answer: B** — The limit of resolution is 0.61 λ divided by NA.

A: This inverts the ratio. The right answer is: r = 0.61λ / NA.
B: The limit of resolution is 0.61 λ divided by NA.
C: This multiplies instead. The right answer is: r = 0.61λ / NA.
D: This inverts the ratio. The right answer is: r = 0.61λ / NA.

Q704 · Easy · *codex, slides 343 to 349*

How does a shorter wavelength change resolution?

1. It gives poorer resolution
2. It gives better resolution
3. It has no effect
4. It removes the diffraction limit

✓ **Answer: B** — The shorter the wavelength, the better the resolution.

A: It improves resolution. The right answer is: It gives better resolution.
B: The shorter the wavelength, the better the resolution.
C: It improves resolution. The right answer is: It gives better resolution.
D: It still has a limit. The right answer is: It gives better resolution.

Q705 · Easy · *codex, slides 343 to 349*

About what is the maximum NA of light microscope objectives in practice?

1. About 0.14
2. About 14
3. About 1.4
4. About 4.1

✓ **Answer: C** — The maximum is about 1.4.

A: This is ten times too low.
B: This is ten times too high.
C: The maximum is about 1.4.
D: This is too high. The right answer is: About 1.4.

Q706 · Easy · *codex, slides 343 to 349*

To which component of white light is the human eye most sensitive?

1. Violet light
2. Red light
3. Green light
4. Blue light

> ✓ **Answer: C** — The eye is most sensitive to green.

A: The eye is less sensitive to violet.
B: The eye is less sensitive to red.
C: The eye is most sensitive to green.
D: The eye is less sensitive to blue.

Q707 · Easy · *codex, slides 343 to 349*

What is the best resolution limit obtainable with white light?

1. About 240 nm
2. About 24 nm
3. About 2.4 µm
4. About 240 µm

> ✓ **Answer: A** — The best limit is about 240 nm.

A: The best limit is about 240 nm.
B: This is ten times too low.
C: This is ten times too high.
D: This is 1,000 times too high.

Q708 · Easy · *codex, slides 343 to 349*

About how wide is a red blood cell?

1. About 7 nm
2. About 70 µm
3. About 7 µm
4. About 7 mm

> ✓ **Answer: C** — A red blood cell is about 7 µm.

A: This is 1,000 times too small.
B: This is ten times too large.
C: A red blood cell is about 7 µm.
D: This is far too large. The right answer is: About 7 µm.

Q709 · Easy · *codex, slides 343 to 349*

What does the limit of resolution r represent?

1. The maximum magnification possible
2. The brightness of the image
3. The focal length of the objective
4. The minimum resolvable distance

✓ **Answer: D** — It is the minimum distance rendered separate.

A: It is not magnification. The right answer is: The minimum distance between two objects that can be seen as separate.
B: It is not brightness. The right answer is: The minimum distance between two objects that can be seen as separate.
C: It is not focal length. The right answer is: The minimum distance between two objects that can be seen as separate.
D: It is the minimum distance rendered separate.

Q710 · Medium · *codex, slides 343 to 349*

Green light spans which wavelength range?

1. 400 to 450 nm
2. 560 to 600 nm
3. 650 to 700 nm
4. 180 to 400 nm

✓ **Answer: B** — Green is about 560 to 600 nm.

A: This is violet to blue. The right answer is: 560 to 600 nm.
B: Green is about 560 to 600 nm.
C: This is red. The right answer is: 560 to 600 nm.
D: This is ultraviolet. The right answer is: 560 to 600 nm.

Q711 · Medium · *codex, slides 343 to 349*

What upper limit does the lecture give for the refractive index n?

1. About 1.7, usually 1.5
2. About 3.0, usually 2.0
3. About 1.0, always
4. About 0.7, usually 0.5

✓ **Answer: A** — n cannot rise above 1.7, and is usually 1.5.

A: n cannot rise above 1.7, and is usually 1.5.
B: These values are not given. The right answer is: About 1.7, usually 1.5.
C: n can be higher than 1.
D: These values are not given. The right answer is: About 1.7, usually 1.5.

Q712 · Medium · *codex, slides 343 to 349*

Using λ = 560 nm and NA = 1.4, what limit of resolution results?

1. About 244 nm
2. About 24 nm
3. About 2,440 nm
4. About 400 nm

> ✓ **Answer: A** — 0.61 × 560 ÷ 1.4 ≈ 244 nm.

A: 0.61 × 560 ÷ 1.4 ≈ 244 nm.
B: This slips a factor of ten.
C: This slips a factor of ten.
D: This is not the result. The right answer is: About 244 nm.

Q713 · Medium · *codex, slides 343 to 349*

Light of 600 nm with an NA of 1.5 gives what limit?

1. About 366 nm
2. About 244 nm
3. About 24 nm
4. About 400 nm

> ✓ **Answer: B** — 0.61 × 600 ÷ 1.5 = 244 nm.

A: This multiplies instead of dividing. The right answer is: About 244 nm.
B: 0.61 × 600 ÷ 1.5 = 244 nm.
C: This slips a factor of ten.
D: This is not the result. The right answer is: About 244 nm.

Q714 · Medium · *codex, slides 343 to 349*

If the NA doubles and the wavelength is unchanged, what happens to r?

1. It doubles
2. It stays the same
3. It halves
4. It becomes zero

> ✓ **Answer: C** — r is inversely proportional to NA.

A: r falls as NA rises. The right answer is: It halves.
B: r depends on NA. The right answer is: It halves.
C: r is inversely proportional to NA.
D: r never reaches zero. The right answer is: It halves.

Q715 · Medium · *codex, slides 343 to 349*

If the wavelength is halved and the NA is unchanged, what happens to r?

1. It doubles
2. It halves
3. It stays the same
4. It quadruples

✓ **Answer: B** — r is directly proportional to λ.

A: r falls with shorter wavelength. The right answer is: It halves.
B: r is directly proportional to λ.
C: r depends on wavelength. The right answer is: It halves.
D: r is not squared. The right answer is: It halves.

Q716 · Medium · *codex, slides 343 to 349*

Why does the maximal resolving power depend mainly on the wavelength?

1. The eyepiece power fixes the NA
2. sin μ stays below 1, and n is limited
3. The lamp power fixes the NA
4. The stage height fixes the NA

✓ **Answer: B** — NA is capped, leaving wavelength as the main variable.

A: This is not the reason. The right answer is: sin μ is always below 1 and n is limited, so NA is capped.
B: NA is capped, leaving wavelength as the main variable.
C: This is not the reason. The right answer is: sin μ is always below 1 and n is limited, so NA is capped.
D: This is not the reason. The right answer is: sin μ is always below 1 and n is limited, so NA is capped.

Q717 · Hard · *codex, slides 343 to 349*

A microscope has a 180 nm limit of resolution. Can it effectively resolve a 20 µm specimen?

1. Yes, because 20 µm is far larger than 180 nm
2. No, because 20 µm is below the limit
3. No, because the limit must exceed 20 µm
4. Only with ultraviolet light

✓ **Answer: A** — The specimen is much bigger than the limit.

A: The specimen is much bigger than the limit.
B: 20 µm is above 180 nm.
C: The limit is a minimum. The right answer is: Yes, because 20 µm is far larger than 180 nm.
D: It does not need UV. The right answer is: Yes, because 20 µm is far larger than 180 nm.

Q718 · Hard · *codex, slides 343 to 349*

An oil lens with n = 1.51 has an angle μ of 90°. What is its NA?

1. 1.51
2. 0.90
3. 90
4. 2.40

✓ **Answer: A** — NA = 1.51 × sin 90° = 1.51.

A: NA = 1.51 × sin 90° = 1.51.
B: This ignores n. The right answer is: 1.51.
C: This uses the angle as NA.
D: This is not the product. The right answer is: 1.51.

Q719 · Hard · *codex, slides 343 to 349*

Which pair of changes gives the best resolution?

1. Shorter wavelength and larger NA
2. Longer wavelength and larger NA
3. Shorter wavelength and smaller NA
4. Longer wavelength and smaller NA

✓ **Answer: A** — Both lower r.

A: Both lower r. It matches what the lecture slides state.
B: A longer wavelength worsens r. The right answer is: Shorter wavelength and larger NA.
C: A smaller NA worsens r. The right answer is: Shorter wavelength and larger NA.
D: Both worsen r. The right answer is: Shorter wavelength and larger NA.

Q720 · Devil · *codex, slides 308, 346, 347*

The best limit of resolution of a light microscope with white light is about 240 nm. Roughly how many such points could fit side by side across a red blood cell 7 μm wide?

1. About 2.9
2. About 290
3. About 0.034
4. About 29

✓ **Answer: D** — 7 μm is 7,000 nm, and 7,000 divided by 240 is about 29.

A: This slips a factor of ten when converting micrometres to nanometres.
B: This is ten times too large from a unit conversion slip.
C: This divides 240 by 7,000, which inverts the calculation.
D: 7 μm is 7,000 nm, and 7,000 divided by 240 is about 29.

Bright-field microscopy · Q721–732

Q721 · Easy · *codex, slides 351 to 353*

Where is the apex of the light cone focused in a bright-field microscope?

1. At the eyepiece
2. At the plane of the specimen
3. At the lamp
4. At the objective rear

✓ **Answer: B** — The apex is focused at the specimen plane.

A: It is focused at the specimen.
B: The apex is focused at the specimen plane.
C: It is focused at the specimen.
D: It is focused at the specimen.

Q722 · Easy · *codex, slides 351 to 353*

What gathers the lamp light in a standard bright-field microscope?

1. The substage condenser
2. The eyepiece
3. The stage clip
4. The nosepiece

✓ **Answer: A** — The substage condenser gathers the light.

A: The substage condenser gathers the light.
B: The eyepiece magnifies. The right answer is: The substage condenser.
C: It holds the slide. The right answer is: The substage condenser.
D: It holds the objectives. The right answer is: The substage condenser.

Q723 · Easy · *codex, slides 351 to 353*

How are specimens seen in a bright-field microscope?

1. By emitting their own bright light
2. By changing the speed and path of light
3. By absorbing UV and then glowing
4. By blocking all of the light

✓ **Answer: B** — They change light speed and path.

A: This describes fluorescence. The right answer is: By changing the speed and path of the light passing through them.
B: They change light speed and path.
C: This describes fluorescence. The right answer is: By changing the speed and path of the light passing through them.
D: This is not the principle. The right answer is: By changing the speed and path of the light passing through them.

Q724 · Easy · *codex, slides 351 to 353*

Differences in light intensity that build an image are called what?

1. Resolution
2. Magnification
3. Aperture
4. Contrast

✓ **Answer: D** — Differences in light intensity are contrast.

A: Resolution is separating detail. The right answer is: Contrast.
B: Magnification is enlargement. The right answer is: Contrast.
C: Aperture is an opening. The right answer is: Contrast.
D: Differences in light intensity are contrast.

Q725 · Easy · *codex, slides 351 to 353*

Which specimens cannot be adequately visualised with bright-field microscopy?

1. Heavily stained thick sections
2. Transparent unstained living cells
3. Opaque rocks and mineral grains
4. Metal alloys and polished ores

✓ **Answer: B** — These lack contrast.

A: These show contrast. The right answer is: Transparent living materials and thin unstained specimens.
B: These lack contrast. It matches what the lecture slides state.
C: Opaque specimens suit stereo microscopes. The right answer is: Transparent living materials and thin unstained specimens.
D: These are not the stated specimens.

Q726 · Medium · *codex, slides 351 to 353*

On which two properties of a specimen does its ability to change light depend?

1. Its overall colour and temperature
2. Its total volume and its weight
3. Its refractive index and its opacity
4. Its age and its place of origin

✓ **Answer: C** — These two properties matter.

A: These are not the stated properties.
B: These are not the stated properties.
C: These two properties matter. It matches what the lecture slides state.
D: These are not the stated properties.

Q727 · Medium · *codex, slides 351 to 353*

What happens if a specimen's refractive index is too similar to the surrounding medium?

1. It will not be seen
2. It will appear brighter
3. It will appear coloured
4. It will appear larger

✓ **Answer: A** — It will not be seen.

A: It will not be seen.
B: It becomes invisible. The right answer is: It will not be seen.
C: It becomes invisible. The right answer is: It will not be seen.
D: It becomes invisible. The right answer is: It will not be seen.

Q728 · Medium · *codex, slides 351 to 353*

How can contrast be enhanced in bright-field microscopy?

1. By removing the condenser
2. By staining the specimen
3. By dimming the lamp a little
4. By raising the stage

✓ **Answer: B** — Staining enhances contrast.

A: This reduces contrast. The right answer is: By staining the specimen.
B: Staining enhances contrast. It matches what the lecture slides state.
C: This does not help. The right answer is: By staining the specimen.
D: This does not help. The right answer is: By staining the specimen.

Q729 · Medium · *codex, slides 351 to 353*

What is a drawback of staining for contrast?

1. It shortens the working distance a lot
2. It adds extra magnification to it
3. It often requires killing the specimen
4. It changes the wavelength of light

✓ **Answer: C** — Staining often kills cells.

A: This is not a drawback. The right answer is: It often requires killing the specimen.
B: This is not a drawback. The right answer is: It often requires killing the specimen.
C: Staining often kills cells. It matches what the lecture slides state.
D: This is not a drawback. The right answer is: It often requires killing the specimen.

Q730 · Medium · *codex, slides 351 to 353*

What produces contrast in bright-field microscopy?

1. Light rays that travel without interacting
2. Light rays changed enough to interfere
3. Light rays blocked entirely
4. Light rays turned into electrons

✓ **Answer: B** — Interference produces contrast.

A: This gives no contrast. The right answer is: Light rays changed enough to interfere with each other.
B: Interference produces contrast. It matches what the lecture slides state.
C: This gives no image. The right answer is: Light rays changed enough to interfere with each other.
D: This is not the mechanism. The right answer is: Light rays changed enough to interfere with each other.

Q731 · Hard · *codex, slides 351 to 353*

Why can unstained living cells not be seen well in bright-field microscopy?

1. Their index matches the medium closely
2. They produce far too much contrast
3. They emit far too much fluorescence
4. They are far too opaque to light

✓ **Answer: A** — Little contrast is produced.

A: Little contrast is produced. It matches what the lecture slides state.
B: They produce little. The right answer is: Their refractive index is close to the medium, so light is hardly changed.
C: They do not fluoresce. The right answer is: Their refractive index is close to the medium, so light is hardly changed.
D: They are largely transparent. The right answer is: Their refractive index is close to the medium, so light is hardly changed.

Q732 · Hard · *codex, slides 351 to 353*

All of the following are true of bright-field microscopy EXCEPT which one?

1. The condenser focuses a light cone on the specimen
2. Contrast can be enhanced by staining
3. Staining often requires killing the cells
4. It is ideal for transparent living specimens

✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: It is ideal for transparent living specimens.
B: This is true. The right answer is: It is ideal for transparent living specimens.
C: This is true. The right answer is: It is ideal for transparent living specimens.
D: Correct choice. It is poor for such specimens.

Dark-field microscopy · Q733–748

Q733 · Easy · *codex, slides 361 to 369*

What blocks the main light beam in a dark-field microscope?

1. A filter in the eyepiece
2. A mirror under the stage
3. A dark disk in the condenser
4. A coat on the slide

✓ **Answer: C** — A dark disk stops the main beam.

A: This is not where it is placed.
B: This is not the mechanism. The right answer is: A dark disk in the condenser.
C: A dark disk stops the main beam.
D: This is not the mechanism. The right answer is: A dark disk in the condenser.

Q734 · Easy · *codex, slides 361 to 369*

How does the specimen appear in dark-field microscopy?

1. Dark against a bright background
2. Coloured against a white background
3. Light against a dark background
4. Invisible

✓ **Answer: C** — The specimen is bright on a dark background.

A: That describes bright-field. The right answer is: Light against a dark background.
B: This is not described. The right answer is: Light against a dark background.
C: The specimen is bright on a dark background.
D: It is visible. The right answer is: Light against a dark background.

Q735 · Easy · *codex, slides 361 to 369*

For which samples is dark-field microscopy well suited?

1. Live and unstained biological samples
2. Fixed and stained sections only
3. Dried metal films and foils
4. Frozen sections of tissue only

✓ **Answer: A** — It suits live unstained samples.

A: It suits live unstained samples.
B: These suit bright-field. The right answer is: Live and unstained biological samples.
C: These are not described. The right answer is: Live and unstained biological samples.
D: These are not described. The right answer is: Live and unstained biological samples.

Q736 · Easy · *codex, slides 361 to 369*

Which spiral organisms are cited as visible with dark-field microscopy?

1. Amoebae
2. Spirochetes
3. Diatoms
4. Algae

✓ **Answer: B** — Spirochetes are seen with dark-field.

A: Amoebae are not the example here.
B: Spirochetes are seen with dark-field.
C: Diatoms are not the example here.
D: Algae are not the example here.

Q737 · Easy · *codex, slides 361 to 369*

What is the disadvantage of dark-field microscopy listed in the lecture?

1. Objects look smaller than they are
2. It cannot show living cells at all
3. It needs electron beams to work
4. Objects look bigger than they actually are

✓ **Answer: D** — Objects appear larger than they are.

A: They look larger. The right answer is: Objects look bigger than they actually are.
B: It suits living cells. The right answer is: Objects look bigger than they actually are.
C: It uses light. The right answer is: Objects look bigger than they actually are.
D: Objects appear larger than they are.

Q738 · Easy · *codex, slides 361 to 369*

Which light enters the objective in dark-field microscopy?

1. Only direct light from the lamp
2. Only ultraviolet light of the lamp
3. Only transmitted direct light
4. Only light scattered by the specimen

✓ **Answer: D** — Only scattered light enters.

A: Direct light is blocked. The right answer is: Only light scattered by the specimen.
B: This is not the light. The right answer is: Only light scattered by the specimen.
C: Direct transmitted light is blocked. The right answer is: Only light scattered by the specimen.
D: Only scattered light enters. It matches what the lecture slides state.

Q739 · Medium · *codex, slides 361 to 369*

In which three situations is a dark-field microscope used for live microorganisms?

1. When fluorescent, opaque or deep frozen
2. When dry, thick, fixed or stained
3. When large, heavy, hot or opaque
4. When unseen, unstainable or distorted by dye

✓ **Answer: D** — These three situations are listed.

A: These are not the listed situations.
B: These are not the listed situations.
C: These are not the listed situations.
D: These three situations are listed.

Q740 · Medium · *codex, slides 361 to 369*

At what angle does light strike the sample in dark-field microscopy?

1. Obliquely
2. Straight down
3. Straight up
4. Parallel to the axis

✓ **Answer: A** — Light strikes at an oblique angle.

A: Light strikes at an oblique angle.
B: This is not the mechanism. The right answer is: Obliquely.
C: This is not the mechanism. The right answer is: Obliquely.
D: This is not the mechanism. The right answer is: Obliquely.

Q741 · Medium · *codex, slides 361 to 369*

Which gold particle size can be seen with dark-field because it is below the diffraction limit?

1. 40 nm gold
2. 400 nm gold
3. 4 µm gold
4. 40 µm gold

✓ **Answer: A** — Sub-diffraction 40 nm gold particles are visible.

A: Sub-diffraction 40 nm gold particles are visible.
B: This is not the stated size.
C: This is not the stated size.
D: This is not the stated size.

Q742 · Medium · *codex, slides 361 to 369*

For which kind of object is dark-field poorly suited?

1. Small particles
2. Unstained microorganisms
3. Water-borne cells
4. Large objects

✓ **Answer: D** — It is not good for large objects.

A: It is ideal for small particles.
B: It is ideal for these. The right answer is: Large objects.
C: It suits these. The right answer is: Large objects.
D: It is not good for large objects.

Q743 · Medium · *codex, slides 361 to 369*

Where is the opaque disc placed in a dark-field microscope?

1. Underneath the condenser lens
2. On top of the eyepiece
3. Inside the objective
4. On the slide

✓ **Answer: A** — The disc is under the condenser lens.

A: The disc is under the condenser lens.
B: This is not the place. The right answer is: Underneath the condenser lens.
C: This is not the place. The right answer is: Underneath the condenser lens.
D: This is not the place. The right answer is: Underneath the condenser lens.

Q744 · Medium · *codex, slides 361 to 369*

In which kind of suspension does the lecture say dark-field is frequently used to examine unstained microorganisms?

1. Bacteria in dry powder
2. Algae in solid rock
3. Fungal spores on glass
4. Yeast cells in liquid

✓ **Answer: D** — Unstained microorganisms in liquid such as yeast cells are named.

A: This is not stated. The right answer is: Yeast cells in liquid.
B: This is not stated. The right answer is: Yeast cells in liquid.
C: This is not stated. The right answer is: Yeast cells in liquid.
D: Unstained microorganisms in liquid such as yeast cells are named.

Q745 · Hard · *codex, slides 361 to 369*

Why does the specimen appear bright on a dark background?

1. The sample emits its own bright light
2. The sample absorbs UV and glows
3. The background is stained black
4. Only scattered light reaches the objective

> ✓ **Answer: D** — Direct light is blocked.

A: This describes fluorescence. The right answer is: Only light scattered by the sample reaches the objective.
B: This describes UV microscopy. The right answer is: Only light scattered by the sample reaches the objective.
C: The background is dark due to blocked light.
D: Direct light is blocked. It matches what the lecture slides state.

Q746 · Hard · *codex, slides 361 to 369*

A dark-field microscope is used to examine all of the following EXCEPT which one?

1. Inherently fluorescent specimens
2. Specimens invisible in ordinary light
3. Specimens that cannot be stained
4. Tiny living cells in a fluid

> ✓ **Answer: A** — Correct choice.

A: Correct choice. These suit fluorescence microscopy.
B: These suit dark-field. The right answer is: Specimens that are inherently fluorescent.
C: These suit dark-field. The right answer is: Specimens that are inherently fluorescent.
D: These suit dark-field. The right answer is: Specimens that are inherently fluorescent.

Q747 · Hard · *codex, slides 361 to 369*

A clinician wants to see live spirochetes in a fluid smear. Which technique suits this?

1. Dark-field microscopy
2. Transmission electron microscopy
3. Bright-field with no stain
4. Fixation and sectioning

> ✓ **Answer: A** — It suits live spirochetes.

A: It suits live spirochetes. It matches what the lecture slides state.
B: It needs dead sections. The right answer is: Dark-field microscopy.
C: The cells have little contrast. The right answer is: Dark-field microscopy.
D: This kills the cells. The right answer is: Dark-field microscopy.

Q748 · Devil · *codex, slides 361 to 369*

Which statement correctly contrasts bright-field and dark-field microscopy?

1. Bright-field shows a bright specimen on a dark background, whereas dark-field shows a dark one on a bright background
2. Both show bright specimens on dark backgrounds
3. Both need a disc in the condenser
4. Bright-field gives a bright background, dark-field a dark one

✓ **Answer: D** — The backgrounds differ.

A: The backgrounds are swapped. The right answer is: Bright-field shows a specimen on a bright background, whereas dark-field shows it bright on a dark background.

B: Bright-field has a bright background. The right answer is: Bright-field shows a specimen on a bright background, whereas dark-field shows it bright on a dark background.

C: Only dark-field does. The right answer is: Bright-field shows a specimen on a bright background, whereas dark-field shows it bright on a dark background.

D: The backgrounds differ. It matches what the lecture slides state.

Phase-contrast microscopy · Q749–772

Q749 · Easy · *codex, slides 370 to 388*

Which microscope makes colourless living cells visible without staining?

1. The phase-contrast microscope
2. The bright-field microscope
3. The transmission electron microscope
4. The ultraviolet microscope

✓ **Answer: A** — It is used to see unstained living cells.

A: It is used to see unstained living cells.

B: It has poor contrast for them.

C: It cannot image living cells. The right answer is: The phase-contrast microscope.

D: It needs UV light. The right answer is: The phase-contrast microscope.

Q750 · Easy · *codex, slides 370 to 388*

What does the wavelength of light measure?

1. Brightness
2. Colour
3. Speed
4. Contrast

✓ **Answer: B** — Wavelength is a measure of colour.

A: Amplitude measures brightness. The right answer is: Colour.

B: Wavelength is a measure of colour.

C: This is not stated. The right answer is: Colour.

D: This is not stated. The right answer is: Colour.

Q751 · Easy · *codex, slides 370 to 388*

What does the amplitude of light measure?

1. Brightness
2. Colour
3. Phase
4. Resolution

✓ **Answer: A** — Amplitude is a measure of brightness.

A: Amplitude is a measure of brightness.
B: Wavelength measures colour. The right answer is: Brightness.
C: This is not stated. The right answer is: Brightness.
D: This is not stated. The right answer is: Brightness.

Q752 · Easy · *codex, slides 370 to 388*

What does the phase-contrast microscope do to the diffracted rays?

1. It blocks them completely
2. It speeds them up
3. It turns them into electrons
4. It further retards them

✓ **Answer: D** — It further retards the diffracted rays.

A: It retards them. The right answer is: It further retards them.
B: It retards them. The right answer is: It further retards them.
C: This is not described. The right answer is: It further retards them.
D: It further retards the diffracted rays.

Q753 · Easy · *codex, slides 370 to 388*

For which specimens is phase-contrast widely used?

1. Dried powders
2. Heavily stained slides
3. Living cells and tissues
4. Frozen blocks

✓ **Answer: C** — It is widely used for living cells and tissues.

A: This is not stated. The right answer is: Living cells and tissues.
B: These do not need it. The right answer is: Living cells and tissues.
C: It is widely used for living cells and tissues.
D: This is not stated. The right answer is: Living cells and tissues.

Q754 · Easy · *codex, slides 370 to 388*

Which diaphragm in phase-contrast makes light waves become in phase?

1. The iris diaphragm
2. The field diaphragm
3. The annular diaphragm
4. The opaque disc

✓ **Answer: C** — Light passes through an annular diaphragm.

A: This is not the stated one.
B: This is not the stated one.
C: Light passes through an annular diaphragm.
D: That belongs to dark-field. The right answer is: The annular diaphragm.

Q755 · Easy · *codex, slides 370 to 388*

Phase contrast is the most commonly used contrasting technique where, according to the lecture?

1. In electron microscopy
2. In our labs
3. In field geology
4. In astronomy

✓ **Answer: B** — It is the most used technique in the labs.

A: This is not stated. The right answer is: In our labs.
B: It is the most used technique in the labs.
C: This is not stated. The right answer is: In our labs.
D: This is not stated. The right answer is: In our labs.

Q756 · Easy · *codex, slides 370 to 388*

What makes living cells hard to see with ordinary light?

1. They are too opaque for light to pass
2. They emit too much light of their own
3. They are colourless and fairly transparent
4. They are too large to fit under the lens

✓ **Answer: C** — Living cells are colourless and transparent.

A: They are largely transparent. The right answer is: They are colourless and more or less transparent.
B: They do not emit light. The right answer is: They are colourless and more or less transparent.
C: Living cells are colourless and transparent.
D: Size is not the problem. The right answer is: They are colourless and more or less transparent.

Q757 · Easy · *codex, slides 370 to 388*

What does staining with dyes usually do to cells?

1. Results in their death or disruption
2. Keeps them alive and moving
3. Makes them fluoresce at once
4. Doubles their size in the dye

✓ **Answer: A** — Staining usually kills or disrupts cells.

A: Staining usually kills or disrupts cells.
B: Staining usually kills them. The right answer is: Results in their death or disruption.
C: This is not the usual result.
D: This is not the result. The right answer is: Results in their death or disruption.

Q758 · Easy · *codex, slides 370 to 388*

In bright-field images of cultured cells, which regions are visible?

1. All of the regions equally well
2. Only the cytoplasm of the cell
3. Refractive regions like the nucleus
4. Only the mitochondria inside it

✓ **Answer: C** — Only highly refractive regions are visible.

A: Many regions are hard to see.
B: The lecture names refractive regions. The right answer is: Highly refractive regions such as the membrane and nucleus.
C: Only highly refractive regions are visible.
D: These are not named. The right answer is: Highly refractive regions such as the membrane and nucleus.

Q759 · Medium · *codex, slides 370 to 388*

Which plate retards the light that passes through the specimen in phase-contrast?

1. The negative filter plate
2. The glass slide
3. The coverslip
4. The positive phase plate

✓ **Answer: D** — The positive phase plate retards the light.

A: This is not described. The right answer is: The positive phase plate.
B: It is not the retarding plate.
C: It is not the retarding plate.
D: The positive phase plate retards the light.

Q760 · Medium · *codex, slides 370 to 388*

What limit does phase-contrast microscopy not overcome?

1. The limit of staining quality
2. The limit of slide size used
3. The wavelength limit of visible light
4. The limit of lamp power output

✓ **Answer: C** — Resolution is still limited by wavelength.

A: This is not the limit. The right answer is: The limit set by the wavelength of visible light.
B: This is not the limit. The right answer is: The limit set by the wavelength of visible light.
C: Resolution is still limited by wavelength.
D: This is not the limit. The right answer is: The limit set by the wavelength of visible light.

Q761 · Medium · *codex, slides 370 to 388*

Which kind of photography has phase-contrast been particularly useful with?

1. Aerial photography
2. X-ray photography
3. Flash photography
4. Time-lapse motion photography

✓ **Answer: D** — It works well with time-lapse photography of living cells.

A: This is not stated. The right answer is: Time-lapse motion photography.
B: This is not stated. The right answer is: Time-lapse motion photography.
C: This is not stated. The right answer is: Time-lapse motion photography.
D: It works well with time-lapse photography of living cells.

Q762 · Medium · *codex, slides 370 to 388*

How do the diffracted rays behave relative to the undiffracted rays?

1. They are advanced
2. They are unchanged
3. They are retarded
4. They are absorbed fully

✓ **Answer: C** — Diffracted rays are retarded.

A: They are retarded. The right answer is: They are retarded.
B: They are retarded. The right answer is: They are retarded.
C: Diffracted rays are retarded. It matches what the lecture slides state.
D: They are retarded. The right answer is: They are retarded.

Q763 · Medium · *codex, slides 370 to 388*

Which details of living cells have been observed with phase-contrast?

1. Atomic structure and electron clouds
2. Only dead cell walls and cork
3. Cell movement, nuclei changes and flow
4. Only DNA sequences in genes

✓ **Answer: C** — These details have been observed.

A: These are not observed. The right answer is: Cell movement, changes in nuclei and cytoplasmic flow.
B: These are not the named details.
C: These details have been observed.
D: These are not observed. The right answer is: Cell movement, changes in nuclei and cytoplasmic flow.

Q764 · Medium · *codex, slides 370 to 388*

What does a greater degree of diffraction do to the image?

1. It makes the image brighter
2. It makes the image coloured
3. It has no effect
4. It makes the image darker

✓ **Answer: D** — Greater diffraction gives a darker image.

A: It makes it darker. The right answer is: It makes the image darker.
B: This is not stated. The right answer is: It makes the image darker.
C: It darkens the image. The right answer is: It makes the image darker.
D: Greater diffraction gives a darker image.

Q765 · Medium · *codex, slides 370 to 388*

Which light passes through the thicker portion of the positive phase plate?

1. Light from the background only
2. Light that passed through the specimen
3. Light from the lamp directly above
4. Light from the eyepiece lens

✓ **Answer: B** — Specimen light passes through the thicker portion.

A: Background light passes through the thinner portion.
B: Specimen light passes through the thicker portion.
C: This is not stated. The right answer is: Light that passed through the specimen.
D: This is not stated. The right answer is: Light that passed through the specimen.

Q766 · Medium · *codex, slides 370 to 388*

What is the effect of the thicker part of the positive phase plate on specimen light?

1. More retardation, so more contrast
2. Less retardation, so contrast is reduced
3. No effect on the specimen light
4. It turns the light into pure UV

✓ **Answer: A** — The thicker portion enhances the phase difference and contrast.

A: The thicker portion enhances the phase difference and contrast.
B: It increases retardation. The right answer is: Greater retardation and loss, so contrast is increased.
C: It has an effect. The right answer is: Greater retardation and loss, so contrast is increased.
D: This is not described. The right answer is: Greater retardation and loss, so contrast is increased.

Q767 · Medium · *codex, slides 370 to 388*

Which illumination method is compared with phase contrast in the cell culture figure?

1. Dark-field illumination
2. Bright-field illumination
3. Fluorescence illumination
4. Electron illumination

✓ **Answer: B** — The figure compares phase contrast with bright-field.

A: The figure compares bright-field. The right answer is: Bright-field illumination.
B: The figure compares phase contrast with bright-field.
C: The figure compares bright-field. The right answer is: Bright-field illumination.
D: The figure compares bright-field. The right answer is: Bright-field illumination.

Q768 · Hard · *codex, slides 370 to 388*

All of the following are true of the phase-contrast microscope EXCEPT which one?

1. It is used to observe living cells
2. It improves contrast
3. It uses both transmitted and scattered light
4. It overcomes the wavelength limit of light

✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: It overcomes the limitations set by the wavelength of visible light.
B: This is true. The right answer is: It overcomes the limitations set by the wavelength of visible light.
C: This is true. The right answer is: It overcomes the limitations set by the wavelength of visible light.
D: Correct choice. Resolution is still limited by wavelength.

Q769 · Hard · *codex, slides 370 to 388*

Which sequence describes how phase contrast creates contrast?

1. Diffracted rays are retarded more, interfere, and contrast rises
2. Undiffracted rays are blocked, and diffracted rays are brightened
3. The specimen is stained, and dye absorbs the rays
4. The lamp is dimmed, and the image darkens

✓ **Answer: A** — Further retardation enhances interference.

A: Further retardation enhances interference. It matches what the lecture slides state.
B: This is not the mechanism. The right answer is: Diffracted rays are retarded further, they interfere with undiffracted rays, and amplitude changes are greater.
C: This is not the mechanism. The right answer is: Diffracted rays are retarded further, they interfere with undiffracted rays, and amplitude changes are greater.
D: This is not the mechanism. The right answer is: Diffracted rays are retarded further, they interfere with undiffracted rays, and amplitude changes are greater.

Q770 · Hard · *codex, slides 370 to 388*

Which microscope is best for viewing the internal structures of a living amoeba?

1. The bright-field microscope with a stain
2. The dark-field microscope
3. The transmission electron microscope
4. The phase-contrast microscope

✓ **Answer: D** — It reveals internal details of living, unstained cells.

A: Staining kills the amoeba. The right answer is: The phase-contrast microscope.
B: It shows outlines rather than internal detail.
C: It cannot image living cells. The right answer is: The phase-contrast microscope.
D: It reveals internal details of living, unstained cells.

Q771 · Hard · *codex, slides 370 to 388*

Why is staining unsuitable for studying cell movement?

1. It usually kills or disrupts the cells
2. It makes the cells much larger
3. It changes the wavelength of light
4. It removes the nucleus entirely

✓ **Answer: A** — Staining usually kills cells.

A: Staining usually kills cells. It matches what the lecture slides state.
B: This is not the reason. The right answer is: It usually kills or disrupts the cells.
C: This is not the reason. The right answer is: It usually kills or disrupts the cells.
D: This is not the reason. The right answer is: It usually kills or disrupts the cells.

Q772 · Devil · *codex, slides 370 to 388*

A researcher wants to film cytoplasmic flow in a cell over many hours. Which technique and reason fit best?

1. Transmission electron microscopy, because it gives the highest resolution
2. Bright-field with a stain, because staining shows movement
3. UV microscopy, because UV is safe for living cells
4. Phase contrast with time-lapse, since living unstained cells can be followed

✓ **Answer: D** — This matches the lecture.

A: It cannot image living cells. The right answer is: Phase-contrast with time-lapse photography, because living unstained cells can be followed.
B: Staining kills the cells. The right answer is: Phase-contrast with time-lapse photography, because living unstained cells can be followed.
C: UV can damage the eye and specimens.
D: This matches the lecture. It matches what the lecture slides state.

Ultraviolet microscopy · Q773–788

Q773 · Easy · *codex, slides 390 to 396*

By how much does UV light increase resolution compared with white light?

1. Ten-fold
2. Five-fold
3. Two-fold
4. One hundred-fold

✓ **Answer: C** — UV increases resolution two-fold.

A: This is not stated. The right answer is: Two-fold.
B: This is not stated. The right answer is: Two-fold.
C: UV increases resolution two-fold. It matches what the lecture slides state.
D: This is not stated. The right answer is: Two-fold.

Q774 · Easy · *codex, slides 390 to 396*

Over which range do ultraviolet wavelengths extend?

1. 400 to 700 nm
2. 180 to 400 nm
3. 700 to 1000 nm
4. 18 to 40 nm

✓ **Answer: B** — UV is 180 to 400 nm.

A: This is visible light. The right answer is: 180 to 400 nm.
B: UV is 180 to 400 nm.
C: This is infrared. The right answer is: 180 to 400 nm.
D: This is too short. The right answer is: 180 to 400 nm.

Q775 · Easy · *codex, slides 390 to 396*

Which lens material replaces glass in UV microscopes?

1. Quartz
2. Plastic
3. Crown glass
4. Flint glass

✓ **Answer: A** — Quartz lenses must be used.

A: Quartz lenses must be used.
B: This is not stated. The right answer is: Quartz.
C: UV cannot pass through glass. The right answer is: Quartz.
D: UV cannot pass through glass. The right answer is: Quartz.

Q776 · Easy · *codex, slides 390 to 396*

Why can UV light not be viewed directly through the eyepiece?

1. It is far too bright to look at
2. It is too slow to reach the eye
3. It has no wavelength to measure
4. It is not visible to the human eye

✓ **Answer: D** — The UV image is not visible.

A: This is not the reason. The right answer is: It is not visible to the human eye.
B: This is not the reason. The right answer is: It is not visible to the human eye.
C: This is not true. The right answer is: It is not visible to the human eye.
D: The UV image is not visible.

Q777 · Easy · *codex, slides 390 to 396*

What can UV light damage?

1. The eye
2. The glass slide
3. The immersion oil
4. The condenser

✓ **Answer: A** — UV tends to damage the eye.

A: UV tends to damage the eye.
B: This is not stated. The right answer is: The eye.
C: This is not stated. The right answer is: The eye.
D: This is not stated. The right answer is: The eye.

Q778 · Easy · *codex, slides 390 to 396*

Which two advantages does UV microscopy offer?

1. Lower cost and much easier use
2. Live imaging and no damage at all
3. Better resolution and higher contrast
4. Wider field and thicker sections

✓ **Answer: C** — These are the two advantages.

A: It is costly. The right answer is: Improved resolution and increased contrast.
B: UV may damage tissue and the eye.
C: These are the two advantages.
D: These are not stated. The right answer is: Improved resolution and increased contrast.

Q779 · Medium · *codex, slides 390 to 396*

Why does UV light improve resolution?

1. Its wavelength is longer than visible light
2. It has a higher refractive index
3. Its wavelength is shorter than visible
4. It bends less in immersion oil

✓ **Answer: C** — The shorter wavelength improves resolution.

A: It is shorter. The right answer is: Its wavelength is shorter than that of visible light.
B: This is not the reason. The right answer is: Its wavelength is shorter than that of visible light.
C: The shorter wavelength improves resolution.
D: This is not the reason. The right answer is: Its wavelength is shorter than that of visible light.

Q780 · Medium · *codex, slides 390 to 396*

How is the UV image made visible to the viewer?

1. With a coloured eyepiece tube
2. With a thicker glass lens
3. With a camera or screen
4. With a stain on the glass slide

✓ **Answer: C** — The image is recorded or projected.

A: This is not stated. The right answer is: With a camera or a fluorescent screen.
B: This is not stated. The right answer is: With a camera or a fluorescent screen.
C: The image is recorded or projected.
D: This is not stated. The right answer is: With a camera or a fluorescent screen.

Q781 · Medium · *codex, slides 390 to 396*

Why cannot glass lenses be used in a UV microscope?

1. Glass absorbs only red light
2. UV cannot pass through glass
3. Glass is too heavy
4. Glass is too expensive

✓ **Answer: B** — UV cannot pass through glass lenses.

A: This is not the reason. The right answer is: UV cannot pass through glass.
B: UV cannot pass through glass lenses.
C: This is not the reason. The right answer is: UV cannot pass through glass.
D: Quartz is the expensive option. The right answer is: UV cannot pass through glass.

Q782 · Medium · *codex, slides 390 to 396*

Which specimens are suited to UV microscopy?

1. Those that absorb UV and re-emit longer light
2. Only those that reflect all of the light
3. Only those that have no refractive index
4. Only those that are dried in air

✓ **Answer: A** — These specimens are suited.

A: These specimens are suited. It matches what the lecture slides state.
B: This is not stated. The right answer is: Those that absorb UV and re-emit longer wavelength light, or are stained with dyes that do.
C: This is not stated. The right answer is: Those that absorb UV and re-emit longer wavelength light, or are stained with dyes that do.
D: This is not stated. The right answer is: Those that absorb UV and re-emit longer wavelength light, or are stained with dyes that do.

Q783 · Medium · *codex, slides 390 to 396*

Who has benefited recently from UV microscopes that give high-resolution images of fresh tissue?

1. Astronomers mapping the stars
2. Geologists studying the rocks
3. Chemists making new dyes
4. Pathologists assessing biopsies

✓ **Answer: D** — Pathologists use it for biopsies.

A: This is not stated. The right answer is: Pathologists assessing biopsies.
B: This is not stated. The right answer is: Pathologists assessing biopsies.
C: This is not stated. The right answer is: Pathologists assessing biopsies.
D: Pathologists use it for biopsies.

Q784 · Medium · *codex, slides 390 to 396*

A microscope has a 240 nm limit with white light. If UV doubles resolution, what is the new limit?

1. About 480 nm
2. About 120 nm
3. About 24 nm
4. About 360 nm

✓ **Answer: B** — Doubling resolution halves the limit.

A: This doubles the limit. The right answer is: About 120 nm.
B: Doubling resolution halves the limit.
C: This is too small. The right answer is: About 120 nm.
D: This is not the result. The right answer is: About 120 nm.

Q785 · Medium · *codex, slides 390 to 396*

How does a sample's response to UV light compare with its response to white light?

1. It is smaller, which lowers contrast
2. It is identical to white light
3. It is zero for most samples
4. It is greater, which increases contrast

✓ **Answer: D** — A greater response gives increased contrast.

A: The response is greater. The right answer is: It is greater, which increases contrast.
B: The response is greater. The right answer is: It is greater, which increases contrast.
C: The response is greater. The right answer is: It is greater, which increases contrast.
D: A greater response gives increased contrast.

Q786 · Hard · *codex, slides 390 to 396*

Which statement lists the disadvantages of the UV microscope?

1. It needs cheap glass lenses, the image is too bright, and UV is safe
2. It needs costly quartz lenses, and UV can damage the eye
3. It needs oil, the image is inverted, and UV cools the slide
4. It has no resolution gain, no contrast gain, and needs no lens

✓ **Answer: B** — These are the disadvantages listed.

A: These are not the disadvantages. The right answer is: It needs costly quartz lenses, the image is invisible to the eye, and UV can damage the eye.
B: These are the disadvantages listed.
C: These are not the disadvantages. The right answer is: It needs costly quartz lenses, the image is invisible to the eye, and UV can damage the eye.
D: It has resolution and contrast gains.

Q787 · Hard · *codex, slides 390 to 396*

All of the following are disadvantages of the UV microscope EXCEPT which one?

1. It needs quartz lenses
2. The image is not visible to the eye
3. UV may damage the eye
4. It cannot improve resolution

✓ **Answer: D** — Correct choice.

A: This is a disadvantage. The right answer is: It cannot improve resolution.
B: This is a disadvantage. The right answer is: It cannot improve resolution.
C: This is a disadvantage. The right answer is: It cannot improve resolution.
D: Correct choice. It improves resolution. It matches what the lecture slides state.

Q788 · Devil · *codex, slides 390 to 396*

Using a 240 nm baseline, can a UV microscope resolve two points 150 nm apart, and what is needed to view them?

1. Yes, since its limit is about 120 nm, and a camera or screen is needed
2. No, since its limit is about 480 nm, and a glass lens is enough
3. Yes, since its limit is about 480 nm, and the eye can see it directly
4. No, since UV gives no gain in resolution, and oil is needed

✓ **Answer: A** — 150 nm exceeds a 120 nm limit, and the image is invisible.

A: 150 nm exceeds a 120 nm limit, and the image is invisible.
B: UV halves the limit. The right answer is: Yes, since its limit is about 120 nm, and a camera or screen is needed.
C: The image is not visible directly.
D: UV improves resolution. The right answer is: Yes, since its limit is about 120 nm, and a camera or screen is needed.

Fluorescence microscopy · Q789–800

Q789 · Easy · *codex, slides 398 to 399*

What is the emission of visible light by substances illuminated with UV light called?

1. Refraction
2. Dispersion
3. Fluorescence
4. Diffraction

✓ **Answer: C** — The effect is called fluorescence.

A: This is bending of light. The right answer is: Fluorescence.
B: This is splitting of colours. The right answer is: Fluorescence.
C: The effect is called fluorescence.
D: This is spreading of light. The right answer is: Fluorescence.

Q790 · Easy · *codex, slides 398 to 399*

What are fluorescent dyes called?

1. Chromatophores
2. Chromosomes
3. Fluorochromes
4. Pigment granules

✓ **Answer: C** — Fluorescent dyes are fluorochromes.

A: This is not the term. The right answer is: Fluorochromes.
B: These are chromatin structures. The right answer is: Fluorochromes.
C: Fluorescent dyes are fluorochromes. It matches what the lecture slides state.
D: This is not the term. The right answer is: Fluorochromes.

Q791 · Easy · *codex, slides 398 to 399*

Which cell components can be naturally fluorescent?

1. Cell walls and capsules
2. Ribosomes and plasmids
3. Chromosomes and nuclei
4. Lipid droplets and glycogen

✓ **Answer: C** — Chromosomes and nuclei can fluoresce naturally.

A: These are not named. The right answer is: Chromosomes and nuclei.
B: These are not named. The right answer is: Chromosomes and nuclei.
C: Chromosomes and nuclei can fluoresce naturally.
D: These are not named. The right answer is: Chromosomes and nuclei.

Q792 · Easy · *codex, slides 398 to 399*

Which light is focused on the specimen in fluorescence microscopy?

1. Infrared rays
2. Ultraviolet light rays
3. A beam of electrons
4. X-rays

✓ **Answer: B** — UV rays are focused on the specimen.

A: This is not stated. The right answer is: Ultraviolet light rays.
B: UV rays are focused on the specimen.
C: This is electron microscopy. The right answer is: Ultraviolet light rays.
D: This is not stated. The right answer is: Ultraviolet light rays.

Q793 · Easy · *codex, slides 398 to 399*

How can non-fluorescing structures be made to fluoresce?

1. By heating them to high temperatures
2. By drying them completely in air
3. By fixing them with osmium tetroxide
4. By staining them with fluorochromes

✓ **Answer: D** — They are stained with fluorescent dyes.

A: This is not stated. The right answer is: By staining them with fluorochromes.
B: This is not stated. The right answer is: By staining them with fluorochromes.
C: This is not stated. The right answer is: By staining them with fluorochromes.
D: They are stained with fluorescent dyes.

Q794 · Medium · *codex, slides 398 to 399*

What kind of light do fluorescent substances emit?

1. Infrared only
2. Visible light
3. Electrons
4. Sound

✓ **Answer: B** — They emit visible light.

A: This is not stated. The right answer is: Visible light.
B: They emit visible light. It matches what the lecture slides state.
C: This is not stated. The right answer is: Visible light.
D: This is not stated. The right answer is: Visible light.

Q795 · Medium · *codex, slides 398 to 399*

In what way do naturally fluorescent components appear?

1. Always black
2. In various colours
3. Always white
4. Invisible

✓ **Answer: B** — They appear in various colours.

A: This is not stated. The right answer is: In various colours.
B: They appear in various colours.
C: This is not stated. The right answer is: In various colours.
D: They are visible. The right answer is: In various colours.

Q796 · Medium · *codex, slides 398 to 399*

Why are fluorochromes used on structures that do not fluoresce naturally?

1. They remove the need for UV light
2. They make those structures glow under UV
3. They block UV from the specimen
4. They convert UV into electrons

✓ **Answer: B** — The dye makes them fluoresce.

A: UV is still needed. The right answer is: They make those structures glow under UV illumination.
B: The dye makes them fluoresce.
C: They help structures emit light. The right answer is: They make those structures glow under UV illumination.
D: This is not described. The right answer is: They make those structures glow under UV illumination.

Q797 · Medium · *codex, slides 398 to 399*

Which type of radiation excites the substances in fluorescence microscopy?

1. Visible green light only
2. Infrared
3. Radio waves
4. Ultraviolet

✓ **Answer: D** — UV excites the substances.

A: The lecture names UV. The right answer is: Ultraviolet.
B: This is not stated. The right answer is: Ultraviolet.
C: This is not stated. The right answer is: Ultraviolet.
D: UV excites the substances. It matches what the lecture slides state.

Q798 · Medium · *codex, slides 398 to 399*

Which statement about fluorescence is correct?

1. All substances emit visible light under any light
2. Only stained structures ever fluoresce
3. Fluorescence needs electron beams
4. Some substances emit visible light under UV

✓ **Answer: D** — This is the definition given.

A: This is not true. The right answer is: Some chemical substances emit visible light when illuminated with UV light.
B: Some components fluoresce naturally. The right answer is: Some chemical substances emit visible light when illuminated with UV light.
C: It uses UV light. The right answer is: Some chemical substances emit visible light when illuminated with UV light.
D: This is the definition given.

Q799 · Hard · *codex, slides 398 to 399*

Why does a fluorescent stain make a structure visible?

1. It reflects all white light equally
2. It absorbs UV light and re-emits visible light
3. It blocks visible light from the background
4. It increases the refractive index of the medium

✓ **Answer: B** — The stain converts UV into visible emission.

A: This is not the mechanism. The right answer is: It absorbs UV light and re-emits visible light.
B: The stain converts UV into visible emission.
C: This is not the mechanism. The right answer is: It absorbs UV light and re-emits visible light.
D: This is not the mechanism. The right answer is: It absorbs UV light and re-emits visible light.

Q800 · Hard · *codex, slides 398 to 399*

All of the following are true of fluorescence microscopy EXCEPT which one?

1. UV rays are focused on the specimen
2. Some components fluoresce naturally
3. It uses a beam of electrons to illuminate the specimen
4. Non-fluorescing structures can be stained with fluorochromes

✓ **Answer: C** — Correct choice.

A: This is true. The right answer is: It uses a beam of electrons to illuminate the specimen.
B: This is true. The right answer is: It uses a beam of electrons to illuminate the specimen.
C: Correct choice. It uses UV light, not electrons.
D: This is true. The right answer is: It uses a beam of electrons to illuminate the specimen.

Module 5 — Principles of fluorescence → Cell lysis and homogenisation

slides 401 to 500 · 200 questions · 15 sections · bank: BIOL151_Question_Bank_Slides401-500.docx
Difficulty: 79 Easy · 80 Medium · 33 Hard · 8 Devil

Principles of fluorescence · Q801–812

Q801 · Easy · *codex, slides 401 to 407*

What rises to a higher energy level when a fluorescent molecule absorbs light?

1. A proton in the atomic nucleus
2. An electron in a given orbital
3. A whole chromosome of the cell
4. A hydrogen bond in the water

✓ **Answer: B** — The absorbed energy raises an electron to a higher energy level.

A: Protons do not rise in energy this way.
B: The absorbed energy raises an electron to a higher energy level.
C: This is not what happens. The right answer is: An electron in a given orbital.
D: This is not what happens. The right answer is: An electron in a given orbital.

Q802 · Easy · *codex, slides 401 to 407*

How does the excitation wavelength compare with the emission wavelength?

1. It is longer
2. It is the same
3. It is shorter
4. It is zero

✓ **Answer: C** — Excitation uses the shorter wavelength.

A: Emission is the longer wavelength. The right answer is: It is shorter.
B: They differ. The right answer is: It is shorter.
C: Excitation uses the shorter wavelength.
D: Both have a wavelength. The right answer is: It is shorter.

Q803 · Easy · *codex, slides 401 to 407*

How does the energy of the emitted light compare with the excitation light?

1. It is more
2. It is less
3. It is the same
4. It is infinite

✓ **Answer: B** — Emission has a longer wavelength and less energy.

A: Emission has less energy. The right answer is: It is less.
B: Emission has a longer wavelength and less energy.
C: Some energy is lost as heat.
D: This is not possible. The right answer is: It is less.

Q804 · Easy · *codex, slides 401 to 407*

Which fluorescent dye is shown with its excitation and emission spectra?

1. Eosin
2. Fluorescein
3. Hematoxylin
4. Crystal violet

> ✓ **Answer: B** — The spectra of fluorescein are shown.

A: Eosin is a routine histology dye.
B: The spectra of fluorescein are shown.
C: Hematoxylin stains nuclei in H&E. The right answer is: Fluorescein.
D: This is a bacteriology dye. The right answer is: Fluorescein.

Q805 · Easy · *codex, slides 401 to 407*

What state is an electron in right after it absorbs the light?

1. An unstable excited state
2. The ground state
3. A stable permanent state in this case
4. A bonded state

> ✓ **Answer: A** — The excited state is unstable.

A: The excited state is unstable.
B: It leaves the ground state. The right answer is: An unstable excited state.
C: The excited state is unstable. The right answer is: An unstable excited state.
D: This is not described. The right answer is: An unstable excited state.

Q806 · Medium · *codex, slides 401 to 407*

What happens to electrons in the excited state?

1. They stay excited and never release energy
2. They leave the atom and form a beam
3. They turn into protons inside the nucleus
4. They return to the ground state, giving off light

> ✓ **Answer: D** — This release produces fluorescence.

A: They are unstable. The right answer is: They return to the ground state, releasing energy as light and heat.
B: This is not described. The right answer is: They return to the ground state, releasing energy as light and heat.
C: This does not occur. The right answer is: They return to the ground state, releasing energy as light and heat.
D: This release produces fluorescence. It matches what the lecture slides state.

Q807 · Medium · *codex, slides 401 to 407*

What is the release of energy as light from excited electrons called?

1. Refraction
2. Diffraction in practice
3. Fluorescence
4. Dispersion

✓ **Answer: C** — The emission of energy is fluorescence.

A: This is bending of light. The right answer is: Fluorescence.
B: This is spreading of light. The right answer is: Fluorescence.
C: The emission of energy is fluorescence.
D: This is splitting of colours. The right answer is: Fluorescence.

Q808 · Medium · *codex, slides 401 to 407*

Fluorescent molecules absorb light at one wavelength and emit it at what?

1. A shorter wavelength
2. The same wavelength
3. A longer wavelength
4. No wavelength

✓ **Answer: C** — Emission is at a longer wavelength.

A: Emission is longer. The right answer is: A longer wavelength.
B: The wavelengths differ. The right answer is: A longer wavelength.
C: Emission is at a longer wavelength.
D: Emitted light has a wavelength. The right answer is: A longer wavelength.

Q809 · Medium · *codex, slides 401 to 407*

Which transition in the electron's energy produces the emitted light?

1. Rise from the ground state to the excited state
2. Loss of the electron from the atom
3. Splitting of the atomic nucleus
4. Return from the excited to the ground state

✓ **Answer: D** — This return releases the light.

A: This is excitation. The right answer is: Return from the excited state to the ground state.
B: This is not the process. The right answer is: Return from the excited state to the ground state.
C: This is not the process. The right answer is: Return from the excited state to the ground state.
D: This return releases the light.

Q810 · Medium · *codex, slides 401 to 407*

Why is the emitted light of lower energy than the absorbed light?

1. The molecule absorbs extra energy from the lamp
2. The wavelength gets shorter
3. Some energy is released as heat
4. The dye converts it to electrons

> ✓ **Answer: C** — Energy is lost as light and heat.

A: This is not the reason. The right answer is: Part of the absorbed energy is released as heat.
B: The wavelength gets longer. The right answer is: Part of the absorbed energy is released as heat.
C: Energy is lost as light and heat.
D: This is not described. The right answer is: Part of the absorbed energy is released as heat.

Q811 · Hard · *codex, slides 401 to 407*

Which statement about wavelengths in fluorescence is correct?

1. Emission wavelength is shorter than excitation wavelength
2. Emission wavelength is longer than excitation wavelength
3. Both wavelengths are always exactly equal
4. Emission wavelength is close to zero

> ✓ **Answer: B** — Emission is at a longer wavelength.

A: This reverses the order. The right answer is: Emission wavelength is longer than excitation wavelength.
B: Emission is at a longer wavelength.
C: They differ. The right answer is: Emission wavelength is longer than excitation wavelength.
D: It is not zero. The right answer is: Emission wavelength is longer than excitation wavelength.

Q812 · Hard · *codex, slides 401 to 407*

All of the following are true of fluorescence EXCEPT which one?

1. Electrons rise to a higher energy level
2. Excited electrons return to the ground state
3. Energy is released as light and heat
4. Emitted light has a shorter wavelength

> ✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: Emitted light has a shorter wavelength than absorbed light.
B: This is true. The right answer is: Emitted light has a shorter wavelength than absorbed light.
C: This is true. The right answer is: Emitted light has a shorter wavelength than absorbed light.
D: Correct choice. The emitted light has a longer wavelength.

Fluorescence microscopy in use · Q813–820

Q813 · Easy · *codex, slides 403, 404, 406*

One of the most popular uses of fluorescence microscopy involves preparing what?

1. Slides coated in paraffin wax
2. Cut sections of epoxy resin
3. Glass slides with copper grids in this case
4. Antibodies for specific proteins

✓ **Answer: D** — Antibodies are prepared to bind specific proteins.

A: This is not the use. The right answer is: Antibodies that bind to specific cellular proteins.
B: This is not the use. The right answer is: Antibodies that bind to specific cellular proteins.
C: This is not the use. The right answer is: Antibodies that bind to specific cellular proteins.
D: Antibodies are prepared to bind specific proteins.

Q814 · Easy · *codex, slides 403, 404, 406*

Which fluorescent dye is complexed with the antibody in the lecture's example?

1. Eosin
2. Nigrosin
3. Fluorescein
4. Safranin

✓ **Answer: C** — The antibodies are complexed with fluorescein.

A: Eosin is a routine dye. The right answer is: Fluorescein.
B: This is an acidic dye. The right answer is: Fluorescein.
C: The antibodies are complexed with fluorescein.
D: This is a basic dye. The right answer is: Fluorescein.

Q815 · Easy · *codex, slides 403, 404, 406*

What is fluorescence microscopy used to detect within a cell?

1. Only the cell wall of the cell
2. Only the temperature inside it
3. Only the pH of the cytoplasm
4. Structures, molecules or proteins

✓ **Answer: D** — It detects structures, molecules or proteins.

A: This is not stated. The right answer is: Structures, molecules or proteins.
B: This is not stated. The right answer is: Structures, molecules or proteins.
C: This is not stated. The right answer is: Structures, molecules or proteins.
D: It detects structures, molecules or proteins.

Q816 · Medium · *codex, slides 403, 404, 406*

How is the dye illuminated in fluorescence microscopy?

1. With unfiltered white light only
2. With a focused beam of electrons
3. With filtered light at the dye's peak
4. With high frequency sound waves

✓ **Answer: C** — Filtered light at the absorbing wavelength is used.

A: The light is filtered. The right answer is: With filtered light at the absorbing wavelength.
B: This is electron microscopy. The right answer is: With filtered light at the absorbing wavelength.
C: Filtered light at the absorbing wavelength is used.
D: This is not stated. The right answer is: With filtered light at the absorbing wavelength.

Q817 · Medium · *codex, slides 403, 404, 406*

What does the filter before the eyepiece allow through?

1. Only the emitted wavelength
2. Only the excitation wavelength
3. All wavelengths equally
4. No light at all

✓ **Answer: A** — Only the emitted wavelength is seen.

A: Only the emitted wavelength is seen.
B: The excitation light is blocked. The right answer is: Only the emitted wavelength.
C: The filter is selective. The right answer is: Only the emitted wavelength.
D: The emitted light is seen. The right answer is: Only the emitted wavelength.

Q818 · Medium · *codex, slides 403, 404, 406*

Why does the dye glow brightly against a dark background?

1. The slide is stained completely black in practice
2. Only emitted light reaches the eyepiece
3. The condenser blocks all light
4. The lamp is switched off

✓ **Answer: B** — Background excitation light is filtered out.

A: This is not the reason. The right answer is: Only the emitted wavelength reaches the eyepieces or camera port.
B: Background excitation light is filtered out.
C: This is not the reason. The right answer is: Only the emitted wavelength reaches the eyepieces or camera port.
D: This is not the reason. The right answer is: Only the emitted wavelength reaches the eyepieces or camera port.

Q819 · Hard · *codex, slides 403, 404, 406*

After a fluorescein-labelled antibody is applied, which structures fluoresce?

1. All of the structures equally
2. Only the cell wall of the cell
3. Only the stain-free background
4. Those containing the specific protein

✓ **Answer: D** — Only structures with the protein bind the antibody.

A: Only specific ones bind. The right answer is: Those containing the specific protein the antibody binds.
B: This is not stated. The right answer is: Those containing the specific protein the antibody binds.
C: The background does not fluoresce. The right answer is: Those containing the specific protein the antibody binds.
D: Only structures with the protein bind the antibody.

Q820 · Devil · *codex, slides 403, 404, 406*

A lab wants to show where one protein sits in cells. Which sequence of steps is correct?

1. Stain with eosin, fix in paraffin, then image with electrons
2. Add DNase, sonicate, then spin in a centrifuge
3. Label an antibody with fluorescein, apply it, then image
4. Freeze the cells, thaw them, then image with a loupe

✓ **Answer: C** — This is the described method.

A: These are not the described steps.
B: These are fractionation steps. The right answer is: Label an antibody with fluorescein, apply it to cells, then image with filtered excitation and an emission filter.
C: This is the described method.
D: These are not the described steps.

Optics of the fluorescence microscope · Q821–830

Q821 · Easy · *codex, slides 410 to 414*

A fluorescence microscope is basically which kind of microscope with added features?

1. A transmission electron microscope
2. A scanning electron microscope
3. A conventional light microscope
4. A dissecting microscope

✓ **Answer: C** — It is a conventional light microscope with added components.

A: It is a light microscope. The right answer is: A conventional light microscope.
B: It is a light microscope. The right answer is: A conventional light microscope.
C: It is a conventional light microscope with added components.
D: It is a light microscope with added features.

Q822 · Easy · *codex, slides 410 to 414*

Which component separates the excitation and emission light paths?

1. The eyepiece
2. The dichroic mirror
3. The diaphragm
4. The nosepiece

> ✓ **Answer: B** — A dichroic mirror separates the paths.

A: The eyepiece magnifies. The right answer is: The dichroic mirror.
B: A dichroic mirror separates the paths.
C: The diaphragm controls light. The right answer is: The dichroic mirror.
D: It holds the objectives. The right answer is: The dichroic mirror.

Q823 · Easy · *codex, slides 410 to 414*

Which lens performs two functions in a fluorescence microscope?

1. The objective lens
2. The eyepiece lens
3. The condenser lens
4. The field lens

> ✓ **Answer: A** — The objective focuses excitation and collects emission.

A: The objective focuses excitation and collects emission.
B: The eyepiece does not do both.
C: The simple condenser is not the lens here.
D: This is not described. The right answer is: The objective lens.

Q824 · Easy · *codex, slides 410 to 414*

What is the configuration called in which excitation and emission both travel through the objective?

1. Epifluorescence
2. Transillumination
3. Dark-field
4. Phase contrast

> ✓ **Answer: A** — This configuration is epifluorescence.

A: This configuration is epifluorescence. It matches what the lecture slides state.
B: This is not the term. The right answer is: Epifluorescence.
C: This is another technique. The right answer is: Epifluorescence.
D: This is another technique. The right answer is: Epifluorescence.

Q825 · Medium · *codex, slides 410 to 414*

What is the first function of the objective in a fluorescence microscope?

1. To collect electrons from the sample
2. To stain the specimen with dye
3. To focus the excitation light
4. To cool the lamp housing down

✓ **Answer: C** — It focuses the excitation light.

A: This is not a function. The right answer is: To focus the excitation light on the sample.
B: This is not a function. The right answer is: To focus the excitation light on the sample.
C: It focuses the excitation light.
D: This is not a function. The right answer is: To focus the excitation light on the sample.

Q826 · Medium · *codex, slides 410 to 414*

What is the second function of the objective in a fluorescence microscope?

1. To filter out all of the light
2. To collect the emitted fluorescence
3. To rotate the slide slowly
4. To heat the specimen gently

✓ **Answer: B** — It collects the emitted fluorescence.

A: This is not a function. The right answer is: To collect the emitted fluorescence.
B: It collects the emitted fluorescence.
C: This is not a function. The right answer is: To collect the emitted fluorescence.
D: This is not a function. The right answer is: To collect the emitted fluorescence.

Q827 · Medium · *codex, slides 410 to 414*

Why must excitation light be focused more strongly than by a simple condenser?

1. To make the image much bigger
2. To shorten the light wavelength as a rule
3. To excite the fluorescent species
4. To cool the sample slightly

✓ **Answer: C** — Strong focus excites the species.

A: This is not the reason. The right answer is: To excite the fluorescent species in the sample.
B: This is not the reason. The right answer is: To excite the fluorescent species in the sample.
C: Strong focus excites the species.
D: This is not the reason. The right answer is: To excite the fluorescent species in the sample.

Q828 · Medium · *codex, slides 410 to 414*

Within the objective, what do the excitation and emission light share?

1. The same optics
2. Separate lenses
3. A dichroic mirror only
4. A beam of electrons

> ✓ **Answer: A** — They share the same optics.

A: They share the same optics.
B: They share the same optics. The right answer is: The same optics.
C: The objective optics are shared. The right answer is: The same optics.
D: This is not the mechanism. The right answer is: The same optics.

Q829 · Hard · *codex, slides 410 to 414*

Why must the elements that separate excitation from emission be very efficient?

1. To limit the background light
2. To raise the NA of the objective
3. To shorten the working distance
4. To reduce the refractive index

> ✓ **Answer: A** — Efficient separation reduces background.

A: Efficient separation reduces background. It matches what the lecture slides state.
B: This is not the reason. The right answer is: To get an emission image without excessive background illumination.
C: This is not the reason. The right answer is: To get an emission image without excessive background illumination.
D: This is not the reason. The right answer is: To get an emission image without excessive background illumination.

Q830 · Hard · *codex, slides 410 to 414*

Which statement describes the key to epifluorescence optics?

1. Using a longer working distance
2. Separating excitation from emission
3. Staining the whole slide black
4. Increasing the magnification used at that stage

> ✓ **Answer: B** — This is the key to the optics.

A: This is not the key. The right answer is: Separating the illumination light from the emission coming from the sample.
B: This is the key to the optics.
C: This is not the key. The right answer is: Separating the illumination light from the emission coming from the sample.
D: This is not the key. The right answer is: Separating the illumination light from the emission coming from the sample.

Electron microscopy: principles · Q831–842

Q831 · Easy · *codex, slides 416 to 423*

What dual nature do electrons have?

1. Only particle-like behaviour
2. Only wave-like behaviour
3. Neither of the two behaviours
4. Both particle-like and wave-like

✓ **Answer: D** — Electrons are both particulate and wave-like.

A: They also behave as waves. The right answer is: Both particle-like and wave-like.
B: They also behave as particles. The right answer is: Both particle-like and wave-like.
C: They have both natures. The right answer is: Both particle-like and wave-like.
D: Electrons are both particulate and wave-like.

Q832 · Easy · *codex, slides 416 to 423*

The wavelength of an electron depends on what?

1. The colour of the lamp
2. The speed at which it is moving
3. The size of the specimen
4. The thickness of the slide

✓ **Answer: B** — Wavelength depends on the electron's speed.

A: Electron microscopes have no lamp colour.
B: Wavelength depends on the electron's speed.
C: This is not the factor. The right answer is: The speed at which it is moving.
D: This is not the factor. The right answer is: The speed at which it is moving.

Q833 · Easy · *codex, slides 416 to 423*

What are the two types of electron microscope?

1. Simple and compound
2. Bright-field and dark-field
3. Transmission and scanning
4. Phase and fluorescence

✓ **Answer: C** — TEM and SEM are the two types.

A: These are light microscopes. The right answer is: Transmission and scanning.
B: These are light techniques. The right answer is: Transmission and scanning.
C: TEM and SEM are the two types.
D: These are light techniques. The right answer is: Transmission and scanning.

Q834 · Easy · *codex, slides 416 to 423*

What is the apparent wavelength of electrons at 60 kV?

1. 5 nm
2. 0.5 nm in this case
3. 0.005 nm
4. 560 nm

✓ **Answer: C** — At 60 kV the wavelength is 0.005 nm.

A: This is 1,000 times too large.
B: This is 100 times too large.
C: At 60 kV the wavelength is 0.005 nm.
D: This is green light. The right answer is: 0.005 nm.

Q835 · Easy · *codex, slides 416 to 423*

What replaces the light source in an electron microscope?

1. A source of electrons
2. A tungsten lamp
3. A mercury arc lamp source
4. A quartz lens

✓ **Answer: A** — A source of electrons replaces the light source.

A: A source of electrons replaces the light source.
B: This is the light microscope source.
C: This is a fluorescence light source.
D: This is a UV lens. The right answer is: A source of electrons.

Q836 · Medium · *codex, slides 416 to 423*

Which equation approximates the wavelength of electrons?

1. $\lambda = 0.61\ NA / r$
2. $\lambda = n \sin \mu$
3. $\lambda = \sqrt{(1.5/V)}$ nm
4. $\lambda = 1.5\ V$ nm

✓ **Answer: C** — This is the equation in the lecture.

A: This is not the equation. The right answer is: $\lambda = \sqrt{(1.5/V)}$ nm.
B: This is the NA equation. The right answer is: $\lambda = \sqrt{(1.5/V)}$ nm.
C: This is the equation in the lecture.
D: This is not the equation. The right answer is: $\lambda = \sqrt{(1.5/V)}$ nm.

Q837 · Medium · *codex, slides 416 to 423*

Why is the theoretical resolving power of electron microscopy not realised?

1. Electrons have no real wavelength as a rule
2. The beam cannot be focused at all
3. Contrast and lens defects limit it
4. The vacuum absorbs all electrons

✓ **Answer: C** — These are the limits stated.

A: They do have a wavelength. The right answer is: It is limited by specimen contrast and imperfect electromagnetic lenses.
B: It can be focused. The right answer is: It is limited by specimen contrast and imperfect electromagnetic lenses.
C: These are the limits stated.
D: This is not the reason. The right answer is: It is limited by specimen contrast and imperfect electromagnetic lenses.

Q838 · Medium · *codex, slides 416 to 423*

Using λ = √(1.5/V) nm, what is the approximate wavelength at 100,000 V?

1. About 0.4 nm
2. About 0.004 nm
3. About 0.04 nm at that stage
4. About 4 nm

✓ **Answer: B** — √(1.5/100,000) is about 0.0039 nm.

A: This is 100 times too large.
B: √(1.5/100,000) is about 0.0039 nm.
C: This is ten times too large.
D: This is 1,000 times too large.

Q839 · Medium · *codex, slides 416 to 423*

What replaces the glass lenses of a light microscope in an electron microscope?

1. Magnetic lenses
2. Quartz lenses
3. Plastic lenses in this case
4. Glass prisms

✓ **Answer: A** — Magnetic lenses focus the electron beam.

A: Magnetic lenses focus the electron beam.
B: These are used in UV microscopes.
C: These are not described. The right answer is: Magnetic lenses.
D: These are not described. The right answer is: Magnetic lenses.

Q840 · Medium · *codex, slides 416 to 423*

What replaces the eyepiece in the scanning electron microscope design?

1. A fluorescent mercury lamp
2. A condenser lens
3. A glass slide
4. A cathode ray tube

✓ **Answer: D** — The SEM uses a cathode ray tube.

A: This is not described. The right answer is: A cathode ray tube.
B: This is not an eyepiece. The right answer is: A cathode ray tube.
C: This is not an eyepiece. The right answer is: A cathode ray tube.
D: The SEM uses a cathode ray tube.

Q841 · Hard · *codex, slides 416 to 423*

Why can electron microscopy in principle resolve far finer detail than light microscopy?

1. The electron beam is brighter than a lamp
2. Electron wavelength is much shorter than light
3. Electrons have a larger NA than glass
4. Electron lenses are made of glass

✓ **Answer: B** — Shorter wavelength gives better resolution.

A: This is not the reason. The right answer is: The wavelength of electrons is much shorter than that of visible light.
B: Shorter wavelength gives better resolution.
C: This is not the reason. The right answer is: The wavelength of electrons is much shorter than that of visible light.
D: They are magnetic. The right answer is: The wavelength of electrons is much shorter than that of visible light.

Q842 · Hard · *codex, slides 416 to 423*

How many times shorter is a 0.005 nm electron wavelength than 560 nm green light?

1. About 1,120 times
2. About 112,000 times
3. About 11,200 times
4. About 1,120,000 times

✓ **Answer: B** — 560 divided by 0.005 is 112,000.

A: This is 100 times too small.
B: 560 divided by 0.005 is 112,000.
C: This is ten times too small.
D: This is ten times too large.

Transmission electron microscopy · Q843–858

Q843 · Easy · *codex, slides 424 to 429*

What produces the electron ray in a TEM?

1. A tungsten halogen lamp bulb
2. A mercury arc lamp source
3. A heated pin-shaped cathode
4. A fluorescent screen coating

✓ **Answer: C** — A heated pin-shaped cathode produces the electron ray.

A: This is a light source. The right answer is: A pin-shaped cathode heated by current.
B: This is a fluorescence source. The right answer is: A pin-shaped cathode heated by current.
C: A heated pin-shaped cathode produces the electron ray.
D: This displays the image. The right answer is: A pin-shaped cathode heated by current.

Q844 · Easy · *codex, slides 424 to 429*

What acceleration voltage range is typical for a TEM?

1. 5 to 15 V
2. 500 to 1500 kV
3. 50 to 150 kV
4. 1 to 5 kV

✓ **Answer: C** — TEM voltages are 50 to 150 kV.

A: This is far too low. The right answer is: 50 to 150 kV.
B: This is ten times too high.
C: TEM voltages are 50 to 150 kV.
D: This is too low. The right answer is: 50 to 150 kV.

Q845 · Easy · *codex, slides 424 to 429*

Which kind of section does the TEM beam pass through?

1. A thick block of wax
2. An ultrathin prepared section
3. A living culture dish
4. A whole insect

✓ **Answer: B** — The beam passes through an ultrathin section.

A: The section must be very thin.
B: The beam passes through an ultrathin section.
C: Living cells cannot be imaged. The right answer is: A specially prepared ultrathin section.
D: Whole specimens are not used. The right answer is: A specially prepared ultrathin section.

Q846 · Easy · *codex, slides 424 to 429*

What do the lens systems of an electron microscope consist of?

1. Electromagnetic coils
2. Polished quartz glass discs
3. Plastic domes and rings
4. Glass spheres in a tube

✓ **Answer: A** — Coils generate the field.

A: Coils generate the field. It matches what the lecture slides state.
B: These are UV lenses. The right answer is: Electronic coils generating an electromagnetic field.
C: These are not described. The right answer is: Electronic coils generating an electromagnetic field.
D: These are not described. The right answer is: Electronic coils generating an electromagnetic field.

Q847 · Easy · *codex, slides 424 to 429*

On what is the TEM image made visible?

1. A glass eyepiece only
2. A sheet of wax
3. A paraffin block
4. A fluorescent screen or film

✓ **Answer: D** — The image is shown on a screen or film.

A: This is not stated. The right answer is: A fluorescent screen or photographic material.
B: This is not stated. The right answer is: A fluorescent screen or photographic material.
C: This is not stated. The right answer is: A fluorescent screen or photographic material.
D: The image is shown on a screen or film.

Q848 · Easy · *codex, slides 424 to 429*

Biological objects give weak contrast in TEM because they consist mainly of what?

1. Heavy metals such as gold
2. Low atomic number elements
3. Elements with high atomic numbers
4. Radioactive isotopes of carbon

✓ **Answer: B** — These deflect electrons weakly.

A: Heavy metals give strong contrast. The right answer is: Elements with low atomic numbers (C, H, N, O).
B: These deflect electrons weakly. It matches what the lecture slides state.
C: These give strong contrast. The right answer is: Elements with low atomic numbers (C, H, N, O).
D: These are not the reason. The right answer is: Elements with low atomic numbers (C, H, N, O).

Q849 · Medium · *codex, slides 424 to 429*

What does the degree of electron deflection depend on?

1. The object's electron density
2. The colour of the object
3. The temperature of the lamp in practice
4. The thickness of the slide

✓ **Answer: A** — Deflection depends on electron density.

A: Deflection depends on electron density.
B: This is not the factor. The right answer is: The electron density of the object.
C: This is not the factor. The right answer is: The electron density of the object.
D: This is not the factor. The right answer is: The electron density of the object.

Q850 · Medium · *codex, slides 424 to 429*

Which atoms deflect electrons more?

1. Atoms of smaller mass
2. Atoms of any mass equally
3. Only hydrogen atoms
4. Atoms of greater mass

✓ **Answer: D** — The greater the mass, the greater the deflection.

A: Smaller mass gives less deflection. The right answer is: Atoms of greater mass.
B: Mass matters. The right answer is: Atoms of greater mass.
C: This is not stated. The right answer is: Atoms of greater mass.
D: The greater the mass, the greater the deflection.

Q851 · Medium · *codex, slides 424 to 429*

What does the projective lens do in a TEM?

1. It enlarges the objective's image
2. It stains the specimen slightly as a rule
3. It controls the lamp output
4. It cuts the section thinly

✓ **Answer: A** — The projective system enlarges the image.

A: The projective system enlarges the image.
B: This is not its role. The right answer is: It further enlarges the image formed by the objective.
C: This is not its role. The right answer is: It further enlarges the image formed by the objective.
D: This is not its role. The right answer is: It further enlarges the image formed by the objective.

Q852 · Medium · *codex, slides 424 to 429*

What power of resolution do modern TEMs reach?

1. 20 to 30 nm at that stage
2. 0.2 to 0.3 nm
3. 2 to 3 nm
4. 240 nm

✓ **Answer: B** — Modern gadgets reach 0.2 to 0.3 nm.

A: This is 100 times too coarse.
B: Modern gadgets reach 0.2 to 0.3 nm.
C: This is ten times too coarse.
D: This is the light microscope limit.

Q853 · Medium · *codex, slides 424 to 429*

What usually restrains the power of resolution of electron microscopy?

1. The wavelength of the electrons only
2. The colour of the stain
3. The age of the microscope
4. Lens quality and preparation

✓ **Answer: D** — These restrain it more than voltage.

A: The voltage is hardly limiting. The right answer is: The quality of the lens systems and the preparation technique.
B: This is not the restraint. The right answer is: The quality of the lens systems and the preparation technique.
C: This is not the restraint. The right answer is: The quality of the lens systems and the preparation technique.
D: These restrain it more than voltage.

Q854 · Medium · *codex, slides 424 to 429*

The useful resolution of TEM corresponds to about what magnification?

1. About 3,000×
2. About 30,000,000×
3. About 300×
4. About 300,000×

✓ **Answer: D** — Useful resolution is around 300,000×.

A: This is 100 times too low.
B: This is 100 times too high.
C: This is far too low. The right answer is: About 300,000×.
D: Useful resolution is around 300,000×.

Q855 · Hard · *codex, slides 424 to 429*

Raising the acceleration voltage shortens the electron waves. Why is this hardly ever limiting?

1. Electrons cannot be accelerated above 50 kV
2. Shorter waves would reduce resolution
3. Lens quality and preparation limit it first
4. The anode absorbs all the electrons

✓ **Answer: C** — These factors usually restrain resolution.

A: Voltages are 50 to 150 kV.
B: They improve resolution. The right answer is: Lens quality and specimen preparation limit resolution first.
C: These factors usually restrain resolution.
D: This is not stated. The right answer is: Lens quality and specimen preparation limit resolution first.

Q856 · Hard · *codex, slides 424 to 429*

All of the following are true of the TEM EXCEPT which one?

1. The beam passes through an ultrathin section
2. Electrons are deflected according to electron density
3. The beam is scanned across the surface of a solid specimen
4. The image is formed on a fluorescent screen

✓ **Answer: C** — Correct choice.

A: This is true. The right answer is: The beam is scanned across the surface of a solid specimen.
B: This is true. The right answer is: The beam is scanned across the surface of a solid specimen.
C: Correct choice. That describes the SEM.
D: This is true. The right answer is: The beam is scanned across the surface of a solid specimen.

Q857 · Hard · *codex, slides 424 to 429*

An unstained biological section gives a faint, low-contrast TEM image. Why?

1. Its high atomic number elements absorb all electrons
2. The section is too thin to scatter any electrons
3. The anode is far too cold to work
4. Its low atomic numbers deflect electrons weakly

✓ **Answer: D** — C, H, N and O give weak contrast.

A: Biological material has low atomic number elements.
B: It is thin but the elements scatter weakly.
C: This is not the reason. The right answer is: Its low atomic number elements deflect electrons weakly.
D: C, H, N and O give weak contrast.

Q858 · Devil · *codex, slides 424 to 429*

Which order correctly follows the electrons through a TEM?

1. Electron gun, condenser, specimen, objective, projective lens, screen
2. Screen, projective lens, objective, specimen, condenser, gun
3. Gun, objective, specimen, condenser, screen, projective lens
4. Condenser, gun, specimen, projective lens, objective, screen

✓ **Answer: A** — This is the path of the beam.

A: This is the path of the beam.
B: This is the reverse order. The right answer is: Electron gun, condenser, specimen, objective, projective lens, screen.
C: The condenser comes before the specimen.
D: This order is wrong. The right answer is: Electron gun, condenser, specimen, objective, projective lens, screen.

Scanning electron microscopy · Q859–874

Q859 · Easy · *codex, slides 432 to 434*

What is the SEM used to look at?

1. The surface of a solid specimen
2. The inside of an ultrathin section
3. Living cells in water
4. The colour of a dye

✓ **Answer: A** — The SEM looks at the surface of a solid specimen.

A: The SEM looks at the surface of a solid specimen.
B: That is the TEM. The right answer is: The surface of a solid specimen.
C: Living cells cannot be imaged. The right answer is: The surface of a solid specimen.
D: It does not show colour. The right answer is: The surface of a solid specimen.

Q860 · Easy · *codex, slides 432 to 434*

Up to what magnification can an SEM reach, according to the lecture?

1. 100,000×
2. 1,000×
3. 10,000,000×
4. 30×

✓ **Answer: A** — SEM magnifications reach up to 100,000×.

A: SEM magnifications reach up to 100,000×.
B: This is a light microscope range.
C: This is far too high. The right answer is: 100,000×.
D: This is a dissecting microscope range.

Q861 · Easy · *codex, slides 432 to 434*

What does the large depth of field in SEM produce?

1. Attractive 3D-looking images
2. Flat two-dimensional images only
3. Coloured images
4. Dark blank images

✓ **Answer: A** — It gives three-dimensional-looking images.

A: It gives three-dimensional-looking images. It matches what the lecture slides state.
B: It produces 3D-looking images. The right answer is: Attractive 3D-looking images.
C: SEM images are not coloured. The right answer is: Attractive 3D-looking images.
D: It produces detailed images. The right answer is: Attractive 3D-looking images.

Q862 · Easy · *codex, slides 432 to 434*

What does the SEM use instead of light to form an image?

1. Electrons
2. Ultraviolet rays
3. Sound waves
4. X-rays

✓ **Answer: A** — The SEM uses electrons.

A: The SEM uses electrons. It matches what the lecture slides state.
B: This is a UV microscope. The right answer is: Electrons.
C: This is not stated. The right answer is: Electrons.
D: This is not stated. The right answer is: Electrons.

Q863 · Easy · *codex, slides 432 to 434*

About what magnification does conventional light microscopy reach, according to the lecture?

1. About 20×
2. About 2,000×
3. About 200,000×
4. About 20,000×

✓ **Answer: B** — It reaches about 2,000×.

A: This is far too low. The right answer is: About 2,000×.
B: It reaches about 2,000×. It matches what the lecture slides state.
C: This is far too high. The right answer is: About 2,000×.
D: This is ten times too high.

Q864 · Easy · *codex, slides 432 to 434*

What does the SEM image of pollen show?

1. A flat stained thin section
2. A very attractive 3D-looking image
3. A set of green fluorescent dots
4. A blank dark field of view

✓ **Answer: B** — The image looks three-dimensional.

A: This is not stated. The right answer is: A very attractive 3D-looking image.
B: The image looks three-dimensional. It matches what the lecture slides state.
C: This is not stated. The right answer is: A very attractive 3D-looking image.
D: This is not stated. The right answer is: A very attractive 3D-looking image.

Q865 · Medium · *codex, slides 432 to 434*

What is the usual resolution of the SEM in the lecture?

1. About 0.2 nm
2. About 10 nm
3. About 240 nm
4. About 10 µm

✓ **Answer: B** — The resolution is usually about 10 nm.

A: This is the TEM figure. The right answer is: About 10 nm.
B: The resolution is usually about 10 nm.
C: This is the light microscope limit.
D: This is 1,000 times too coarse.

Q866 · Medium · *codex, slides 432 to 434*

At what magnification is the 10 nm resolution quoted?

1. 20,000×
2. 2,000×
3. 200×
4. 200,000×

✓ **Answer: A** — It is quoted with 20,000× magnification.

A: It is quoted with 20,000× magnification.
B: This is ten times too low.
C: This is far too low. The right answer is: 20,000×.
D: This is ten times too high.

Q867 · Medium · *codex, slides 432 to 434*

What does a large field of focus allow in SEM?

1. Only a tiny spot to be in focus
2. The whole sample to be stained
3. Much of the sample in focus at once
4. The beam to be turned off at once in this case

✓ **Answer: C** — Much of the sample is sharp together.

A: It allows a large area. The right answer is: A large amount of the sample to be in focus at once.
B: This is not related. The right answer is: A large amount of the sample to be in focus at once.
C: Much of the sample is sharp together.
D: This is not related. The right answer is: A large amount of the sample to be in focus at once.

Q868 · Medium · *codex, slides 432 to 434*

Why can SEM reveal details that light microscopy cannot resolve?

1. Electrons have a much shorter wavelength
2. Electrons are heavier than light
3. The SEM uses a much larger lamp
4. The SEM uses much thicker sections

✓ **Answer: A** — Shorter wavelength improves resolution.

A: Shorter wavelength improves resolution. It matches what the lecture slides state.
B: This is not the reason. The right answer is: The shorter wavelength of electrons gives higher resolution.
C: It has no lamp. The right answer is: The shorter wavelength of electrons gives higher resolution.
D: It images surfaces. The right answer is: The shorter wavelength of electrons gives higher resolution.

Q869 · Medium · *codex, slides 432 to 434*

Why is the SEM one of the most heavily used instruments in research?

1. It is cheap, portable and simple to run
2. It needs no vacuum in its column at all
3. It shows living cells in true colour
4. It combines magnification, depth and resolution

✓ **Answer: D** — These advantages are listed.

A: This is not stated. The right answer is: It combines high magnification, large depth of focus, high resolution and ease of observation.
B: This is not stated. The right answer is: It combines high magnification, large depth of focus, high resolution and ease of observation.
C: This is not stated. The right answer is: It combines high magnification, large depth of focus, high resolution and ease of observation.
D: These advantages are listed. It matches what the lecture slides state.

Q870 · Medium · *codex, slides 432 to 434*

What happens to complex three-dimensional objects in an SEM?

1. They remain sharp and in focus
2. They appear flat
3. They are destroyed instantly in practice
4. They are turned inside out

✓ **Answer: A** — The depth of field keeps them in focus.

A: The depth of field keeps them in focus.
B: They appear three-dimensional. The right answer is: They remain sharp and in focus.
C: This is not stated. The right answer is: They remain sharp and in focus.
D: This is not described. The right answer is: They remain sharp and in focus.

Q871 · Hard · *codex, slides 432 to 434*

Which is a stated advantage of the SEM over the light microscope?

1. A greater depth of field
2. A longer wavelength of illumination
3. A glass lens system
4. A lower magnification limit

✓ **Answer: A** — SEM gives greater depth of field.

A: SEM gives greater depth of field.
B: Electrons have a shorter wavelength. The right answer is: A greater depth of field.
C: SEMs use magnetic lenses. The right answer is: A greater depth of field.
D: SEM reaches higher magnification. The right answer is: A greater depth of field.

Q872 · Hard · *codex, slides 432 to 434*

All of the following are advantages of the SEM over the light microscope EXCEPT which one?

1. It has a larger depth of field
2. It views living specimens in water
3. It reaches higher magnification
4. It resolves finer detail

✓ **Answer: B** — Correct choice.

A: This is an advantage. The right answer is: It views living specimens in water.
B: Correct choice. Living specimens are not viewed.
C: This is an advantage. The right answer is: It views living specimens in water.
D: This is an advantage. The right answer is: It views living specimens in water.

Q873 · Hard · *codex, slides 432 to 434*

Which statement correctly contrasts TEM and SEM?

1. TEM images ultrathin sections, SEM images solid surfaces
2. TEM images solid surfaces, whereas SEM images ultrathin sections
3. Both image living cells in a water drop
4. Both use glass lenses and a bright lamp

✓ **Answer: A** — These are their uses.

A: These are their uses. It matches what the lecture slides state.
B: The uses are swapped. The right answer is: TEM passes electrons through ultrathin sections, whereas SEM images the surface of solid specimens.
C: Neither images living cells. The right answer is: TEM passes electrons through ultrathin sections, whereas SEM images the surface of solid specimens.
D: Both use magnetic lenses and electrons.

Q874 · Devil · *codex, slides 432 to 434*

The SEM reaches 100,000× and the light microscope about 2,000×. How many times greater is the SEM limit?

1. 5 times
2. 500 times
3. 50 times
4. 200 times

✓ **Answer: C** — 100,000 divided by 2,000 is 50.

A: This is ten times too small.
B: This is ten times too large.
C: 100,000 divided by 2,000 is 50.
D: This is not the ratio. The right answer is: 50 times.

The magnetic lens system · Q875–882

Q875 · Easy · *codex, slides 439 to 440*

What does the condenser lens control in the electron microscope?

1. The colour of the electrons
2. The thickness of the section
3. The intensity of the electron beam
4. The vacuum level in the column

✓ **Answer: C** — It controls the beam intensity.

A: This is not stated. The right answer is: The intensity of the electron beam reaching the specimen.
B: This is not controlled by the lens.
C: It controls the beam intensity.
D: This is not stated. The right answer is: The intensity of the electron beam reaching the specimen.

Q876 · Easy · *codex, slides 439 to 440*

What do the scanning coils do?

1. Heat the specimen to dryness
2. Cut thin sections of tissue
3. Stain the sample with dye
4. Deflect the beam in x and y

✓ **Answer: D** — They deflect the beam in x and y.

A: This is not stated. The right answer is: Deflect the beam in the x and y axes.
B: This is not stated. The right answer is: Deflect the beam in the x and y axes.
C: This is not stated. The right answer is: Deflect the beam in the x and y axes.
D: They deflect the beam in x and y.

Q877 · Easy · *codex, slides 439 to 440*

What is the objective lens aperture used for?

1. To add colour to the image
2. To cool the specimen down
3. To raise the voltage applied
4. To exclude scattered electrons

✓ **Answer: D** — It excludes extraneous electrons.

A: This is not stated. The right answer is: To reduce or exclude scattered electrons.
B: This is not stated. The right answer is: To reduce or exclude scattered electrons.
C: This is not stated. The right answer is: To reduce or exclude scattered electrons.
D: It excludes extraneous electrons. It matches what the lecture slides state.

Q878 · Medium · *codex, slides 439 to 440*

What does the objective lens do to the electron beam?

1. It stains the specimen slightly
2. It focuses it on the specimen
3. It deflects it in the x and y axes
4. It controls its intensity

✓ **Answer: B** — It focuses (de-magnifies) the beam on the specimen.

A: This is not its role. The right answer is: It brings it into focus on the specimen.
B: It focuses (de-magnifies) the beam on the specimen.
C: That is the scanning coils. The right answer is: It brings it into focus on the specimen.
D: That is the condenser lens. The right answer is: It brings it into focus on the specimen.

Q879 · Medium · *codex, slides 439 to 440*

Where are the scanning coils found?

1. Above the electron gun
2. Below the condenser lens
3. Inside the specimen
4. At the screen

✓ **Answer: B** — They are below the condenser system.

A: This is not stated. The right answer is: Below the condenser lens, associated with the objective lens area.
B: They are below the condenser system.
C: This is not stated. The right answer is: Below the condenser lens, associated with the objective lens area.
D: This is not stated. The right answer is: Below the condenser lens, associated with the objective lens area.

Q880 · Medium · *codex, slides 439 to 440*

How does the beam move across the sample?

1. As a single fixed spot of light
2. As a flood over the whole stage
3. As lines of dwell times across an area
4. As rotating rings of electrons

✓ **Answer: C** — The beam spot moves in lines across the area.

A: It moves across the area. The right answer is: As lines of consecutive dwell times across a rectangular area.
B: It is a beam spot. The right answer is: As lines of consecutive dwell times across a rectangular area.
C: The beam spot moves in lines across the area.
D: This is not described. The right answer is: As lines of consecutive dwell times across a rectangular area.

Q881 · Hard · *codex, slides 439 to 440*

Which parts form the magnetic lens system of the electron microscope?

1. Eyepiece, stage, diaphragm and clip
2. Cathode, anode, screen and a coil
3. Glass slide, coverslip, oil and clip
4. Condenser lens, objective lens and coils

✓ **Answer: D** — These are the parts listed.

A: These are light microscope parts. The right answer is: Condenser lens, objective lens and scanning coils.
B: These are not the lens system.
C: These are not the lens system.
D: These are the parts listed.

Q882 · Hard · *codex, slides 439 to 440*

All of the following are functions of the magnetic lens system EXCEPT which one?

1. The condenser lens controls beam intensity
2. The objective lens focuses the beam on the specimen
3. The aperture excludes scattered electrons
4. The condenser lens deflects the beam in the x and y axes

✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: The condenser lens deflects the beam in the x and y axes.
B: This is true. The right answer is: The condenser lens deflects the beam in the x and y axes.
C: This is true. The right answer is: The condenser lens deflects the beam in the x and y axes.
D: Correct choice. The scanning coils deflect the beam.

Light versus electron microscope · Q883–892

Q883 · Easy · *codex, slides 442, 474*

Air fills the interior of which instrument?

1. The electron microscope
2. The scanning electron microscope
3. The transmission electron microscope
4. The light microscope

✓ **Answer: D** — The light microscope is air-filled.

A: It is under vacuum. The right answer is: The light microscope.
B: It is under vacuum. The right answer is: The light microscope.
C: It is under vacuum. The right answer is: The light microscope.
D: The light microscope is air-filled.

Q884 · Easy · *codex, slides 442, 474*

Which microscope uses glass lenses?

1. The light microscope
2. The electron microscope
3. The TEM
4. The SEM

✓ **Answer: A** — It uses glass lenses.

A: It uses glass lenses. It matches what the lecture slides state.
B: It uses magnets. The right answer is: The light microscope.
C: It uses magnets. The right answer is: The light microscope.
D: It uses magnets. The right answer is: The light microscope.

Q885 · Easy · *codex, slides 442, 474*

Which instrument works with its interior under vacuum?

1. The light microscope
2. The dissecting microscope
3. The dark-field microscope
4. The electron microscope

> ✓ **Answer: D** — It operates under vacuum.

A: It is air-filled. The right answer is: The electron microscope.
B: It is air-filled. The right answer is: The electron microscope.
C: It is air-filled. The right answer is: The electron microscope.
D: It operates under vacuum. It matches what the lecture slides state.

Q886 · Easy · *codex, slides 442, 474*

Which microscope gives monochrome images?

1. The electron microscope
2. The light microscope
3. The phase-contrast microscope
4. The stereo microscope

> ✓ **Answer: A** — Colours are not visible in EM.

A: Colours are not visible in EM.
B: Colours are visible. The right answer is: The electron microscope.
C: It is a light microscope. The right answer is: The electron microscope.
D: It is a light microscope. The right answer is: The electron microscope.

Q887 · Medium · *codex, slides 442, 474*

What are the maximum resolving powers of the light and electron microscopes?

1. About 0.2 nm and 240 nm
2. About 24 nm and 2 nm
3. About 240 nm and 0.2 nm
4. About 2400 nm and 20 nm

> ✓ **Answer: C** — These are the maximum resolving powers.

A: These are swapped. The right answer is: About 240 nm and 0.2 nm.
B: These are not the values. The right answer is: About 240 nm and 0.2 nm.
C: These are the maximum resolving powers.
D: These are not the values. The right answer is: About 240 nm and 0.2 nm.

Q888 · Medium · *codex, slides 442, 474*

What magnification range does the electron microscope offer?

1. ×30 to ×1,500
2. ×3 to ×30
3. ×1,000 to ×1,500
4. ×300 to ×500,000

✓ **Answer: D** — This is the stated range.

A: This is a light microscope range.
B: This is a dissecting range. The right answer is: ×300 to ×500,000.
C: This is the light microscope. The right answer is: ×300 to ×500,000.
D: This is the stated range.

Q889 · Medium · *codex, slides 442, 474*

What radiation source does the electron microscope use?

1. A quartz halogen lamp bulb
2. A mercury arc lamp source
3. A high-voltage tungsten source
4. A xenon flash tube lamp

✓ **Answer: C** — It uses a high-voltage tungsten source.

A: This is the light microscope source.
B: This is a fluorescence source. The right answer is: A high-voltage tungsten source.
C: It uses a high-voltage tungsten source.
D: This is not stated. The right answer is: A high-voltage tungsten source.

Q890 · Medium · *codex, slides 442, 474*

How can specimens be prepared for the light microscope?

1. Only as dehydrated dead tissue
2. Only as ultrathin resin sections
3. Only as deeply frozen blocks
4. As temporary mounts, living or dead

✓ **Answer: D** — Living or dead specimens can be mounted.

A: This is the electron microscope. The right answer is: As temporary mounts of living or dead material.
B: This is the electron microscope. The right answer is: As temporary mounts of living or dead material.
C: This is not stated. The right answer is: As temporary mounts of living or dead material.
D: Living or dead specimens can be mounted.

Q891 · Hard · *codex, slides 442, 474*

Which row correctly compares light and electron microscope preparation?

1. Fixation: OsO_4 versus alcohol; embedding: resin versus wax
2. Fixation: none versus alcohol; embedding: wax versus gelatin
3. Fixation: alcohol versus OsO_4 or $KMnO_4$; embedding: wax versus resin
4. Fixation: alcohol versus alcohol; embedding: wax versus wax

✓ **Answer: C** — These are the stated differences.

A: These are swapped. The right answer is: Fixation: alcohol versus OsO_4 or $KMnO_4$; embedding: wax versus resin.
B: These are not stated. The right answer is: Fixation: alcohol versus OsO_4 or $KMnO_4$; embedding: wax versus resin.
C: These are the stated differences.
D: They differ. The right answer is: Fixation: alcohol versus OsO_4 or $KMnO_4$; embedding: wax versus resin.

Q892 · Hard · *codex, slides 442, 474*

All of the following distinguish the electron microscope from the light microscope EXCEPT which one?

1. It uses a vacuum interior
2. It has a fluorescent screen for viewing
3. It uses a glass lens system
4. It has far greater resolving power

✓ **Answer: C** — Correct choice.

A: This is a difference. The right answer is: It uses a glass lens system.
B: This is a difference. The right answer is: It uses a glass lens system.
C: Correct choice. It uses magnetic lenses.
D: This is a difference. The right answer is: It uses a glass lens system.

Fixation · Q893–906

Q893 · Easy · *codex, slides 445 to 449*

How many steps does fixation consist of?

1. One
2. Three
3. Four
4. Two

✓ **Answer: D** — Fixation has two steps.

A: It has two steps. The right answer is: Two.
B: It has two steps. The right answer is: Two.
C: It has two steps. The right answer is: Two.
D: Fixation has two steps. It matches what the lecture slides state.

Q894 · Easy · *codex, slides 445 to 449*

Which agent fixes tissue by freezing it very rapidly?

1. Formaldehyde
2. Xylene
3. Paraffin wax
4. Liquid nitrogen

✓ **Answer: D** — Liquid nitrogen is a physical fixative.

A: This is a chemical fixative. The right answer is: Liquid nitrogen.
B: This is a clearing agent. The right answer is: Liquid nitrogen.
C: This is an embedding medium. The right answer is: Liquid nitrogen.
D: Liquid nitrogen is a physical fixative.

Q895 · Easy · *codex, slides 445 to 449*

What is the temperature of liquid nitrogen?

1. −20 °C in practice
2. −196 °C
3. 0 °C
4. 37 °C

✓ **Answer: B** — Liquid nitrogen is at −196 °C.

A: This is the freezing microtome temperature.
B: Liquid nitrogen is at −196 °C.
C: This is the freezing point of water.
D: This is body temperature. The right answer is: −196 °C.

Q896 · Easy · *codex, slides 445 to 449*

Which chemicals fix proteins for electron microscopy?

1. Osmium tetroxide and permanganate
2. Acetic acid and chromic acid
3. Xylene and ethanol
4. Formaldehyde and glutaraldehyde

✓ **Answer: D** — They fix proteins.

A: They fix lipids. The right answer is: Formaldehyde and glutaraldehyde.
B: These are used for light microscopy.
C: These are not fixatives. The right answer is: Formaldehyde and glutaraldehyde.
D: They fix proteins. It matches what the lecture slides state.

Q897 · Easy · *codex, slides 445 to 449*

Which chemicals fix lipids for electron microscopy?

1. Formaldehyde and glutaraldehyde
2. Osmium tetroxide and permanganate
3. Acetone, alcohol and acetic acid as a rule
4. Xylene, ethanol and paraffin wax

✓ **Answer: B** — They fix lipids.

A: They fix proteins. The right answer is: Osmium tetroxide and potassium permanganate.
B: They fix lipids. It matches what the lecture slides state.
C: These are light microscopy fixatives. The right answer is: Osmium tetroxide and potassium permanganate.
D: These are not fixatives. The right answer is: Osmium tetroxide and potassium permanganate.

Q898 · Medium · *codex, slides 445 to 449*

What does fixation prevent in the tissue?

1. Autolysis
2. Staining
3. Sectioning
4. Dehydration

✓ **Answer: A** — Fixation prevents autolysis.

A: Fixation prevents autolysis. It matches what the lecture slides state.
B: It does not prevent staining. The right answer is: Autolysis.
C: It does not prevent sectioning. The right answer is: Autolysis.
D: It does not prevent dehydration. The right answer is: Autolysis.

Q899 · Medium · *codex, slides 445 to 449*

What else must tissue be protected from during fixation?

1. Exposure to light
2. Contact with glass
3. Bacterial or fungal attack
4. Staining dyes

✓ **Answer: C** — Fixation protects against microbes.

A: This is not stated. The right answer is: Bacterial or fungal attack.
B: This is not stated. The right answer is: Bacterial or fungal attack.
C: Fixation protects against microbes. It matches what the lecture slides state.
D: This is not stated. The right answer is: Bacterial or fungal attack.

Q900 · Medium · *codex, slides 445 to 449*

Why does physical fixation freeze the tissue so rapidly?

1. So that the tissue turns to paraffin
2. So that the stain sticks better
3. So disruptive ice crystals do not form
4. So that the tissue becomes transparent

✓ **Answer: C** — Rapid freezing avoids ice crystals.

A: This is not the reason. The right answer is: So that disruptive ice crystals do not form.
B: This is not the reason. The right answer is: So that disruptive ice crystals do not form.
C: Rapid freezing avoids ice crystals.
D: This is not the reason. The right answer is: So that disruptive ice crystals do not form.

Q901 · Medium · *codex, slides 445 to 449*

What happens to frozen tissue if it is brought to room temperature?

1. It becomes permanently fixed
2. It rapidly undergoes autolysis
3. It turns into hard wax
4. It becomes stained blue

✓ **Answer: B** — It is fixed only while frozen.

A: It is fixed only while frozen.
B: It is fixed only while frozen.
C: This is not stated. The right answer is: It rapidly undergoes autolysis.
D: This is not stated. The right answer is: It rapidly undergoes autolysis.

Q902 · Medium · *codex, slides 445 to 449*

What must be done to keep permanent preparations of frozen sections?

1. They must be heated
2. They must be dried in air
3. They must be chemically fixed
4. They must be embedded in xylene

✓ **Answer: C** — Permanent preparations need chemical fixation.

A: This is not stated. The right answer is: They must be chemically fixed.
B: This is not stated. The right answer is: They must be chemically fixed.
C: Permanent preparations need chemical fixation.
D: This is not stated. The right answer is: They must be chemically fixed.

Q903 · Medium · *codex, slides 445 to 449*

Which components do chemical fixatives stabilise?

1. Only water
2. Proteins and lipids
3. Only ions
4. Only dyes

> ✓ **Answer: B** — These are the major structural components.

A: This is not stated. The right answer is: Proteins and lipids.
B: These are the major structural components.
C: This is not stated. The right answer is: Proteins and lipids.
D: This is not stated. The right answer is: Proteins and lipids.

Q904 · Hard · *codex, slides 445 to 449*

All of the following are fixatives used for light microscopy EXCEPT which one?

1. Osmium tetroxide
2. Acetic acid
3. Mercuric chloride
4. Formaldehyde

> ✓ **Answer: A** — Correct choice.

A: Correct choice. It is used for electron microscopy.
B: This is used for light microscopy.
C: This is used for light microscopy.
D: This is used for light microscopy.

Q905 · Hard · *codex, slides 445 to 449*

Which are fixatives used for electron microscopy? 1. Glutaraldehyde. 2. Osmium tetroxide. 3. Acetic acid. 4. Potassium permanganate.

1. 1 and 2 only
2. 1, 2 and 4 only
3. 2, 3 and 4 only
4. 1, 3 and 4 only

> ✓ **Answer: B** — Glutaraldehyde, osmium tetroxide and potassium permanganate are used; acetic acid is a light microscopy fixative.

A: This leaves out potassium permanganate, which is also used.
B: Glutaraldehyde, osmium tetroxide and potassium permanganate are used; acetic acid is a light microscopy fixative.
C: Acetic acid is a light microscopy fixative and this omits glutaraldehyde.
D: Acetic acid is a light microscopy fixative and this omits osmium tetroxide.

Q906 · Devil · *codex, slides 445 to 449*

A researcher freezes tissue in liquid nitrogen and cuts frozen sections, but wants permanent slides for next year. What must be done?

1. Leave them at room temperature, because freezing has fixed them permanently
2. Embed them in dry ice, because ice is a permanent fixative
3. Chemically fix the sections, because frozen tissue is fixed only while frozen
4. Soak them in xylene, because xylene is a fixative

✓ **Answer: C** — Permanent preparations need chemical fixation.

A: Frozen tissue autolyses when warmed. The right answer is: Chemically fix the sections, because frozen tissue is fixed only while frozen.
B: This is not stated. The right answer is: Chemically fix the sections, because frozen tissue is fixed only while frozen.
C: Permanent preparations need chemical fixation.
D: Xylene is a clearing agent. The right answer is: Chemically fix the sections, because frozen tissue is fixed only while frozen.

Embedding · Q907–924

Q907 · Easy · *codex, slides 450 to 458*

What is the most frequently used embedding matrix for light microscopy?

1. Epoxy resin at that stage
2. Agar jelly
3. Gelatin
4. Paraffin wax

✓ **Answer: D** — Paraffin wax is the most frequently used matrix.

A: This is for electron microscopy. The right answer is: Paraffin wax.
B: This is not stated. The right answer is: Paraffin wax.
C: This is not stated. The right answer is: Paraffin wax.
D: Paraffin wax is the most frequently used matrix.

Q908 · Easy · *codex, slides 450 to 458*

Why must tissue be dehydrated before paraffin embedding?

1. Paraffin is far too thick
2. Paraffin and water do not mix
3. Tissue is too transparent
4. Water is itself a stain

✓ **Answer: B** — Paraffin does not mix with water.

A: This is not the reason. The right answer is: Paraffin is immiscible with water.
B: Paraffin does not mix with water.
C: This is not the reason. The right answer is: Paraffin is immiscible with water.
D: This is not the reason. The right answer is: Paraffin is immiscible with water.

Q909 · Easy · *codex, slides 450 to 458*

Which clearing agent removes the ethanol?

1. Xylene
2. Propylene oxide
3. Formaldehyde
4. Osmium tetroxide

✓ **Answer: A** — Xylene is the usual clearing agent.

A: Xylene is the usual clearing agent.
B: This is the resin solvent. The right answer is: Xylene.
C: This is a fixative. The right answer is: Xylene.
D: This is a fixative. The right answer is: Xylene.

Q910 · Easy · *codex, slides 450 to 458*

What is the typical thickness of paraffin sections for light microscopy?

1. 5 nm
2. 50 µm
3. 5 µm
4. 5 mm

✓ **Answer: C** — Paraffin sections are typically 5 µm.

A: This is 1,000 times too thin.
B: This is ten times too thick.
C: Paraffin sections are typically 5 µm.
D: This is far too thick. The right answer is: 5 µm.

Q911 · Easy · *codex, slides 450 to 458*

Typical electron microscopy sections measure how thick?

1. 5 µm
2. 80 to 100 nm
3. 80 to 100 µm
4. 8 to 10 nm

✓ **Answer: B** — EM sections are typically 80 to 100 nm.

A: This is the light microscopy thickness.
B: EM sections are typically 80 to 100 nm.
C: This is 1,000 times too thick.
D: This is ten times too thin.

Q912 · Easy · *codex, slides 450 to 458*

Which materials are used to embed specimens for electron microscopy?

1. Paraffin wax
2. Raw carrot
3. Agar plates
4. Epoxy or acrylic resins

✓ **Answer: D** — Resins provide a harder matrix.

A: It is not hard enough. The right answer is: Epoxy or acrylic resins.
B: This supports thick plant sections. The right answer is: Epoxy or acrylic resins.
C: These are not stated. The right answer is: Epoxy or acrylic resins.
D: Resins provide a harder matrix.

Q913 · Easy · *codex, slides 450 to 458*

What does xylene replace during embedding?

1. The paraffin
2. The ethanol
3. The fixative
4. The stain

✓ **Answer: B** — Xylene replaces the ethanol.

A: Paraffin replaces xylene. The right answer is: The ethanol.
B: Xylene replaces the ethanol. It matches what the lecture slides state.
C: It does not replace the fixative.
D: It does not replace the stain.

Q914 · Medium · *codex, slides 450 to 458*

How is the tissue dehydrated before embedding?

1. With a single pure water bath
2. With stronger and stronger ethanol
3. With dry heat in an oven only
4. With acetone vapour in a jar only in this case

✓ **Answer: B** — Increasing ethanol concentrations are used.

A: Water is not a dehydrating agent.
B: Increasing ethanol concentrations are used.
C: This is not stated. The right answer is: With progressively more concentrated ethanol baths.
D: This is not stated. The right answer is: With progressively more concentrated ethanol baths.

Q915 · Medium · *codex, slides 450 to 458*

What replaces the xylene in the sample?

1. Molten paraffin wax
2. Propylene oxide
3. Absolute ethanol
4. Liquid nitrogen

> ✓ **Answer: A** — Molten paraffin infiltrates the sample.

A: Molten paraffin infiltrates the sample.
B: This is the resin solvent. The right answer is: Molten paraffin wax.
C: This comes before xylene. The right answer is: Molten paraffin wax.
D: This is a physical fixative. The right answer is: Molten paraffin wax.

Q916 · Medium · *codex, slides 450 to 458*

Which solvent replaces xylene in epoxy resin embedding?

1. Propylene oxide
2. Ethanol
3. Acetic acid
4. Formaldehyde

> ✓ **Answer: A** — Propylene oxide is the resin solvent.

A: Propylene oxide is the resin solvent.
B: This is the dehydrating agent. The right answer is: Propylene oxide.
C: This is a fixative. The right answer is: Propylene oxide.
D: This is a fixative. The right answer is: Propylene oxide.

Q917 · Medium · *codex, slides 450 to 458*

How is the resin-impregnated specimen polymerised?

1. By baking it in an oven
2. By freezing it in liquid nitrogen
3. By soaking it in xylene
4. By staining it with eosin

> ✓ **Answer: A** — The specimen is baked in an oven.

A: The specimen is baked in an oven.
B: This is a fixation method. The right answer is: By baking it in an oven.
C: This is not stated. The right answer is: By baking it in an oven.
D: This is not stated. The right answer is: By baking it in an oven.

Q918 · Medium · *codex, slides 450 to 458*

Why does too thick a section give a poor electron micrograph?

1. Electrons pass through without any scatter
2. The section turns into wax
3. Electrons scatter, giving poor contrast
4. The vacuum absorbs the beam

✓ **Answer: C** — Thick sections scatter all electrons.

A: They are scattered. The right answer is: Electrons are scattered, giving poor contrast and loss of detail.
B: This is not stated. The right answer is: Electrons are scattered, giving poor contrast and loss of detail.
C: Thick sections scatter all electrons.
D: This is not the reason. The right answer is: Electrons are scattered, giving poor contrast and loss of detail.

Q919 · Medium · *codex, slides 450 to 458*

What are raw carrot and unripe pawpaw used for?

1. Staining thin animal sections
2. Supporting thick plant sections
3. Fixing tissue in the cold
4. Cutting ultrathin resin sections

✓ **Answer: B** — They sandwich thick plant specimens.

A: This is not stated. The right answer is: Supporting relatively thick plant sections.
B: They sandwich thick plant specimens.
C: This is not stated. The right answer is: Supporting relatively thick plant sections.
D: This is not stated. The right answer is: Supporting relatively thick plant sections.

Q920 · Medium · *codex, slides 450 to 458*

Why are samples embedded in a matrix?

1. To solidify them for fine sectioning
2. To make them strongly magnetic
3. To dissolve them in warm water
4. To turn them into resin only

✓ **Answer: A** — Thin slices improve access and reduce overlay.

A: Thin slices improve access and reduce overlay.
B: This is not stated. The right answer is: To solidify them for fine sectioning and improve access of dyes and antibodies.
C: This is not stated. The right answer is: To solidify them for fine sectioning and improve access of dyes and antibodies.
D: This is not stated. The right answer is: To solidify them for fine sectioning and improve access of dyes and antibodies.

Q921 · Hard · *codex, slides 450 to 458*

Which sequence is correct for preparing a paraffin section?

1. Clearing, fixation, dehydration, then infiltration
2. Fixation, dehydration, clearing, then infiltration with wax
3. Infiltration, clearing, dehydration, then fixation
4. Dehydration, infiltration, fixation, then clearing

✓ **Answer: B** — This is the processing order.

A: The order is wrong. The right answer is: Fixation, dehydration, clearing, then infiltration with wax.
B: This is the processing order.
C: This reverses the order. The right answer is: Fixation, dehydration, clearing, then infiltration with wax.
D: The order is wrong. The right answer is: Fixation, dehydration, clearing, then infiltration with wax.

Q922 · Hard · *codex, slides 450 to 458*

Why is paraffin unsuitable for electron microscopy sections?

1. It is far too expensive to use
2. It is too transparent to electrons
3. It dissolves in the epoxy resin
4. It is not hard enough for 80 nm slices

✓ **Answer: D** — It does not provide a sufficiently hard matrix.

A: This is not the reason. The right answer is: It is not hard enough to cut the 80 to 100 nm slices needed.
B: This is not the reason. The right answer is: It is not hard enough to cut the 80 to 100 nm slices needed.
C: This is not the reason. The right answer is: It is not hard enough to cut the 80 to 100 nm slices needed.
D: It does not provide a sufficiently hard matrix.

Q923 · Hard · *codex, slides 450 to 458*

All of the following are used in the embedding procedure for light microscopy EXCEPT which one?

1. Ethanol
2. Propylene oxide
3. Xylene
4. Molten paraffin wax

✓ **Answer: B** — Correct choice.

A: It is used for dehydration. The right answer is: Propylene oxide.
B: Correct choice. It is the solvent for resin embedding.
C: It is used for clearing. The right answer is: Propylene oxide.
D: It infiltrates the sample. The right answer is: Propylene oxide.

Q924 · Devil · *codex, slides 450 to 458*

A light microscopy section is 5 µm thick and an electron microscopy section is 50 nm. How many times thicker is the light microscopy section?

1. 10 times
2. 1,000 times
3. 100 times
4. 50 times

> ✓ **Answer: C** — 5,000 nm divided by 50 nm is 100.

A: This is ten times too small.
B: This is ten times too large.
C: 5,000 nm divided by 50 nm is 100.
D: This is not the ratio. The right answer is: 100 times.

Sectioning · Q925–934

Q925 · Easy · *codex, slides 459 to 460*

Which instrument is used to cut thin sections?

1. A microtome
2. A centrifuge
3. A homogenizer
4. A spectrophotometer

> ✓ **Answer: A** — A microtome cuts sections.

A: A microtome cuts sections. It matches what the lecture slides state.
B: This separates fractions. The right answer is: A microtome.
C: This disrupts cells. The right answer is: A microtome.
D: This measures absorbance. The right answer is: A microtome.

Q926 · Easy · *codex, slides 459 to 460*

Which cutting edge is used for wax-embedded specimens?

1. A steel razor
2. A diamond knife
3. A glass knife
4. A laser blade

> ✓ **Answer: A** — A steel razor cuts wax-embedded specimens.

A: A steel razor cuts wax-embedded specimens.
B: This is for araldite. The right answer is: A steel razor.
C: This is for araldite. The right answer is: A steel razor.
D: This is not stated. The right answer is: A steel razor.

Q927 · Easy · *codex, slides 459 to 460*

Which cutting edges are used for araldite-embedded specimens?

1. Steel razors
2. Glass or diamond knives
3. Plastic blades
4. Wooden blades

✓ **Answer: B** — Glass or diamond knives cut araldite.

A: These are for wax. The right answer is: Glass or diamond knives.
B: Glass or diamond knives cut araldite.
C: These are not stated. The right answer is: Glass or diamond knives.
D: These are not stated. The right answer is: Glass or diamond knives.

Q928 · Easy · *codex, slides 459 to 460*

What supports sections for electron microscopy?

1. A grid of fine copper strands
2. A glass slide
3. A wax block
4. A cover glass only

✓ **Answer: A** — Sections are mounted on copper grids.

A: Sections are mounted on copper grids.
B: This is for light microscopy. The right answer is: A grid of fine copper strands.
C: This is not the support. The right answer is: A grid of fine copper strands.
D: This is not stated. The right answer is: A grid of fine copper strands.

Q929 · Medium · *codex, slides 459 to 460*

Which three parts does every microtome have?

1. A lamp, a lens, a stage and a clip
2. Holder, cutting edge and thickness regulator
3. A gun, an anode, a screen and a coil
4. A pestle, a tube, a piston and a seal

✓ **Answer: B** — These are the parts of all microtomes.

A: These are light microscope parts. The right answer is: A specimen holder, a sharp cutting edge and a thickness regulator.
B: These are the parts of all microtomes.
C: These are electron microscope parts. The right answer is: A specimen holder, a sharp cutting edge and a thickness regulator.
D: These are homogenizer parts. The right answer is: A specimen holder, a sharp cutting edge and a thickness regulator.

Q930 · Medium · *codex, slides 459 to 460*

At what temperature is a freezing microtome maintained?

1. −20 °C
2. −196 °C
3. 0 °C
4. 37 °C

✓ **Answer: A** — Frozen specimens are cut at −20 °C.

A: Frozen specimens are cut at −20 °C.
B: This is liquid nitrogen. The right answer is: −20 °C.
C: This is not the stated temperature.
D: This is body temperature. The right answer is: −20 °C.

Q931 · Medium · *codex, slides 459 to 460*

Light microscopy sections lie within what thickness range?

1. 50 to 100 nm
2. 10 to 20 nm
3. 1 to 2 mm
4. 1000 to 20,000 nm

✓ **Answer: D** — Light microscopy sections are 1000 to 20,000 nm.

A: This is for electron microscopy. The right answer is: 1000 to 20,000 nm.
B: This is far too thin. The right answer is: 1000 to 20,000 nm.
C: This is far too thick. The right answer is: 1000 to 20,000 nm.
D: Light microscopy sections are 1000 to 20,000 nm.

Q932 · Medium · *codex, slides 459 to 460*

How thin are sections cut for electron microscopy?

1. 1000 to 20,000 nm
2. 5 to 10 nm
3. 50 to 100 nm
4. 5 to 10 µm

✓ **Answer: C** — EM sections are 50 to 100 nm.

A: This is for light microscopy. The right answer is: 50 to 100 nm.
B: This is far too thin. The right answer is: 50 to 100 nm.
C: EM sections are 50 to 100 nm.
D: This is for light microscopy. The right answer is: 50 to 100 nm.

Q933 · Hard · *codex, slides 459 to 460*

Which pairing of embedding medium and cutting edge is correct?

1. Wax: steel razor; araldite: glass or diamond
2. Wax: diamond knife; araldite: steel razor
3. Wax: glass knife; araldite: plastic knife
4. Wax and araldite both: a steel razor

✓ **Answer: A** — These pairings are given.

A: These pairings are given. It matches what the lecture slides state.
B: The pairings are swapped. The right answer is: Wax: steel razor; araldite: glass or diamond knife.
C: Neither is correct. The right answer is: Wax: steel razor; araldite: glass or diamond knife.
D: Araldite needs glass or diamond. The right answer is: Wax: steel razor; araldite: glass or diamond knife.

Q934 · Hard · *codex, slides 459 to 460*

All of the following are used to mount sections EXCEPT which one?

1. A glass slide
2. A paraffin block
3. A copper grid
4. A grid of fine copper strands

✓ **Answer: B** — Correct choice.

A: It is used for light microscopy.
B: Correct choice. It is not a mount.
C: It is used for electron microscopy.
D: It is used for electron microscopy.

Staining for light microscopy · Q935–954

Q935 · Easy · *codex, slides 463 to 467, 470*

Why must thin sections usually be stained before examination?

1. They are too thick to stain
2. They are too dry to cut
3. They are too small to see
4. They are nearly transparent

✓ **Answer: D** — Thin sections are almost transparent.

A: They are thin. The right answer is: They are transparent or nearly so.
B: This is not the reason. The right answer is: They are transparent or nearly so.
C: This is not the reason. The right answer is: They are transparent or nearly so.
D: Thin sections are almost transparent.

Q936 · Easy · *codex, slides 463 to 467, 470*

Dyes with a negative charge are called what?

1. Basic dyes
2. Neutral dyes
3. Fixative dyes
4. Acidic dyes

✓ **Answer: D** — Acidic dyes carry a negative charge.

A: Basic dyes are positively charged. The right answer is: Acidic dyes.
B: These are neither. The right answer is: Acidic dyes.
C: These are not a stated group.
D: Acidic dyes carry a negative charge.

Q937 · Easy · *codex, slides 463 to 467, 470*

Which group of dyes carries a positive charge?

1. Acidic dyes
2. Neutral dyes
3. Fixative dyes
4. Basic dyes

✓ **Answer: D** — Basic dyes carry a positive charge.

A: Acidic dyes are negatively charged. The right answer is: Basic dyes.
B: These are neither. The right answer is: Basic dyes.
C: These are not a stated group.
D: Basic dyes carry a positive charge.

Q938 · Easy · *codex, slides 463 to 467, 470*

Which of these is an acidic dye?

1. Eosin
2. Crystal violet
3. Methylene blue
4. Safranin

✓ **Answer: A** — Eosin is an acidic dye.

A: Eosin is an acidic dye.
B: This is a basic dye. The right answer is: Eosin.
C: This is a basic dye. The right answer is: Eosin.
D: This is a basic dye. The right answer is: Eosin.

Q939 · Easy · *codex, slides 463 to 467, 470*

Which of these is a basic dye?

1. Crystal violet
2. Eosin
3. Nigrosine
4. India ink

> ✓ **Answer: A** — Crystal violet is a basic dye.

A: Crystal violet is a basic dye.
B: This is an acidic dye. The right answer is: Crystal violet.
C: This is an acidic dye. The right answer is: Crystal violet.
D: This is an acidic dye. The right answer is: Crystal violet.

Q940 · Easy · *codex, slides 463 to 467, 470*

Which stain colours cell nuclei blue in H&E?

1. Eosin
2. Giemsa
3. Safranin
4. Hematoxylin

> ✓ **Answer: D** — Hematoxylin stains nuclei blue.

A: Eosin stains cytoplasm pink. The right answer is: Hematoxylin.
B: This is a neutral dye. The right answer is: Hematoxylin.
C: This is a basic dye. The right answer is: Hematoxylin.
D: Hematoxylin stains nuclei blue. It matches what the lecture slides state.

Q941 · Easy · *codex, slides 463 to 467, 470*

What colour does eosin give the cytoplasm?

1. Red or shades of pink
2. Blue
3. Green
4. Yellow

> ✓ **Answer: A** — Eosin stains cytoplasm red or pink.

A: Eosin stains cytoplasm red or pink.
B: Hematoxylin stains nuclei blue. The right answer is: Red or shades of pink.
C: This is not stated. The right answer is: Red or shades of pink.
D: This is not stated. The right answer is: Red or shades of pink.

Q942 · Easy · *codex, slides 463 to 467, 470*

Giemsa stain is which kind of dye?

1. An acidic dye
2. A basic dye
3. A fluorescent dye
4. A neutral dye

✓ **Answer: D** — Giemsa is a neutral dye.

A: It is not acidic. The right answer is: A neutral dye.
B: It is not basic. The right answer is: A neutral dye.
C: This is not stated. The right answer is: A neutral dye.
D: Giemsa is a neutral dye.

Q943 · Medium · *codex, slides 463 to 467, 470*

Why are basic dyes most commonly used in bacteriology?

1. Bacterial cells are positively charged
2. Bacterial cells are electrically neutral in practice
3. Basic dyes are cheaper to buy
4. Bacterial surfaces are negatively charged

✓ **Answer: D** — Basic dyes bind negative charges.

A: They are negatively charged. The right answer is: The surfaces of bacterial cells are negatively charged.
B: They are negatively charged. The right answer is: The surfaces of bacterial cells are negatively charged.
C: This is not the reason. The right answer is: The surfaces of bacterial cells are negatively charged.
D: Basic dyes bind negative charges.

Q944 · Medium · *codex, slides 463 to 467, 470*

What do acidic dyes bind to?

1. Positively charged proteins
2. Negatively charged nucleic acids
3. Only to lipids in the membrane
4. Only to water in the cell

✓ **Answer: A** — Acidic dyes bind positive structures.

A: Acidic dyes bind positive structures.
B: This is for basic dyes. The right answer is: Positively charged cell structures such as some proteins.
C: This is not stated. The right answer is: Positively charged cell structures such as some proteins.
D: This is not stated. The right answer is: Positively charged cell structures such as some proteins.

Q945 · Medium · *codex, slides 463 to 467, 470*

What does hematoxylin react with primarily?

1. Negatively charged nucleic acids
2. Positively charged membrane lipids
3. Neutral sugars in the cytoplasm
4. Free water in the cytoplasm

✓ **Answer: A** — It reacts with nucleic acids in the nucleus.

A: It reacts with nucleic acids in the nucleus.
B: This is not stated. The right answer is: Negatively charged molecules such as nucleic acids.
C: This is not stated. The right answer is: Negatively charged molecules such as nucleic acids.
D: This is not stated. The right answer is: Negatively charged molecules such as nucleic acids.

Q946 · Medium · *codex, slides 463 to 467, 470*

What does eosin react with largely?

1. Nucleic acids in the nucleus
2. Cell wall cellulose fibres
3. Lipid droplets in the cytoplasm only as a rule
4. Basic groups present in the cytoplasm

✓ **Answer: D** — Eosin stains basic groups in the cytoplasm.

A: This is hematoxylin. The right answer is: Basic groups present in the cytoplasm.
B: This is not stated. The right answer is: Basic groups present in the cytoplasm.
C: This is not stated. The right answer is: Basic groups present in the cytoplasm.
D: Eosin stains basic groups in the cytoplasm.

Q947 · Medium · *codex, slides 463 to 467, 470*

Where did most commonly used light microscopy stains originate?

1. Aromatic dyes made for textiles
2. Mineral dyes from ground rocks
3. Dyes made for electron microscopy
4. Plant pigments from leaves only

✓ **Answer: A** — They were first produced for textiles.

A: They were first produced for textiles.
B: This is not stated. The right answer is: Organic aromatic dyes made for the textile industry.
C: This is not stated. The right answer is: Organic aromatic dyes made for the textile industry.
D: This is not stated. The right answer is: Organic aromatic dyes made for the textile industry.

Q948 · Medium · *codex, slides 463 to 467, 470*

What are acidic dyes used for in the microbiology laboratory?

1. Staining nucleic acids in the nucleus
2. Background staining (capsules)
3. Fixing bacteria to the slide
4. Embedding tissue in the wax

✓ **Answer: B** — They provide background staining.

A: Basic dyes do this. The right answer is: Background staining, such as capsule staining.
B: They provide background staining. It matches what the lecture slides state.
C: They do not fix. The right answer is: Background staining, such as capsule staining.
D: They do not embed. The right answer is: Background staining, such as capsule staining.

Q949 · Medium · *codex, slides 463 to 467, 470*

What do neutral dyes stain?

1. Nucleic acids and cytoplasm
2. Only lipids
3. Only cell walls
4. Only the nucleolus

✓ **Answer: A** — Neutral dyes stain both.

A: Neutral dyes stain both. It matches what the lecture slides state.
B: This is not stated. The right answer is: Nucleic acids and cytoplasm.
C: This is not stated. The right answer is: Nucleic acids and cytoplasm.
D: This is not stated. The right answer is: Nucleic acids and cytoplasm.

Q950 · Medium · *codex, slides 463 to 467, 470*

Which stains are routine for most animal tissues?

1. Crystal violet and safranin
2. Giemsa and methylene blue
3. India ink and nigrosine
4. Hematoxylin and eosin (H&E)

✓ **Answer: D** — H&E is the routine stain for most animal tissues.

A: These are bacteriology dyes. The right answer is: Hematoxylin and eosin (H&E).
B: These are not the routine pair.
C: These are acidic background stains. The right answer is: Hematoxylin and eosin (H&E).
D: H&E is the routine stain for most animal tissues.

Q951 · Hard · *codex, slides 463 to 467, 470*

Which dye is NOT a basic dye?

1. Crystal violet
2. Methylene blue
3. Eosin
4. Safranin

✓ **Answer: C** — Correct choice.

A: This is a basic dye. The right answer is: Eosin.
B: This is a basic dye. The right answer is: Eosin.
C: Correct choice. Eosin is an acidic dye.
D: This is a basic dye. The right answer is: Eosin.

Q952 · Hard · *codex, slides 463 to 467, 470*

Which statements about staining are correct? 1. Hematoxylin stains nuclei blue. 2. Eosin colours cytoplasm pink. 3. Acidic dyes are positively charged. 4. Basic dyes bind negatively charged molecules.

1. 1 and 2 only
2. 2, 3 and 4 only
3. 1, 2 and 4 only
4. 1, 3 and 4 only

✓ **Answer: C** — Statements 1, 2 and 4 are true; acidic dyes are negatively charged, so statement 3 is false.

A: This leaves out statement 4, which is also correct.
B: Statement 3 is false and this omits statement 1.
C: Statements 1, 2 and 4 are true; acidic dyes are negatively charged, so statement 3 is false.
D: Statement 3 is false because acidic dyes are negatively charged.

Q953 · Hard · *codex, slides 463 to 467, 470*

Why is H&E used as a starting point in histopathology?

1. It is the only dye that works on tissue
2. It makes all cells fluoresce brightly
3. It gives essential structural information
4. It fixes the tissue at the same time

✓ **Answer: C** — This is the stated reason.

A: This is not stated. The right answer is: It gives essential structural information, and many conditions can be diagnosed from it alone.
B: This is not stated. The right answer is: It gives essential structural information, and many conditions can be diagnosed from it alone.
C: This is the stated reason.
D: This is not stated. The right answer is: It gives essential structural information, and many conditions can be diagnosed from it alone.

Q954 · Devil · *codex, slides 463 to 467, 470*

A pathologist sees blue nuclei and pink cytoplasm in a skin section. Which dyes and which binding logic fit?

1. Eosin binds nucleic acids, and hematoxylin binds basic cytoplasmic groups
2. Hematoxylin binds nucleic acids, and eosin binds cytoplasm
3. Both dyes bind only lipids and fats
4. Both dyes bind only cellulose fibres

✓ **Answer: B** — This matches the staining mechanism.

A: The dyes are swapped. The right answer is: Hematoxylin binds negatively charged nucleic acids, and eosin binds basic cytoplasmic groups.
B: This matches the staining mechanism.
C: They bind other components. The right answer is: Hematoxylin binds negatively charged nucleic acids, and eosin binds basic cytoplasmic groups.
D: They do not bind cellulose. The right answer is: Hematoxylin binds negatively charged nucleic acids, and eosin binds basic cytoplasmic groups.

Staining for electron microscopy · Q955–968

Q955 · Easy · *codex, slides 471 to 473*

What must stains impart to sections in electron microscopy instead of colour?

1. Fluorescence
2. A pink tint
3. Contrast
4. Heat

✓ **Answer: C** — EM stains impart contrast.

A: This is not the aim. The right answer is: Contrast.
B: Electron images have no colour. The right answer is: Contrast.
C: EM stains impart contrast. It matches what the lecture slides state.
D: This is not stated. The right answer is: Contrast.

Q956 · Easy · *codex, slides 471 to 473*

Which two elements are used as stains in electron microscopy?

1. Lead and uranium
2. Carbon and hydrogen
3. Sodium and potassium
4. Oxygen and nitrogen

✓ **Answer: A** — Pb and uranium are used.

A: Pb and uranium are used.
B: These are low atomic number elements.
C: These are not stated. The right answer is: Lead and uranium.
D: These are low atomic number elements.

Q957 · Easy · *codex, slides 471 to 473*

Uranium binds preferentially to which molecules?

1. Lipids and membranes
2. Water and ions
3. Nucleic acids and proteins
4. Cellulose

> ✓ **Answer: C** — Uranium binds nucleic acids and proteins.

A: This is lead. The right answer is: Nucleic acids and proteins.
B: This is not stated. The right answer is: Nucleic acids and proteins.
C: Uranium binds nucleic acids and proteins.
D: This is not stated. The right answer is: Nucleic acids and proteins.

Q958 · Easy · *codex, slides 471 to 473*

Lead binds preferentially to which components?

1. Nucleic acids and proteins
2. Water
3. Glycogen
4. Lipids and membranes

> ✓ **Answer: D** — Lead binds lipids and membranes.

A: This is uranium. The right answer is: Lipids and membranes.
B: This is not stated. The right answer is: Lipids and membranes.
C: This is not stated. The right answer is: Lipids and membranes.
D: Lead binds lipids and membranes.

Q959 · Easy · *codex, slides 471 to 473*

Which stain imparts electron density to membranes and lipids?

1. Eosin
2. Hematoxylin
3. Osmium
4. Xylene

> ✓ **Answer: C** — Osmium imparts electron density to membranes and lipids.

A: This is a light microscopy dye.
B: This is a light microscopy dye.
C: Osmium imparts electron density to membranes and lipids.
D: This is a clearing agent. The right answer is: Osmium.

Q960 · Easy · *codex, slides 471 to 473*

What kind of background does negative staining produce?

1. A transparent background
2. A coloured background
3. A fluorescent background
4. An electron-dense background

> ✓ **Answer: D** — The background is electron dense.

A: The background is dense. The right answer is: An electron-dense background.
B: EM does not show colour. The right answer is: An electron-dense background.
C: This is not stated. The right answer is: An electron-dense background.
D: The background is electron dense.

Q961 · Medium · *codex, slides 471 to 473*

Why do unstained sections give faint, low-contrast images in EM?

1. Electrons are all absorbed by the resin
2. The resin is completely opaque
3. Electrons pass through unstained tissue
4. The beam is switched off midway

> ✓ **Answer: C** — Little contrast results.

A: They pass through. The right answer is: Electrons pass easily through the resin and the unstained tissue.
B: It is not opaque. The right answer is: Electrons pass easily through the resin and the unstained tissue.
C: Little contrast results. It matches what the lecture slides state.
D: This is not the reason. The right answer is: Electrons pass easily through the resin and the unstained tissue.

Q962 · Medium · *codex, slides 471 to 473*

Why do lead and uranium increase contrast?

1. They add colour to the final image
2. They cool the electron beam
3. High atomic number raises density
4. They shorten the wavelength

> ✓ **Answer: C** — High atomic number increases electron density.

A: EM images have no colour. The right answer is: They have high atomic numbers, which raises electron density.
B: This is not stated. The right answer is: They have high atomic numbers, which raises electron density.
C: High atomic number increases electron density.
D: This is not stated. The right answer is: They have high atomic numbers, which raises electron density.

Q963 · Medium · *codex, slides 471 to 473*

The double staining of uranium and lead is to electron microscopy as which stain pair is to light microscopy?

1. Crystal violet and safranin
2. Giemsa and eosin
3. Nigrosin and India ink
4. Hematoxylin and eosin

✓ **Answer: D** — This analogy is given in the lecture.

A: This pairing is not given. The right answer is: Hematoxylin and eosin.
B: This pairing is not given. The right answer is: Hematoxylin and eosin.
C: This pairing is not given. The right answer is: Hematoxylin and eosin.
D: This analogy is given in the lecture.

Q964 · Medium · *codex, slides 471 to 473*

Which are examples of negative stains?

1. Hematoxylin, eosin, Giemsa and safranin
2. Phosphotungstate, uranyl acetate and molybdate
3. Osmium, lead, uranium and glutaraldehyde
4. Crystal violet, safranin and nigrosin

✓ **Answer: B** — These are listed negative stains.

A: These are light microscopy stains. The right answer is: Potassium phosphotungstate, uranyl acetate and ammonium molybdate.
B: These are listed negative stains.
C: These are not negative stains. The right answer is: Potassium phosphotungstate, uranyl acetate and ammonium molybdate.
D: These are bacteriology dyes. The right answer is: Potassium phosphotungstate, uranyl acetate and ammonium molybdate.

Q965 · Medium · *codex, slides 471 to 473*

How does the specimen appear in negative staining?

1. Bright on a dark background
2. Dark on a bright background
3. Coloured on a white background
4. Invisible

✓ **Answer: A** — The specimen appears bright.

A: The specimen appears bright. It matches what the lecture slides state.
B: This is positive-like contrast. The right answer is: Bright on a dark background.
C: There is no colour. The right answer is: Bright on a dark background.
D: It appears bright. The right answer is: Bright on a dark background.

Q966 · Hard · *codex, slides 471 to 473*

Which statement correctly pairs EM stains with their targets?

1. Uranium: lipids; lead: nucleic acids; osmium: proteins at that stage
2. Uranium: nucleic acids; lead: lipids; osmium: membranes
3. Uranium: water; lead: sugars; osmium: salts
4. All three bind only cellulose and salts

✓ **Answer: B** — These are the targets.

A: The targets are mixed up. The right answer is: Uranium: nucleic acids and proteins; lead: lipids and membranes; osmium: membranes and lipids.

B: These are the targets. It matches what the lecture slides state.

C: These are not stated. The right answer is: Uranium: nucleic acids and proteins; lead: lipids and membranes; osmium: membranes and lipids.

D: This is not stated. The right answer is: Uranium: nucleic acids and proteins; lead: lipids and membranes; osmium: membranes and lipids.

Q967 · Hard · *codex, slides 471 to 473*

All of the following are true of positive staining in EM EXCEPT which one?

1. It is used for isolated organelles and membranes
2. It is used for small particles such as viruses and ribosomes
3. Lipid-rich and nucleic acid-rich parts appear dark
4. It produces an electron-dense background

✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: It produces an electron-dense background.

B: This is true. The right answer is: It produces an electron-dense background.

C: This is true. The right answer is: It produces an electron-dense background.

D: Correct choice. That describes negative staining.

Q968 · Devil · *codex, slides 471 to 473*

Which statement correctly contrasts positive and negative staining?

1. Positive staining darkens parts, negative gives a bright specimen
2. Positive staining gives a bright background, whereas negative staining darkens components
3. Both give a bright specimen on a bright background
4. Both add colour to the sections

✓ **Answer: A** — These are the two effects.

A: These are the two effects.

B: The effects are swapped. The right answer is: Positive staining darkens the components, whereas negative staining gives a dense background with a bright specimen.

C: They differ. The right answer is: Positive staining darkens the components, whereas negative staining gives a dense background with a bright specimen.

D: EM stains give contrast, not colour.

Cell fractionation · Q969–976

Q969 · Easy · *codex, slides 475 to 477*

What is the process of disrupting cells and separating their components called?

1. Cell fixation
2. Cell embedding
3. Cell staining
4. Cell fractionation

✓ **Answer: D** — This process is cell fractionation.

A: This is a preparation step. The right answer is: Cell fractionation.
B: This is a preparation step. The right answer is: Cell fractionation.
C: This is a preparation step. The right answer is: Cell fractionation.
D: This process is cell fractionation.

Q970 · Easy · *codex, slides 475 to 477*

In what kind of medium are cells usually homogenised?

1. Pure distilled water in this case
2. An iso-osmotic medium
3. Pure ethanol
4. Liquid nitrogen

✓ **Answer: B** — An iso-osmotic medium is used.

A: This would burst organelles. The right answer is: A supportive iso-osmotic medium.
B: An iso-osmotic medium is used.
C: This is not stated. The right answer is: A supportive iso-osmotic medium.
D: This is a fixation agent. The right answer is: A supportive iso-osmotic medium.

Q971 · Easy · *codex, slides 475 to 477*

What is the first step in cell fractionation?

1. Chromatography
2. Spectrophotometry
3. Autoradiography
4. Cell lysis

✓ **Answer: D** — Cell lysis is the first step.

A: This is an analysis step. The right answer is: Cell lysis.
B: This is an analysis step. The right answer is: Cell lysis.
C: This is an analysis step. The right answer is: Cell lysis.
D: Cell lysis is the first step.

Q972 · Medium · *codex, slides 475 to 477*

Which three steps are listed before analysis?

1. Fixation, embedding and staining
2. Sectioning, mounting and viewing
3. Lysis, homogenisation and separation
4. Freezing, thawing and drying out

✓ **Answer: C** — These are the three steps listed.

A: These are preparation steps for microscopy.
B: These are microscopy steps. The right answer is: Cell lysis, homogenisation and separation.
C: These are the three steps listed.
D: These are not the steps listed.

Q973 · Medium · *codex, slides 475 to 477*

Which three techniques are listed for analysing the fractions?

1. Fixation, embedding, sectioning and mounting
2. Spectrophotometry, autoradiography and chromatography
3. Sonication, lysis, blending, grinding and mixing
4. Staining, mounting, drying, sealing and labelling

✓ **Answer: B** — These are the analysis techniques.

A: These are preparation steps. The right answer is: Spectrophotometry, autoradiography and chromatography.
B: These are the analysis techniques.
C: These are disruption methods. The right answer is: Spectrophotometry, autoradiography and chromatography.
D: These are preparation steps. The right answer is: Spectrophotometry, autoradiography and chromatography.

Q974 · Medium · *codex, slides 475 to 477*

What is the product of homogenising cells called?

1. A homogenate
2. A pellet
3. A section
4. A fixative

✓ **Answer: A** — Homogenisation gives a homogenate.

A: Homogenisation gives a homogenate. It matches what the lecture slides state.
B: This forms on centrifugation. The right answer is: A homogenate.
C: This is cut with a microtome.
D: This is a chemical. The right answer is: A homogenate.

Q975 · Medium · *codex, slides 475 to 477*

What is the aim of separating cell fragments and organelles in the homogenate?

1. To stain them all the same colour
2. To embed them in resin
3. To destroy them completely
4. To analyse each fragment

✓ **Answer: D** — This allows each fragment to be studied.

A: This is not the aim. The right answer is: To analyse the chemical activity of the separated fragments.
B: This is not the aim. The right answer is: To analyse the chemical activity of the separated fragments.
C: This is not the aim. The right answer is: To analyse the chemical activity of the separated fragments.
D: This allows each fragment to be studied.

Q976 · Hard · *codex, slides 475 to 477*

Which sequence correctly describes cell fractionation followed by analysis?

1. Lysis, homogenisation, separation, then analysis
2. Separation, lysis, homogenisation, then fixation and staining
3. Fixation, embedding, sectioning, then centrifugation
4. Analysis, lysis, separation, then homogenisation

✓ **Answer: A** — This is the sequence in the lecture.

A: This is the sequence in the lecture.
B: The order is wrong. The right answer is: Lysis, homogenisation, separation, then analysis by spectrophotometry, autoradiography or chromatography.
C: These are preparation steps. The right answer is: Lysis, homogenisation, separation, then analysis by spectrophotometry, autoradiography or chromatography.
D: The order is wrong. The right answer is: Lysis, homogenisation, separation, then analysis by spectrophotometry, autoradiography or chromatography.

Cell lysis and homogenisation · Q977–1000

Q977 · Easy · *codex, slides 485 to 499*

Before proteins can be purified, which step must come first?

1. Staining
2. Centrifugation
3. Cell lysis
4. Embedding

✓ **Answer: C** — Cell lysis is the first step.

A: This is not a first step.
B: This comes after disruption. The right answer is: Cell lysis.
C: Cell lysis is the first step.
D: This is a microscopy step. The right answer is: Cell lysis.

Q978 · Easy · *codex, slides 485 to 499*

Which two devices use rotating blades to grind tissue such as liver or muscle?

1. The Dounce and the Potter-Elvehjem in practice
2. The French press and the sonicator
3. The Waring blender and the Polytron
4. The microtome and the centrifuge

✓ **Answer: C** — These are the mechanical disruption tools.

A: These are liquid homogenisers. The right answer is: The Waring blender and the Polytron.
B: These use pressure and sound. The right answer is: The Waring blender and the Polytron.
C: These are the mechanical disruption tools.
D: These are not for disruption. The right answer is: The Waring blender and the Polytron.

Q979 · Easy · *codex, slides 485 to 499*

Which homogenizer has a round glass pestle driven into a glass tube?

1. The Potter-Elvehjem
2. The French press
3. The Dounce homogenizer
4. The Polytron

✓ **Answer: C** — A Dounce has a glass pestle.

A: This has a Teflon pestle. The right answer is: The Dounce homogenizer.
B: This has a piston. The right answer is: The Dounce homogenizer.
C: A Dounce has a glass pestle.
D: This has rotating blades. The right answer is: The Dounce homogenizer.

Q980 · Easy · *codex, slides 485 to 499*

Which homogenizer has a Teflon pestle shaped to fit a rounded or conical vessel?

1. The Dounce
2. The Potter-Elvehjem
3. The French press
4. The Waring blender as a rule

✓ **Answer: B** — It uses a Teflon pestle.

A: This has a glass pestle. The right answer is: The Potter-Elvehjem homogenizer.
B: It uses a Teflon pestle.
C: This has a piston. The right answer is: The Potter-Elvehjem homogenizer.
D: This has blades. The right answer is: The Potter-Elvehjem homogenizer.

Q981 · Easy · *codex, slides 485 to 499*

Which device forces a sample through a tiny hole under high pressure?

1. The French press
2. The Dounce
3. The Polytron
4. The sonicator

> ✓ **Answer: A** — A piston applies high pressure.

A: A piston applies high pressure.
B: It uses a pestle. The right answer is: The French press.
C: It uses blades. The right answer is: The French press.
D: It uses sound. The right answer is: The French press.

Q982 · Easy · *codex, slides 485 to 499*

What does sonication use to lyse cells?

1. Rotating blades
2. A glass pestle
3. Liquid nitrogen
4. High frequency sound waves

> ✓ **Answer: D** — Sonication uses sound waves.

A: This is mechanical disruption. The right answer is: Pulsed, high frequency sound waves.
B: This is a Dounce. The right answer is: Pulsed, high frequency sound waves.
C: This is for freezing. The right answer is: Pulsed, high frequency sound waves.
D: Sonication uses sound waves. It matches what the lecture slides state.

Q983 · Easy · *codex, slides 485 to 499*

Which method is most common for disrupting plant cells?

1. Sonication
2. Mortar and pestle grinding
3. The French press
4. Freeze and thaw

> ✓ **Answer: B** — This is the most common method.

A: This is not stated for plants.
B: This is the most common method.
C: This is not stated for plants.
D: This is not stated for plants.

Q984 · Easy · *codex, slides 485 to 499*

In what is plant tissue frozen before grinding with a mortar and pestle?

1. Distilled water
2. Pure ethanol
3. Paraffin wax
4. Liquid nitrogen

✓ **Answer: D** — Tissue is frozen in liquid nitrogen.

A: This is not stated. The right answer is: Liquid nitrogen.
B: This is not stated. The right answer is: Liquid nitrogen.
C: This is not stated. The right answer is: Liquid nitrogen.
D: Tissue is frozen in liquid nitrogen.

Q985 · Easy · *codex, slides 485 to 499*

Which enzyme can be added to reduce viscosity caused by released DNA?

1. Catalase
2. DNase
3. Amylase
4. Pepsin

✓ **Answer: B** — DNase reduces viscosity.

A: This acts on hydrogen peroxide. The right answer is: DNase.
B: DNase reduces viscosity. It matches what the lecture slides state.
C: This digests starch. The right answer is: DNase.
D: This digests protein. The right answer is: DNase.

Q986 · Easy · *codex, slides 485 to 499*

What do protease inhibitors prevent during lysis?

1. DNA copying by polymerases
2. Lipid oxidation in membranes
3. Cell swelling in the buffer
4. Proteolysis (protein degradation)

✓ **Answer: D** — They prevent proteolysis.

A: This is not their role. The right answer is: Proteolysis, the degradation of proteins.
B: This is not their role. The right answer is: Proteolysis, the degradation of proteins.
C: This is not their role. The right answer is: Proteolysis, the degradation of proteins.
D: They prevent proteolysis. It matches what the lecture slides state.

Q987 · Medium · *codex, slides 485 to 499*

Which homogenisation method is most widely used for small volumes and cultured cells?

1. Liquid homogenisation
2. Mortar and pestle
3. Sonication
4. The Waring blender

✓ **Answer: A** — It is the most widely used for small volumes.

A: It is the most widely used for small volumes.
B: This is used for plant cells.
C: This is a separate class. The right answer is: Liquid homogenisation.
D: This is for large tissue amounts.

Q988 · Medium · *codex, slides 485 to 499*

How do liquid homogenizers lyse cells?

1. By heating the suspension to boiling
2. By adding a chemical fixative
3. By forcing cells through a gap
4. By drying the cells in air

✓ **Answer: C** — They shear the membranes.

A: This is not stated. The right answer is: By forcing the suspension through a narrow space, shearing membranes.
B: This is not stated. The right answer is: By forcing the suspension through a narrow space, shearing membranes.
C: They shear the membranes. It matches what the lecture slides state.
D: This is not stated. The right answer is: By forcing the suspension through a narrow space, shearing membranes.

Q989 · Medium · *codex, slides 485 to 499*

What do the microscopic vapour bubbles do in sonication?

1. They stain the cells and nuclei
2. They cool the sample quickly
3. They implode, sending shock waves
4. They dissolve all the DNA there

✓ **Answer: C** — The implosion causes shock waves.

A: This is not stated. The right answer is: They implode and send out shock waves.
B: This is not stated. The right answer is: They implode and send out shock waves.
C: The implosion causes shock waves.
D: This is not stated. The right answer is: They implode and send out shock waves.

Q990 · Medium · *codex, slides 485 to 499*

How is overheating prevented during sonication?

1. By running it continuously
2. By adding paraffin wax first
3. By short bursts in an ice bath
4. By using a glass pestle too

✓ **Answer: C** — Multiple short bursts on ice are used.

A: This would cause heating. The right answer is: By short bursts with the sample in an ice bath.
B: This is not stated. The right answer is: By short bursts with the sample in an ice bath.
C: Multiple short bursts on ice are used.
D: This is not stated. The right answer is: By short bursts with the sample in an ice bath.

Q991 · Medium · *codex, slides 485 to 499*

Sonication is best suited to what sample volumes?

1. Volumes above 100 litres
2. Volumes below 100 ml
3. Volumes of exactly 1 litre
4. Volumes between 250 and 500 ml

✓ **Answer: B** — It suits volumes under 100 ml.

A: This is not stated. The right answer is: Volumes below 100 ml.
B: It suits volumes under 100 ml.
C: This is not stated. The right answer is: Volumes below 100 ml.
D: The French press is for 40 to 250 ml.

Q992 · Medium · *codex, slides 485 to 499*

How does the freeze and thaw method break cells?

1. Heating melts the membranes at 100 °C
2. Dehydration by strong alcohol baths
3. Shearing through very narrow tubes
4. Ice crystals break the cells

✓ **Answer: D** — This describes the mechanism.

A: This is not stated. The right answer is: Ice crystals form so cells swell and break, then contract on thawing.
B: This is not stated. The right answer is: Ice crystals form so cells swell and break, then contract on thawing.
C: This is liquid homogenisation. The right answer is: Ice crystals form so cells swell and break, then contract on thawing.
D: This describes the mechanism. It matches what the lecture slides state.

Q993 · Medium · *codex, slides 485 to 499*

Why is mortar and pestle the fastest method for plant cells?

1. Plant cells have no membrane at all
2. The wall is strong cellulose
3. Plant cells are very small indeed
4. Plant cells contain very much DNase

> ✓ **Answer: B** — The tough wall needs crushing.

A: They have a membrane. The right answer is: The cell wall has the tensile strength of cellulose and other polysaccharides.
B: The tough wall needs crushing.
C: This is not the reason. The right answer is: The cell wall has the tensile strength of cellulose and other polysaccharides.
D: This is not the reason. The right answer is: The cell wall has the tensile strength of cellulose and other polysaccharides.

Q994 · Medium · *codex, slides 485 to 499*

What does suspending cells in a hypotonic buffer do?

1. It fixes them firmly in place
2. It swells them so they burst
3. It stains all of them blue
4. It freezes them solid fast

> ✓ **Answer: B** — Hypotonic buffer helps lysis.

A: This is not stated. The right answer is: It makes them swell and burst more readily under shearing.
B: Hypotonic buffer helps lysis. It matches what the lecture slides state.
C: This is not stated. The right answer is: It makes them swell and burst more readily under shearing.
D: This is not stated. The right answer is: It makes them swell and burst more readily under shearing.

Q995 · Medium · *codex, slides 485 to 499*

Which additive helps crush the cell walls of yeast cells?

1. Dry ice
2. Glass beads
3. Paraffin
4. Xylene

> ✓ **Answer: B** — Glass beads help crush the walls.

A: This is not stated. The right answer is: Glass beads.
B: Glass beads help crush the walls.
C: This is not stated. The right answer is: Glass beads.
D: This is not stated. The right answer is: Glass beads.

Q996 · Medium · *codex, slides 485 to 499*

Why is nuclease treatment not needed for sonicated material?

1. Sonicated samples contain no DNA at that stage
2. Sonication raises viscosity
3. Nucleases are destroyed by cold
4. Sonication shears the chromosomes

> ✓ **Answer: D** — Sonication shears chromosomes.

A: They contain DNA. The right answer is: Sonication shears the chromosomes.
B: It does not need this. The right answer is: Sonication shears the chromosomes.
C: This is not stated. The right answer is: Sonication shears the chromosomes.
D: Sonication shears chromosomes. It matches what the lecture slides state.

Q997 · Hard · *codex, slides 485 to 499*

All of the following are traditional (non-detergent) lysis methods EXCEPT which one?

1. Sonication
2. Freeze and thaw
3. Mortar and pestle
4. Treatment with a detergent

> ✓ **Answer: D** — Correct choice.

A: This is a traditional method. The right answer is: Treatment with a detergent.
B: This is a traditional method. The right answer is: Treatment with a detergent.
C: This is a traditional method. The right answer is: Treatment with a detergent.
D: Correct choice. Detergent-based lysis is a separate class.

Q998 · Hard · *codex, slides 485 to 499*

Which are physical (non-detergent) lysis methods? 1. Sonication. 2. Freeze and thaw. 3. Detergent treatment. 4. Mortar and pestle.

1. 1, 2 and 4 only
2. 1 and 3 only
3. 2, 3 and 4 only
4. 1, 3 and 4 only

> ✓ **Answer: A** — Sonication, freeze and thaw and mortar and pestle are physical methods; detergent treatment is a separate class.

A: Sonication, freeze and thaw and mortar and pestle are physical methods; detergent treatment is a separate class.
B: This omits two physical methods and wrongly includes detergent treatment.
C: Detergent treatment is not a physical method and this omits sonication.
D: Detergent treatment is not a physical method and this omits freeze and thaw.

Q999 · Hard · *codex, slides 485 to 499*

A yeast suspension resists lysis in a blender. Which two additives could help?

1. Liquid nitrogen to freeze the cells, or paraffin
2. A lytic enzyme for the wall, or glass beads
3. Formaldehyde to fix the cells, or xylene
4. Eosin to stain the wall, or glycerol

✓ **Answer: B** — These are the listed facilitators.

A: These are not the facilitators. The right answer is: A lytic enzyme to digest the wall polysaccharide, or glass beads.
B: These are the listed facilitators.
C: These are not the facilitators. The right answer is: A lytic enzyme to digest the wall polysaccharide, or glass beads.
D: These are not the facilitators. The right answer is: A lytic enzyme to digest the wall polysaccharide, or glass beads.

Q1000 · Devil · *codex, slides 485 to 499*

Which statement is correct about viscosity after lysis?

1. It falls as nucleic acids are released, and nuclease is always required
2. It rises, and only protease inhibitors reduce it
3. It rises, DNase and RNase reduce it, and sonicated samples need none
4. It is unchanged, so no additive is ever needed

✓ **Answer: C** — This summarises the lecture.

A: It rises, and sonicated material needs none.
B: DNase and RNase reduce it. The right answer is: It rises as nucleic acids are released, DNase and RNase reduce it, but sonicated material needs no nuclease.
C: This summarises the lecture. It matches what the lecture slides state.
D: It rises during lysis. The right answer is: It rises as nucleic acids are released, DNase and RNase reduce it, but sonicated material needs no nuclease.

Module 6 — Differential centrifugation → Rf values and interpreting data

slides 501 to 562 · 120 questions · 10 sections · bank: BIOL151_Question_Bank_Slides501-562.docx
Difficulty: 48 Easy · 47 Medium · 20 Hard · 5 Devil

Differential centrifugation · Q1001–1020

Q1001 · Easy · *codex, slides 502 to 506*

What is the use of increased gravity to speed up the sedimentation of substances called?

1. Chromatography
2. Homogenisation
3. Autoradiography
4. Centrifugation

✓ **Answer: D** — Centrifugation uses increased gravity to speed sedimentation.

A: This separates by partitioning. The right answer is: Centrifugation.
B: This disrupts cells. The right answer is: Centrifugation.
C: This visualises radioactive substances. The right answer is: Centrifugation.
D: Centrifugation uses increased gravity to speed sedimentation.

Q1002 · Easy · *codex, slides 502 to 506*

Which instrument spins samples at various speeds to separate cell parts?

1. The microtome
2. The centrifuge
3. The spectrophotometer
4. The cuvette

✓ **Answer: B** — The centrifuge spins at various speeds.

A: This cuts sections. The right answer is: The centrifuge.
B: The centrifuge spins at various speeds.
C: This measures light absorption. The right answer is: The centrifuge.
D: This holds a liquid sample. The right answer is: The centrifuge.

Q1003 · Easy · *codex, slides 502 to 506*

What name is given to the large cell structures that settle at the bottom of the tube?

1. Supernatant
2. Homogenate
3. Gradient
4. Pellets

✓ **Answer: D** — The large structures settle as pellets.

A: This is the liquid above the pellet.
B: This is the whole disrupted mixture.
C: This is a layered medium. The right answer is: Pellets.
D: The large structures settle as pellets.

Q1004 · Easy · *codex, slides 502 to 506*

What is the liquid left above the pellet called?

1. The pellet
2. The homogenate
3. The supernatant
4. The fraction

> ✓ **Answer: C** — The supernatant holds the smaller parts in liquid.

A: The pellet is the settled material.
B: This is the whole mixture. The right answer is: The supernatant.
C: The supernatant holds the smaller parts in liquid.
D: This is not the stated term.

Q1005 · Easy · *codex, slides 502 to 506*

On what is separation in differential centrifugation based primarily?

1. The colour of the particles
2. The charge of the particles
3. The solubility of the particles
4. The size of the particles

> ✓ **Answer: D** — Size is the main basis of separation.

A: This is not the basis. The right answer is: The size of the particles.
B: This is not the basis. The right answer is: The size of the particles.
C: This is not the basis. The right answer is: The size of the particles.
D: Size is the main basis of separation.

Q1006 · Easy · *codex, slides 502 to 506*

What pellets after 1000 × g for 10 minutes?

1. Unbroken cells and heavy nuclei
2. Mitochondria and some lysosomes
3. Ribosomes and small vesicles
4. Soluble proteins and ions

> ✓ **Answer: A** — These pellet at 1000 × g for 10 minutes.

A: These pellet at 1000 × g for 10 minutes.
B: These pellet at 10,000 × g.
C: These are not stated here. The right answer is: Unbroken cells and heavy nuclei.
D: These stay in the supernatant. The right answer is: Unbroken cells and heavy nuclei.

Q1007 · Easy · *codex, slides 502 to 506*

Which organelles pellet after 10,000 × g for 20 minutes?

1. Unbroken cells and heavy nuclei
2. Chromosomes and nucleoli only
3. Mitochondria, lysosomes, microbodies
4. Plasma membrane sheets and ER

✓ **Answer: C** — These pellet at 10,000 × g for 20 minutes.

A: These pellet at 1000 × g.
B: These are not stated here. The right answer is: Mitochondria, lysosomes and microbodies.
C: These pellet at 10,000 × g for 20 minutes.
D: These are not stated here. The right answer is: Mitochondria, lysosomes and microbodies.

Q1008 · Easy · *codex, slides 502 to 506*

How does the centrifugal force change between successive spins in differential centrifugation?

1. It is decreased each time
2. It is increased each time
3. It stays constant
4. It is varied at random

✓ **Answer: B** — The speed increases with each trial.

A: It is increased. The right answer is: It is increased each time.
B: The speed increases with each trial.
C: It is increased. The right answer is: It is increased each time.
D: It is increased. The right answer is: It is increased each time.

Q1009 · Medium · *codex, slides 502 to 506*

What is done with the supernatant after the first spin?

1. It is decanted and spun again
2. It is discarded at once
3. It is stained blue and dried
4. It is embedded in hot wax

✓ **Answer: A** — The supernatant is spun again faster.

A: The supernatant is spun again faster.
B: It is spun again. The right answer is: It is decanted and centrifuged again at higher speed.
C: This is not stated. The right answer is: It is decanted and centrifuged again at higher speed.
D: This is not stated. The right answer is: It is decanted and centrifuged again at higher speed.

Q1010 · Medium · *codex, slides 502 to 506*

What do successively higher speeds collect?

1. Successively larger parts
2. The same parts every time
3. Only soluble molecules
4. Successively smaller parts

✓ **Answer: D** — Higher speeds collect smaller parts.

A: Larger parts pellet first. The right answer is: Successively smaller parts of the cell.
B: Different parts pellet. The right answer is: Successively smaller parts of the cell.
C: Smaller parts include more than soluble molecules.
D: Higher speeds collect smaller parts.

Q1011 · Medium · *codex, slides 502 to 506*

Why are organelle pellets only partially pure?

1. They are made of one type of organelle
2. They are dissolved in the supernatant
3. They are contaminated with other particles
4. They are stained with dye

✓ **Answer: C** — Pellets are typically contaminated.

A: They contain other particles. The right answer is: They are contaminated with other particles.
B: They are in the pellet. The right answer is: They are contaminated with other particles.
C: Pellets are typically contaminated. It matches what the lecture slides state.
D: This is not stated. The right answer is: They are contaminated with other particles.

Q1012 · Medium · *codex, slides 502 to 506*

How can contaminants smaller in size be removed from a pellet?

1. Resuspend and re-pellet it
2. Heat it to boiling point
3. Dry it in warm air
4. Add xylene to it

✓ **Answer: A** — Repeated washing removes smaller contaminants.

A: Repeated washing removes smaller contaminants.
B: This is not stated. The right answer is: Resuspend it in isotonic solvent and re-pellet it repeatedly.
C: This is not stated. The right answer is: Resuspend it in isotonic solvent and re-pellet it repeatedly.
D: This is not stated. The right answer is: Resuspend it in isotonic solvent and re-pellet it repeatedly.

Q1013 · Medium · *codex, slides 502 to 506*

In which kind of solvents are pellets washed?

1. Hypotonic solvents only
2. Isotonic solvents
3. Pure ethanol
4. Liquid nitrogen

✓ **Answer: B** — Isotonic solvents are used for washing.

A: The lecture names isotonic. The right answer is: Isotonic solvents.
B: Isotonic solvents are used for washing.
C: This is not stated. The right answer is: Isotonic solvents.
D: This is not stated. The right answer is: Isotonic solvents.

Q1014 · Medium · *codex, slides 502 to 506*

What is differential centrifugation commonly used for?

1. Producing fully pure single molecules
2. Staining organelles for the microscope
3. Cutting thin sections of tissue
4. Simple pelleting and partial purification

✓ **Answer: D** — These are its common uses.

A: It gives partial purity. The right answer is: Simple pelleting and partially pure preparations of organelles and macromolecules.
B: This is not its use. The right answer is: Simple pelleting and partially pure preparations of organelles and macromolecules.
C: This is not its use. The right answer is: Simple pelleting and partially pure preparations of organelles and macromolecules.
D: These are its common uses.

Q1015 · Medium · *codex, slides 502 to 506*

What does partial purification by differential centrifugation serve as?

1. The final step of any purification
2. A replacement for homogenisation
3. A preliminary step before a gradient
4. A fixation method for tissue

✓ **Answer: C** — It prepares for further purification.

A: It is preliminary. The right answer is: A preliminary step before density gradient separation.
B: It follows homogenisation. The right answer is: A preliminary step before density gradient separation.
C: It prepares for further purification.
D: It is not fixation. The right answer is: A preliminary step before density gradient separation.

Q1016 · Medium · *codex, slides 502 to 506*

Which statement about differential centrifugation is NOT true?

1. It uses progressively increasing force
2. It generates pellets and supernatants
3. It gives partially pure organelles
4. It separates particles mainly by their density

✓ **Answer: D** — Correct choice.

A: This is true. The right answer is: It separates particles mainly by their density.
B: This is true. The right answer is: It separates particles mainly by their density.
C: This is true. The right answer is: It separates particles mainly by their density.
D: Correct choice. It separates mainly by size.

Q1017 · Hard · *codex, slides 502 to 506*

Which order of pelleting is expected as the force increases?

1. Mitochondria first, then nuclei at higher force of spinning
2. All organelles together at 1000 × g in one pellet
3. Nuclei at low force, then mitochondria at higher force
4. Lysosomes first, then unbroken cells at higher force

✓ **Answer: C** — Larger structures pellet first.

A: Nuclei are larger and pellet first.
B: They pellet at different forces. The right answer is: Nuclei at low force, then mitochondria, lysosomes and microbodies at higher force.
C: Larger structures pellet first. It matches what the lecture slides state.
D: Unbroken cells pellet first. The right answer is: Nuclei at low force, then mitochondria, lysosomes and microbodies at higher force.

Q1018 · Hard · *codex, slides 502 to 506*

A student's next spin is ten times the force of the 1000 × g spin that pelleted nuclei. Which force is this?

1. 100 × g
2. 1,000,000 × g
3. 100,000 × g
4. 10,000 × g

✓ **Answer: D** — Ten times 1000 × g is 10,000 × g.

A: This is a tenth of the force.
B: This is far too high. The right answer is: 10,000 × g.
C: This is ten times too high.
D: Ten times 1000 × g is 10,000 × g.

Q1019 · Hard · *codex, slides 502 to 506*

A 10,000 × g pellet of mitochondria is still contaminated. Which step comes next?

1. Discard the pellet and start again with distilled water
2. Wash in isotonic solvent and re-pellet, then use a gradient
3. Add detergent to dissolve the contaminants
4. Stain the pellet and view it directly under a lens

✓ **Answer: B** — Washing then gradient purification follows.

A: This is not stated. The right answer is: Wash by resuspending in isotonic solvent and re-pelleting, then purify by density gradient.

B: Washing then gradient purification follows.

C: This is not stated. The right answer is: Wash by resuspending in isotonic solvent and re-pelleting, then purify by density gradient.

D: This does not purify. The right answer is: Wash by resuspending in isotonic solvent and re-pelleting, then purify by density gradient.

Q1020 · Devil · *codex, slides 502 to 506*

Which workflow correctly purifies mitochondria?

1. Homogenise, spin high first, then low for nuclei, then stain the pellet
2. Spin the intact cells, then homogenise, then use a density gradient
3. Stain the cells, spin once at 1000 × g, then embed in hot wax
4. Homogenise, spin low for nuclei, spin higher for mitochondria, then use a gradient

✓ **Answer: D** — This follows the lecture sequence.

A: The order is wrong. The right answer is: Homogenise, spin low to pellet nuclei, spin the supernatant higher for mitochondria, then use a density gradient.

B: Homogenisation comes first. The right answer is: Homogenise, spin low to pellet nuclei, spin the supernatant higher for mitochondria, then use a density gradient.

C: These are not purification steps. The right answer is: Homogenise, spin low to pellet nuclei, spin the supernatant higher for mitochondria, then use a density gradient.

D: This follows the lecture sequence.

Density gradient centrifugation · Q1021–1032

Q1021 · Easy · *codex, slides 509 to 513*

Which method is preferred to purify subcellular organelles and macromolecules?

1. Density gradient centrifugation
2. Differential centrifugation alone
3. Paper chromatography alone
4. Sonication of the cells

✓ **Answer: A** — It is the preferred purification method.

A: It is the preferred purification method.

B: This gives partial purity. The right answer is: Density gradient centrifugation.

C: This is not stated. The right answer is: Density gradient centrifugation.

D: This disrupts cells. The right answer is: Density gradient centrifugation.

Q1022 · Easy · *codex, slides 509 to 513*

Which medium is named as an example for generating a density gradient?

1. Paraffin wax
2. Sucrose
3. Xylene
4. Eosin

✓ **Answer: B** — Sucrose is a gradient medium.

A: This is an embedding medium. The right answer is: Sucrose.
B: Sucrose is a gradient medium.
C: This is a clearing agent. The right answer is: Sucrose.
D: This is a dye. The right answer is: Sucrose.

Q1023 · Easy · *codex, slides 509 to 513*

Where is the heaviest layer placed in a density gradient tube?

1. At the bottom
2. At the top
3. In the middle only
4. Outside the tube

✓ **Answer: A** — The heaviest layer is at the bottom.

A: The heaviest layer is at the bottom.
B: The lightest layer is at the top.
C: It is at the bottom. The right answer is: At the bottom.
D: It is in the tube. The right answer is: At the bottom.

Q1024 · Easy · *codex, slides 509 to 513*

Where is the cell suspension added to the gradient?

1. At the bottom of the tube
2. Into the middle layer
3. On top of the gradient
4. Beside the tube

✓ **Answer: C** — The suspension is added to the top.

A: It is added to the top.
B: It is added to the top.
C: The suspension is added to the top.
D: It is added to the top.

Q1025 · Easy · *codex, slides 509 to 513*

Into which two categories is density gradient centrifugation classified?

1. Differential and analytical
2. Simple and compound
3. Paper and thin layer
4. Rate-zonal and isopycnic

✓ **Answer: D** — These are the two categories.

A: These are other centrifugation types. The right answer is: Rate-zonal and isopycnic.
B: These are microscope types. The right answer is: Rate-zonal and isopycnic.
C: These are chromatography types. The right answer is: Rate-zonal and isopycnic.
D: These are the two categories.

Q1026 · Medium · *codex, slides 509 to 513*

In which two modes can a density gradient be generated?

1. Hot or cold
2. Wet or dry
3. Discontinuous or continuous
4. Fast or slow

✓ **Answer: C** — Gradients can be discontinuous or continuous.

A: This is not stated. The right answer is: Discontinuous or continuous.
B: This is not stated. The right answer is: Discontinuous or continuous.
C: Gradients can be discontinuous or continuous.
D: This is not stated. The right answer is: Discontinuous or continuous.

Q1027 · Medium · *codex, slides 509 to 513*

What density do viruses have in the buoyant density example?

1. 11 to 12 g/cm³
2. 0.1 to 0.2 g/cm³
3. 5 to 6 g/cm³
4. 1.1 to 1.2 g/cm³

✓ **Answer: D** — The viruses have densities of 1.1 to 1.2 g/cm³.

A: This is ten times too high.
B: This is ten times too low.
C: This is not stated. The right answer is: 1.1 to 1.2 g/cm³.
D: The viruses have densities of 1.1 to 1.2 g/cm³.

Q1028 · Medium · *codex, slides 509 to 513*

Which components move fastest down the tube in buoyant density centrifugation?

1. The lightest components
2. The smallest components
3. The coloured components
4. The densest components

✓ **Answer: D** — The densest components move fastest.

A: The densest move fastest. The right answer is: The densest components.
B: Density is the basis here. The right answer is: The densest components.
C: This is not stated. The right answer is: The densest components.
D: The densest components move fastest.

Q1029 · Medium · *codex, slides 509 to 513*

Where does a component stop in the gradient?

1. At its own sucrose density
2. At the very bottom always
3. At the top always
4. Wherever the tube ends

✓ **Answer: A** — It stops where the density matches its own.

A: It stops where the density matches its own.
B: It stops at its own density.
C: It stops at its own density.
D: It stops at its own density.

Q1030 · Medium · *codex, slides 509 to 513*

What do the bands at the bottom of the gradient contain?

1. High buoyant density components
2. Components with low buoyant densities
3. Only water and buffer
4. Only dissolved salts and ions

✓ **Answer: A** — Dense components lie at the bottom.

A: Dense components lie at the bottom.
B: These are at the top. The right answer is: Components with high buoyant densities.
C: This is not stated. The right answer is: Components with high buoyant densities.
D: This is not stated. The right answer is: Components with high buoyant densities.

Q1031 · Hard · *codex, slides 509 to 513*

Why do components with high buoyant density band lower in the gradient than those with low buoyant density?

1. Dense components are lighter, so they sink more slowly
2. Each stops where the density matches its own
3. The gradient is lightest at the bottom of the tube
4. All components stop at the same point in the gradient

✓ **Answer: B** — The matching point is deeper for denser particles.

A: Dense components sink farther. The right answer is: Each travels until the gradient density matches its own, which lies deeper for denser particles.
B: The matching point is deeper for denser particles.
C: It is heaviest at the bottom.
D: They stop at different points. The right answer is: Each travels until the gradient density matches its own, which lies deeper for denser particles.

Q1032 · Hard · *codex, slides 509 to 513*

All of the following are true of a density gradient EXCEPT which one?

1. The suspension is added on top
2. It can be continuous or discontinuous
3. The lightest layer is at the bottom
4. Sucrose can be used as a medium

✓ **Answer: C** — Correct choice.

A: This is true. The right answer is: The lightest layer is placed at the bottom of the tube.
B: This is true. The right answer is: The lightest layer is placed at the bottom of the tube.
C: Correct choice. The heaviest layer is at the bottom.
D: This is true. The right answer is: The lightest layer is placed at the bottom of the tube.

Rate-zonal and isopycnic separation · Q1033–1044

Q1033 · Easy · *codex, slides 513 to 518*

Which separation uses particle size and mass rather than density?

1. Rate-zonal separation
2. Isopycnic separation
3. Differential pelleting
4. Analytical separation

✓ **Answer: A** — Rate-zonal separation uses size and mass.

A: Rate-zonal separation uses size and mass.
B: This uses density. The right answer is: Rate-zonal separation.
C: This is not the named method.
D: This is not the named method.

Q1034 · Easy · *codex, slides 513 to 518*

Which separation uses particle density?

1. Rate-zonal separation
2. Paper chromatography alone
3. Autoradiography
4. Isopycnic separation

✓ **Answer: D** — Isopycnic separation uses density.

A: This uses size and mass. The right answer is: Isopycnic separation.
B: This is not centrifugation. The right answer is: Isopycnic separation.
C: This is not centrifugation. The right answer is: Isopycnic separation.
D: Isopycnic separation uses density. It matches what the lecture slides state.

Q1035 · Easy · *codex, slides 513 to 518*

Which common example uses a CsCl gradient?

1. Separation of nucleic acids
2. Separation of antibody classes
3. Separation of pigments
4. Separation of whole cells

✓ **Answer: A** — Nucleic acids are separated in CsCl.

A: Nucleic acids are separated in CsCl.
B: These use rate-zonal separation. The right answer is: Separation of nucleic acids.
C: This is chromatography. The right answer is: Separation of nucleic acids.
D: This is not the example. The right answer is: Separation of nucleic acids.

Q1036 · Easy · *codex, slides 513 to 518*

In isopycnic separation, a particle sinks until what is reached?

1. The bottom of the tube
2. Where the densities are equal
3. The top of the tube
4. The edge of the cuvette

✓ **Answer: B** — It stops where the densities match.

A: It stops at its own density.
B: It stops where the densities match.
C: It sinks, not rises. The right answer is: A position where the solution density equals its own.
D: This is not stated. The right answer is: A position where the solution density equals its own.

Q1037 · Easy · *codex, slides 513 to 518*

Which common example is separated by rate-zonal separation?

1. Nucleic acids in CsCl
2. Whole nuclei
3. Plant cell walls
4. Antibody classes

✓ **Answer: D** — Antibody classes are an example.

A: These use isopycnic separation. The right answer is: Antibody classes.
B: This is not the example. The right answer is: Antibody classes.
C: This is not the example. The right answer is: Antibody classes.
D: Antibody classes are an example.

Q1038 · Medium · *codex, slides 513 to 518*

Why can antibody classes be separated by mass but not by density?

1. They have different densities and the same mass
2. Similar densities but different masses
3. They have no real mass at all
4. They are too large to centrifuge

✓ **Answer: B** — Mass differs while density is similar.

A: The reverse is stated. The right answer is: They have very similar densities but different masses.
B: Mass differs while density is similar.
C: They have mass. The right answer is: They have very similar densities but different masses.
D: This is not stated. The right answer is: They have very similar densities but different masses.

Q1039 · Medium · *codex, slides 513 to 518*

Once isopycnic quasi-equilibrium is reached, what does more centrifugation do?

1. It has no influence on migration
2. It pushes the particle to the bottom
3. It pushes the particle to the top
4. It dissolves the particle

✓ **Answer: A** — Further spinning does not change the position.

A: Further spinning does not change the position.
B: It no longer influences migration. The right answer is: It has no influence on migration of the particle.
C: It no longer influences migration. The right answer is: It has no influence on migration of the particle.
D: This is not stated. The right answer is: It has no influence on migration of the particle.

Q1040 · Medium · *codex, slides 513 to 518*

Which cellular organelles are cited as an example for rate-zonal separation?

1. Chloroplasts only
2. Cell walls
3. Plasmids
4. Endosomes

✓ **Answer: D** — Endosomes are an example.

A: This is not stated. The right answer is: Endosomes.
B: This is not stated. The right answer is: Endosomes.
C: This is not stated. The right answer is: Endosomes.
D: Endosomes are an example. It matches what the lecture slides state.

Q1041 · Medium · *codex, slides 513 to 518*

All of the following are true of isopycnic separation EXCEPT which one?

1. Separation depends on particle density
2. Particles stop where the solution density equals their own
3. The duration always changes the final position
4. A CsCl gradient can separate nucleic acids

✓ **Answer: C** — Correct choice.

A: This is true. The right answer is: The duration of centrifugation always changes the final position.
B: This is true. The right answer is: The duration of centrifugation always changes the final position.
C: Correct choice. Once at equilibrium, time has no influence.
D: This is true. The right answer is: The duration of centrifugation always changes the final position.

Q1042 · Hard · *codex, slides 513 to 518*

A mixture contains particles of the same density but different masses. Which separation should be used?

1. Isopycnic, because it separates by density
2. Neither, because they cannot be separated
3. Rate-zonal, because it separates by size and mass
4. Paper chromatography, because it uses density

✓ **Answer: C** — Mass differences are exploited.

A: Densities are the same. The right answer is: Rate-zonal, because it separates by size and mass.
B: They can be separated by mass.
C: Mass differences are exploited. It matches what the lecture slides state.
D: It does not use density. The right answer is: Rate-zonal, because it separates by size and mass.

Q1043 · Hard · *codex, slides 513 to 518*

Which statement correctly describes rate-zonal separation?

1. It exploits particle size and mass
2. It exploits only the colour of the particles
3. It requires the particles to reach equilibrium
4. It uses a single layer without a gradient

✓ **Answer: A** — This is the description in the lecture.

A: This is the description in the lecture.
B: This is not stated. The right answer is: It exploits particle size and mass instead of density for sedimentation.
C: This describes isopycnic separation. The right answer is: It exploits particle size and mass instead of density for sedimentation.
D: It uses a gradient. The right answer is: It exploits particle size and mass instead of density for sedimentation.

Q1044 · Devil · *codex, slides 513 to 518*

Which statement correctly contrasts rate-zonal with isopycnic separation?

1. Rate-zonal depends on density, whereas isopycnic depends on size and mass
2. Both depend only on the colour of particles
3. Both continue until particles reach the bottom
4. Rate-zonal uses size and mass, isopycnic uses density

✓ **Answer: D** — These are the differences.

A: The bases are swapped. The right answer is: Rate-zonal depends on size and mass, whereas isopycnic depends on density and ends at equilibrium.
B: Neither does. The right answer is: Rate-zonal depends on size and mass, whereas isopycnic depends on density and ends at equilibrium.
C: Isopycnic ends at equilibrium. The right answer is: Rate-zonal depends on size and mass, whereas isopycnic depends on density and ends at equilibrium.
D: These are the differences. It matches what the lecture slides state.

The analytical ultracentrifuge · Q1045–1052

Q1045 · Easy · *codex, slides 519 to 521*

What maximum force can an analytical ultracentrifuge generate?

1. Up to 5,000 g
2. Up to 50 g
3. Up to 5,000,000 g
4. Up to 500,000 g

✓ **Answer: D** — It generates forces of up to 500,000 g.

A: This is 100 times too low.
B: This is far too low. The right answer is: Up to 500,000 g.
C: This is ten times too high.
D: It generates forces of up to 500,000 g.

Q1046 · Easy · *codex, slides 519 to 521*

What is the centrifuge cell of an analytical ultracentrifuge made of?

1. Paraffin
2. Cellulose
3. Quartz
4. Teflon

✓ **Answer: C** — The cell is made of quartz.

A: This is an embedding medium. The right answer is: Quartz.
B: This is not stated. The right answer is: Quartz.
C: The cell is made of quartz.
D: This is not stated. The right answer is: Quartz.

Q1047 · Easy · *codex, slides 519 to 521*

With which media is the specimen mixed in the analytical ultracentrifuge?

1. Xylene or ethanol
2. Eosin or hematoxylin
3. Water or oil only
4. Sucrose or caesium chloride

✓ **Answer: D** — Sucrose or CsCl is used.

A: These are processing solvents. The right answer is: Sucrose or caesium chloride.
B: These are dyes. The right answer is: Sucrose or caesium chloride.
C: This is not stated. The right answer is: Sucrose or caesium chloride.
D: Sucrose or CsCl is used.

Q1048 · Medium · *codex, slides 519 to 521*

On which fundamental property does analytical ultracentrifugation rely?

1. Colour and light refraction
2. Mass and gravitation
3. Charge and magnetism
4. Heat and pressure

✓ **Answer: B** — It relies on mass and gravitation.

A: This is not stated. The right answer is: Mass, and the laws of gravitation.
B: It relies on mass and gravitation.
C: This is not stated. The right answer is: Mass, and the laws of gravitation.
D: This is not stated. The right answer is: Mass, and the laws of gravitation.

Q1049 · Medium · *codex, slides 519 to 521*

Does analytical ultracentrifugation need standards for comparison?

1. Yes, it always needs standards
2. No, it is a primary technique
3. Yes, but only with sucrose
4. Only when using caesium chloride

✓ **Answer: B** — It is a primary technique requiring no standards.

A: It requires none. The right answer is: No, it is a primary technique.
B: It is a primary technique requiring no standards.
C: It requires none. The right answer is: No, it is a primary technique.
D: It requires none. The right answer is: No, it is a primary technique.

Q1050 · Medium · *codex, slides 519 to 521*

What forms at the top of the cell during analytical ultracentrifugation?

1. A solid pellet of particles only
2. A layer of coloured dye
3. Pure solvent, sharply bounded
4. A layer of paraffin wax

✓ **Answer: C** — Particles sediment and leave pure solvent at the top.

A: The top holds pure solvent. The right answer is: Pure solvent, with a sharp boundary below it.
B: This is not stated. The right answer is: Pure solvent, with a sharp boundary below it.
C: Particles sediment and leave pure solvent at the top.
D: This is not stated. The right answer is: Pure solvent, with a sharp boundary below it.

Q1051 · Hard · *codex, slides 519 to 521*

Which kinds of molecules can the analytical ultracentrifuge separate and characterise?

1. Very small molecules and macromolecules
2. Only whole living cells in water
3. Only large tissue blocks of organs
4. Only dried powders of minerals

✓ **Answer: A** — It can characterise these molecules.

A: It can characterise these molecules.
B: This is not stated. The right answer is: Very small molecules and macromolecules such as ribosomes and proteins.
C: This is not stated. The right answer is: Very small molecules and macromolecules such as ribosomes and proteins.
D: This is not stated. The right answer is: Very small molecules and macromolecules such as ribosomes and proteins.

Q1052 · Hard · *codex, slides 519 to 521*

How does an analytical ultracentrifuge differ from a preparative centrifuge?

1. It is a simpler device that only pellets cells at 1000 g
2. It uses no centrifugal force at all
3. A refinement that analyses solution behaviour
4. It is used only for staining

✓ **Answer: C** — It refines preparative centrifuges for analysis.

A: It is a refinement. The right answer is: It is a refinement that analyses solution behaviour at forces up to 500,000 g.
B: It uses very high force. The right answer is: It is a refinement that analyses solution behaviour at forces up to 500,000 g.
C: It refines preparative centrifuges for analysis.
D: It is used for analysis. The right answer is: It is a refinement that analyses solution behaviour at forces up to 500,000 g.

Principles of spectrophotometry · Q1053–1064

Q1053 · Easy · *codex, slides 524 to 526*

What does the spectrometer part of a spectrophotometer produce?

1. A focused beam of electrons
2. A short flash of heat
3. A cloud of coloured dye
4. Light of a selected wavelength

✓ **Answer: D** — It produces light of any selected colour.

A: This is an electron microscope. The right answer is: Light of a selected wavelength.
B: This is not stated. The right answer is: Light of a selected wavelength.
C: This is not stated. The right answer is: Light of a selected wavelength.
D: It produces light of any selected colour.

Q1054 · Easy · *codex, slides 524 to 526*

What does the photometer measure?

1. The intensity of light
2. The colour of the sample only
3. The temperature of the tube
4. The mass of the sample

✓ **Answer: A** — The photometer measures light intensity.

A: The photometer measures light intensity.
B: It measures intensity. The right answer is: The intensity of light.
C: This is not stated. The right answer is: The intensity of light.
D: This is not stated. The right answer is: The intensity of light.

Q1055 · Easy · *codex, slides 524 to 526*

What holds the liquid sample in a spectrophotometer?

1. A microscope slide
2. A cuvette
3. A paper strip
4. A copper grid

✓ **Answer: B** — The liquid sits in a cuvette.

A: This is for microscopy. The right answer is: A cuvette.
B: The liquid sits in a cuvette.
C: This is for chromatography. The right answer is: A cuvette.
D: This is for electron microscopy. The right answer is: A cuvette.

Q1056 · Easy · *codex, slides 524 to 526*

Where is the cuvette placed?

1. Between the beam and the photometer
2. Before the lamp of the machine
3. Behind the photometer and display
4. Inside the galvanometer housing

✓ **Answer: A** — It sits between the beam and the photometer.

A: It sits between the beam and the photometer.
B: This is not stated. The right answer is: Between the spectrometer beam and the photometer.
C: This is not stated. The right answer is: Between the spectrometer beam and the photometer.
D: This is not stated. The right answer is: Between the spectrometer beam and the photometer.

Q1057 · Easy · *codex, slides 524 to 526*

Which display device is normally used to show the photometer signal?

1. A microscope
2. A thermometer
3. A galvanometer
4. A microtome

✓ **Answer: C** — A galvanometer is normally used.

A: This is not a display device here.
B: This is not stated. The right answer is: A galvanometer.
C: A galvanometer is normally used.
D: This cuts sections. The right answer is: A galvanometer.

Q1058 · Medium · *codex, slides 524 to 526*

What does the photometer deliver to the display device?

1. A focused beam of electrons
2. A flash of light
3. A voltage signal
4. A cloud of steam

✓ **Answer: C** — It delivers a voltage signal.

A: This is not stated. The right answer is: A voltage signal.
B: This is not stated. The right answer is: A voltage signal.
C: It delivers a voltage signal.
D: This is not stated. The right answer is: A voltage signal.

Q1059 · Medium · *codex, slides 524 to 526*

What makes the display signal change?

1. The colour of the plastic cuvette
2. The light absorbed by the liquid
3. The size of the laboratory room
4. The age of the sample tube

✓ **Answer: B** — The signal changes as absorption changes.

A: This is not stated. The right answer is: The amount of light absorbed by the liquid.
B: The signal changes as absorption changes.
C: This is not stated. The right answer is: The amount of light absorbed by the liquid.
D: This is not stated. The right answer is: The amount of light absorbed by the liquid.

Q1060 · Medium · *codex, slides 524 to 526*

How many instruments make up a spectrophotometer?

1. One
2. Three
3. Two
4. Four

✓ **Answer: C** — A spectrometer and a photometer.

A: It has two instruments. The right answer is: Two.
B: It has two instruments. The right answer is: Two.
C: A spectrometer and a photometer.
D: It has two instruments. The right answer is: Two.

Q1061 · Medium · *codex, slides 524 to 526*

What does the lecture mean by the colour of light produced by the spectrometer?

1. The brightness
2. The wavelength
3. The speed
4. The temperature

✓ **Answer: B** — Colour is wavelength.

A: This is amplitude. The right answer is: The wavelength.
B: Colour is wavelength. It matches what the lecture slides state.
C: This is not stated. The right answer is: The wavelength.
D: This is not stated. The right answer is: The wavelength.

Q1062 · Medium · *codex, slides 524 to 526*

Which part measures the amount of light passing through the tube?

1. The photometer
2. The spectrometer
3. The cuvette
4. The galvanometer

✓ **Answer: A** — The photometer measures the light.

A: The photometer measures the light.
B: This produces the light. The right answer is: The photometer.
C: This holds the liquid. The right answer is: The photometer.
D: This displays the signal. The right answer is: The photometer.

Q1063 · Hard · *codex, slides 524 to 526*

Which sequence correctly follows the light in a spectrophotometer?

1. Photometer, cuvette, spectrometer, then display device
2. Spectrometer, cuvette with sample, photometer, then display device
3. Cuvette, display device, spectrometer, then photometer
4. Display device, photometer, cuvette, then spectrometer

✓ **Answer: B** — This is the light path and signal path.

A: The order is wrong. The right answer is: Spectrometer, cuvette with sample, photometer, then display device.
B: This is the light path and signal path.
C: The order is wrong. The right answer is: Spectrometer, cuvette with sample, photometer, then display device.
D: The order is wrong. The right answer is: Spectrometer, cuvette with sample, photometer, then display device.

Q1064 · Hard · *codex, slides 524 to 526*

All of the following are parts of a spectrophotometer set-up EXCEPT which one?

1. A microtome
2. A spectrometer
3. A photometer
4. A cuvette

✓ **Answer: A** — Correct choice.

A: Correct choice. A microtome cuts sections.
B: This is a part. The right answer is: A microtome.
C: This is a part. The right answer is: A microtome.
D: This is a part. The right answer is: A microtome.

Colour, absorbance and concentration · Q1065–1080

Q1065 · Easy · *codex, slides 532 to 535*

If a material absorbs violet light, what colour does it appear?

1. Orange
2. Red
3. Blue
4. Yellow

✓ **Answer: D** — Violet absorbed gives yellow.

A: This is seen when blue is absorbed.
B: This is seen when green is absorbed.
C: This is seen when orange is absorbed.
D: Violet absorbed gives yellow. It matches what the lecture slides state.

Q1066 · Easy · *codex, slides 532 to 535*

If a material absorbs blue light, what colour does it appear?

1. Yellow
2. Orange
3. Red
4. Violet

✓ **Answer: B** — Blue absorbed gives orange.

A: This is seen when violet is absorbed.
B: Blue absorbed gives orange. It matches what the lecture slides state.
C: This is seen when green is absorbed.
D: This is seen when yellow is absorbed.

Q1067 · Easy · *codex, slides 532 to 535*

If a material absorbs yellow light, what colour does it appear?

1. Orange
2. Green
3. Blue
4. Violet

✓ **Answer: D** — Yellow absorbed gives violet.

A: This is seen when blue is absorbed.
B: This is not the complement. The right answer is: Violet.
C: This is seen when orange is absorbed.
D: Yellow absorbed gives violet. It matches what the lecture slides state.

Q1068 · Easy · *codex, slides 532 to 535*

What colour does haemoglobin appear?

1. Blue
2. Green
3. Red
4. Violet

✓ **Answer: C** — Haemoglobin appears red.

A: It absorbs blue light. The right answer is: Red.
B: It absorbs green light. The right answer is: Red.
C: Haemoglobin appears red. It matches what the lecture slides state.
D: This is not stated. The right answer is: Red.

Q1069 · Easy · *codex, slides 532 to 535*

In the equation A = εcl, what does ε represent?

1. The molar absorptivity
2. The path length
3. The concentration
4. The absorbance

✓ **Answer: A** — ε is the molar absorptivity.

A: ε is the molar absorptivity.
B: This is l. The right answer is: The molar absorptivity.
C: This is c. The right answer is: The molar absorptivity.
D: This is A. The right answer is: The molar absorptivity.

Q1070 · Easy · *codex, slides 532 to 535*

Absorbance is proportional to what?

1. The percentage transmittance
2. The path of the sunlight
3. The temperature of the lamp
4. The concentration of the analyte

✓ **Answer: D** — Absorbance is proportional to concentration.

A: %T is not proportional to concentration.
B: This is not stated. The right answer is: The concentration of the analyte.
C: This is not stated. The right answer is: The concentration of the analyte.
D: Absorbance is proportional to concentration.

Q1071 · Medium · *codex, slides 532 to 535*

Which light does haemoglobin absorb much more effectively than red?

1. Red light
2. Infrared light
3. Blue and green light
4. Ultraviolet light only

✓ **Answer: C** — It absorbs blue and green more effectively.

A: It absorbs less red. The right answer is: Blue and green light.
B: This is not stated. The right answer is: Blue and green light.
C: It absorbs blue and green more effectively.
D: This is not stated. The right answer is: Blue and green light.

Q1072 · Medium · *codex, slides 532 to 535*

What is proportional to the haemoglobin concentration in solution?

1. The amount of red light transmitted only
2. The viscosity of the solution
3. The absorbance of blue or green light
4. The size of the cuvette

✓ **Answer: C** — This is the proportional measurement.

A: This is not stated. The right answer is: The absorbance of blue or green light.
B: This is not stated. The right answer is: The absorbance of blue or green light.
C: This is the proportional measurement.
D: This is not stated. The right answer is: The absorbance of blue or green light.

Q1073 · Medium · *codex, slides 532 to 535*

Why is absorbance generally preferred over % transmittance?

1. Absorbance is proportional to concentration
2. %T cannot be measured at all by any instrument
3. %T needs no light source at all
4. Absorbance is always larger in value

✓ **Answer: A** — This is the stated reason.

A: This is the stated reason.
B: It can be measured. The right answer is: Absorbance is proportional to concentration, whereas %T is not.
C: This is not stated. The right answer is: Absorbance is proportional to concentration, whereas %T is not.
D: This is not stated. The right answer is: Absorbance is proportional to concentration, whereas %T is not.

Q1074 · Medium · *codex, slides 532 to 535*

Which relationship between absorbance and % transmittance is correct?

1. $A = 2 + \log_{10} \%T$
2. $A = \%T / 100$
3. $A = \log_{10} \%T$ only
4. $A = 2 - \log_{10} \%T$

✓ **Answer: D** — This is the correct relationship.

A: The sign is wrong. The right answer is: $A = 2 - \log_{10} \%T$.
B: This is not the relationship. The right answer is: $A = 2 - \log_{10} \%T$.
C: This omits the 2. The right answer is: $A = 2 - \log_{10} \%T$.
D: This is the correct relationship.

Q1075 · Medium · *codex, slides 532 to 535*

In A = εcl, what do c and l stand for?

1. Colour and light
2. Cuvette and lens
3. Charge and length
4. Concentration and path length

✓ **Answer: D** — c is concentration and l is path length.

A: These are not the terms. The right answer is: Concentration and path length.
B: These are not the terms. The right answer is: Concentration and path length.
C: These are not the terms. The right answer is: Concentration and path length.
D: c is concentration and l is path length.

Q1076 · Medium · *codex, slides 532 to 535*

If colour development is linked to concentration, how can concentration be measured?

1. By counting the cuvettes used
2. By measuring light absorption
3. By measuring the room temperature
4. By weighing the light beam

✓ **Answer: B** — Absorption measures concentration.

A: This is not stated. The right answer is: By determining the extent of light absorption at the appropriate wavelength.
B: Absorption measures concentration. It matches what the lecture slides state.
C: This is not stated. The right answer is: By determining the extent of light absorption at the appropriate wavelength.
D: This is not stated. The right answer is: By determining the extent of light absorption at the appropriate wavelength.

Q1077 · Hard · *codex, slides 532 to 535*

A sample transmits 10% of the light. What is its absorbance?

1. 2
2. 0.1
3. 1
4. 10

✓ **Answer: C** — $A = 2 - \log_{10} 10 = 1$.

A: This is A when %T is 1.
B: This is not the result. The right answer is: 1.
C: $A = 2 - \log_{10} 10 = 1$.
D: This is %T. The right answer is: 1.

Q1078 · Hard · *codex, slides 532 to 535*

A sample transmits 1% of the light. What is its absorbance?

1. 2
2. 1
3. 0
4. 0.01

✓ **Answer: A** — $A = 2 - \log_{10} 1 = 2$.

A: $A = 2 - \log_{10} 1 = 2$.
B: This is A when %T is 10.
C: This is A when %T is 100.
D: This is not the result. The right answer is: 2.

Q1079 · Hard · *codex, slides 532 to 535*

If the concentration of a coloured solution doubles at a fixed path length, what happens to its absorbance?

1. It halves
2. It doubles
3. It stays the same
4. It falls to zero

✓ **Answer: B** — Absorbance is proportional to concentration.

A: It is proportional. The right answer is: It doubles.
B: Absorbance is proportional to concentration.
C: It is proportional. The right answer is: It doubles.
D: It does not. The right answer is: It doubles.

Q1080 · Devil · *codex, slides 532 to 535*

A solution has an absorbance of 1 at a wavelength it absorbs as blue light. What colour does it look, and what is its %T?

1. Yellow, with a %T of 1%
2. Orange, with a %T of 100%
3. Orange, with a %T of 10%
4. Violet, with a %T of 10%

✓ **Answer: C** — Blue absorbed looks orange, and A = 1 gives %T = 10.

A: Violet absorbed looks yellow, and A = 1 gives 10%.
B: A = 1 gives 10%. The right answer is: Orange, with a %T of 10%.
C: Blue absorbed looks orange, and A = 1 gives %T = 10.
D: Yellow absorbed looks violet. The right answer is: Orange, with a %T of 10%.

Autoradiography: principle and procedure · Q1081–1092

Q1081 · Easy · *codex, slides 536 to 539*

What does autoradiography visualise?

1. The colour of a stain dye
2. The temperature of a sample
3. The weight of a single cell
4. Distribution of radioactive label

✓ **Answer: D** — It visualises radioactive label distribution.

A: This is not stated. The right answer is: The distribution of radioactively labelled substances.
B: This is not stated. The right answer is: The distribution of radioactively labelled substances.
C: This is not stated. The right answer is: The distribution of radioactively labelled substances.
D: It visualises radioactive label distribution.

Q1082 · Easy · *codex, slides 536 to 539*

What is the radioactive sample covered with in autoradiography?

1. Paraffin wax
2. Epoxy resin
3. Immersion oil
4. Photographic emulsion

✓ **Answer: D** — The sample is covered with emulsion.

A: This is an embedding medium. The right answer is: Photographic emulsion.
B: This is an embedding medium. The right answer is: Photographic emulsion.
C: This is for microscopy. The right answer is: Photographic emulsion.
D: The sample is covered with emulsion.

Q1083 · Easy · *codex, slides 536 to 539*

Which ions are reduced to atoms in the emulsion?

1. Na^+ ions
2. Ca^{2+} ions
3. Ag^+ ions
4. Cl^- ions

✓ **Answer: C** — Silver ions are reduced to silver atoms.

A: These are not reduced here. The right answer is: Ag^+ ions.
B: These are not reduced here. The right answer is: Ag^+ ions.
C: Silver ions are reduced to silver atoms.
D: These are not reduced here. The right answer is: Ag^+ ions.

Q1084 · Easy · *codex, slides 536 to 539*

Which isotope is among those most widely used in biological research?

1. Uranium-235
2. Iodine-131 only
3. Radon-222
4. Tritium (^3H)

✓ **Answer: D** — Tritium is widely used.

A: This is not listed. The right answer is: Tritium (^3H).
B: This is not listed. The right answer is: Tritium (^3H).
C: This is not listed. The right answer is: Tritium (^3H).
D: Tritium is widely used. It matches what the lecture slides state.

Q1085 · Easy · *codex, slides 536 to 539*

What forms the dark bands in an autoradiogram?

1. Dye molecules
2. Wax crystals
3. Silver atoms
4. Salt crystals

✓ **Answer: C** — Reduced silver forms the dark bands.

A: This is not stated. The right answer is: Silver atoms.
B: This is not stated. The right answer is: Silver atoms.
C: Reduced silver forms the dark bands.
D: This is not stated. The right answer is: Silver atoms.

Q1086 · Medium · *codex, slides 536 to 539*

Which particles from the radioactive salts activate the silver in the emulsion?

1. Negatively charged beta particles
2. Positively charged alpha particles
3. Neutral photons only, no charge
4. Positively charged protons only

✓ **Answer: A** — Beta particles activate silver.

A: Beta particles activate silver. It matches what the lecture slides state.
B: The lecture names beta particles. The right answer is: Negatively charged beta particles.
C: This is not stated. The right answer is: Negatively charged beta particles.
D: This is not stated. The right answer is: Negatively charged beta particles.

Q1087 · Medium · *codex, slides 536 to 539*

What does washing with fixers leave on the slide?

1. All the silver halide
2. Only the dye
3. Insoluble silver atoms only
4. Only the wax

✓ **Answer: C** — Only insoluble silver remains.

A: This is washed away. The right answer is: Insoluble silver atoms only.
B: This is not stated. The right answer is: Insoluble silver atoms only.
C: Only insoluble silver remains. It matches what the lecture slides state.
D: This is not stated. The right answer is: Insoluble silver atoms only.

Q1088 · Medium · *codex, slides 536 to 539*

Which instrument can be used to quantify an autoradiogram?

1. A microtome
2. A densitometer
3. A centrifuge
4. A galvanometer

✓ **Answer: B** — A densitometer gives quantitative estimates.

A: This cuts sections. The right answer is: A densitometer.
B: A densitometer gives quantitative estimates.
C: This separates fractions. The right answer is: A densitometer.
D: This displays a spectrophotometer signal. The right answer is: A densitometer.

Q1089 · Medium · *codex, slides 536 to 539*

What does preflashing the film do?

1. It destroys the silver crystals
2. It makes the film thicker
3. It increases sensitivity
4. It removes the emulsion

✓ **Answer: C** — Preflashing improves sensitivity.

A: It improves sensitivity. The right answer is: It increases sensitivity, needing only one hit per crystal.
B: This is not stated. The right answer is: It increases sensitivity, needing only one hit per crystal.
C: Preflashing improves sensitivity. It matches what the lecture slides state.
D: This is not stated. The right answer is: It increases sensitivity, needing only one hit per crystal.

Q1090 · Hard · *codex, slides 536 to 539*

Which sequence correctly describes the autoradiography procedure?

1. Wash with fixer, cover with emulsion, reduce Ag^+, then view
2. View first, then cover with emulsion, then reduce Ag^+
3. Reduce Ag^+, cover with emulsion, wash, then activate silver
4. Emulsion, silver activated, Ag^+ reduced, fixer wash, then viewing

✓ **Answer: D** — This follows the lecture steps.

A: The order is wrong. The right answer is: Cover with emulsion, silver halide is activated, Ag^+ is reduced to dark Ag, fixer washes, and the autoradiogram is viewed.
B: The order is wrong. The right answer is: Cover with emulsion, silver halide is activated, Ag^+ is reduced to dark Ag, fixer washes, and the autoradiogram is viewed.
C: The order is wrong. The right answer is: Cover with emulsion, silver halide is activated, Ag^+ is reduced to dark Ag, fixer washes, and the autoradiogram is viewed.
D: This follows the lecture steps.

Q1091 · Hard · *codex, slides 536 to 539*

All of the following are isotopes named for biological autoradiography EXCEPT which one?

1. Tritium (^{3}H)
2. Carbon-14
3. Uranium-235
4. Phosphorus-32

✓ **Answer: C** — Correct choice.

A: This is listed. The right answer is: Uranium-235.
B: This is listed. The right answer is: Uranium-235.
C: Correct choice. It is not listed.
D: This is listed. The right answer is: Uranium-235.

Q1092 · Devil · *codex, slides 536 to 539*

A researcher incubates tissue with ^{35}S-labelled amino acids to see where proteins are made. How does the method reveal the sites?

1. It is incorporated and its beta particles darken the silver halide
2. The label dyes the proteins blue, which is then photographed
3. The label makes proteins fluoresce under UV and is photographed
4. The label is separated from the proteins by a centrifuge

✓ **Answer: A** — This matches the described mechanism.

A: This matches the described mechanism.
B: This is not the mechanism. The right answer is: The label is incorporated into proteins, its beta particles reduce silver halide, and dark grains mark the sites.
C: This is not the mechanism. The right answer is: The label is incorporated into proteins, its beta particles reduce silver halide, and dark grains mark the sites.
D: This is not the mechanism. The right answer is: The label is incorporated into proteins, its beta particles reduce silver halide, and dark grains mark the sites.

Autoradiography with tritiated thymidine · Q1093–1098

Q1093 · Easy · *codex, slides 543, 544*

Which labelled nucleoside is used to label DNA in the lecture's example?

1. Tritiated uridine
2. Radioactive glucose
3. Tritiated thymidine
4. Radioactive glycine

✓ **Answer: C** — Cells are grown with tritiated thymidine.

A: Uridine is used for RNA. The right answer is: Tritiated thymidine.
B: This is not the example. The right answer is: Tritiated thymidine.
C: Cells are grown with tritiated thymidine.
D: This is not the example. The right answer is: Tritiated thymidine.

Q1094 · Easy · *codex, slides 543, 544*

Into which molecule is tritiated thymidine incorporated?

1. Messenger RNA
2. Plasma membrane lipids
3. Chromosomal DNA
4. Ribosomal proteins

✓ **Answer: C** — It is incorporated into chromosomal DNA.

A: Thymidine is not in RNA. The right answer is: Chromosomal DNA.
B: This is not stated. The right answer is: Chromosomal DNA.
C: It is incorporated into chromosomal DNA.
D: This is not stated. The right answer is: Chromosomal DNA.

Q1095 · Medium · *codex, slides 543, 544*

Why does tritiated thymidine label DNA and not RNA?

1. Thymidine is not present in RNA
2. Thymidine is too large for RNA
3. RNA is destroyed by the emulsion
4. RNA never contains any isotopes

✓ **Answer: A** — Thymidine is found only in DNA.

A: Thymidine is found only in DNA.
B: This is not the reason. The right answer is: Thymidine is not present in RNA.
C: This is not the reason. The right answer is: Thymidine is not present in RNA.
D: This is not the reason. The right answer is: Thymidine is not present in RNA.

Q1096 · Medium · *codex, slides 543, 544*

Which silver salt is in the emulsion used for chromosome labelling?

1. Silver nitrate
2. Silver bromide (AgBr)
3. Sodium chloride
4. Calcium carbonate

✓ **Answer: B** — The emulsion contains silver bromide.

A: This is not stated. The right answer is: Silver bromide (AgBr).
B: The emulsion contains silver bromide.
C: This is not stated. The right answer is: Silver bromide (AgBr).
D: This is not stated. The right answer is: Silver bromide (AgBr).

Q1097 · Medium · *codex, slides 543, 544*

How do the silver grains appear after the radiation converts Ag^+ to metal?

1. As blue patches
2. As small black dots
3. As glowing green rings
4. As transparent crystals

✓ **Answer: B** — The grains look like small black dots.

A: This is not stated. The right answer is: As small black dots.
B: The grains look like small black dots.
C: This is not stated. The right answer is: As small black dots.
D: This is not stated. The right answer is: As small black dots.

Q1098 · Hard · *codex, slides 543, 544*

Which sequence correctly describes labelling of chromosomes with tritiated thymidine?

1. Grow cells with label, fix chromosomes, immerse in emulsion, wash off excess AgBr
2. Immerse in emulsion first, then grow cells with the label, then lyse
3. Wash away AgBr first, then fix the chromosomes, then grow cells
4. Lyse the cells, wash them, then grow them with the label

✓ **Answer: A** — This follows the lecture.

A: This follows the lecture. It matches what the lecture slides state.
B: The order is wrong. The right answer is: Grow cells with the label, lyse and fix chromosomes to a surface, immerse in emulsion, then wash away excess AgBr.
C: The order is wrong. The right answer is: Grow cells with the label, lyse and fix chromosomes to a surface, immerse in emulsion, then wash away excess AgBr.
D: The order is wrong. The right answer is: Grow cells with the label, lyse and fix chromosomes to a surface, immerse in emulsion, then wash away excess AgBr.

Chromatography and the paper technique · Q1099–1110

Q1099 · Easy · *codex, slides 546 to 552*

What is the stationary phase in partition chromatography?

1. A liquid
2. A solid
3. A gas
4. A vacuum

✓ **Answer: A** — The stationary phase is a liquid.

A: The stationary phase is a liquid.
B: This is adsorption chromatography. The right answer is: A liquid.
C: This is not stated. The right answer is: A liquid.
D: This is not stated. The right answer is: A liquid.

Q1100 · Easy · *codex, slides 546 to 552*

Adsorption chromatography uses which kind of stationary phase?

1. A liquid
2. A gas
3. A solid
4. A plasma

> ✓ **Answer: C** — The stationary phase is a solid.

A: This is partition chromatography. The right answer is: A solid.
B: This is not stated. The right answer is: A solid.
C: The stationary phase is a solid.
D: This is not stated. The right answer is: A solid.

Q1101 · Easy · *codex, slides 546 to 552*

Which technique has largely replaced paper chromatography?

1. Autoradiography
2. Thin layer chromatography
3. Spectrophotometry
4. Differential centrifugation

> ✓ **Answer: B** — TLC has largely replaced it.

A: This is a different technique. The right answer is: Thin layer chromatography.
B: TLC has largely replaced it.
C: This is a different technique. The right answer is: Thin layer chromatography.
D: This is a different technique. The right answer is: Thin layer chromatography.

Q1102 · Easy · *codex, slides 546 to 552*

How is the sample applied to the paper?

1. As a thick coat of paraffin wax
2. As a small capillary spot
3. As a stream from a water hose
4. As a block of hard resin

> ✓ **Answer: B** — A small spot is placed with a capillary tube.

A: This is not stated. The right answer is: As a small spot placed with a capillary tube.
B: A small spot is placed with a capillary tube.
C: This is not stated. The right answer is: As a small spot placed with a capillary tube.
D: This is not stated. The right answer is: As a small spot placed with a capillary tube.

Q1103 · Easy · *codex, slides 546 to 552*

About how far above the base of the paper is the sample spot placed?

1. About 2 cm
2. About 20 cm
3. About 2 mm
4. About 12 cm

✓ **Answer: A** — The spot is about 2 cm from the base.

A: The spot is about 2 cm from the base.
B: This is far too high. The right answer is: About 2 cm.
C: This is too low. The right answer is: About 2 cm.
D: This is too high. The right answer is: About 2 cm.

Q1104 · Medium · *codex, slides 546 to 552*

What drives the solvent up the paper?

1. Gravity pulling it down
2. Capillary action
3. An electric field
4. Centrifugal force

✓ **Answer: B** — Capillary action moves the solvent.

A: Gravity opposes the rise. The right answer is: Capillary action.
B: Capillary action moves the solvent.
C: This is not stated. The right answer is: Capillary action.
D: This is not stated. The right answer is: Capillary action.

Q1105 · Medium · *codex, slides 546 to 552*

Where must the sample spot be relative to the solvent surface?

1. Below the solvent surface
2. Dissolved in the solvent
3. Above the solvent surface
4. Outside the container

✓ **Answer: C** — The spot must be above the solvent.

A: The spot must not be submerged.
B: The spot must be above it.
C: The spot must be above the solvent.
D: It is inside the container. The right answer is: Above the solvent surface.

Q1106 · Medium · *codex, slides 546 to 552*

Which solvents are named for paper chromatography?

1. Ethanol, water or acetone
2. Xylene, paraffin or resin
3. Eosin, safranin or crystal violet
4. Sucrose, CsCl or glycerol

✓ **Answer: A** — These are the named solvents.

A: These are the named solvents.
B: These are processing media. The right answer is: Ethanol, water or acetone.
C: These are dyes. The right answer is: Ethanol, water or acetone.
D: These are other media. The right answer is: Ethanol, water or acetone.

Q1107 · Medium · *codex, slides 546 to 552*

Which two factors make compounds travel at different rates on paper?

1. Colour and brightness of the spot
2. Weight and height of the paper strip
3. Age and temperature of the lamp
4. Solubility and attraction to the paper

✓ **Answer: D** — These two factors decide the rate.

A: This is not stated. The right answer is: Solubility in the solvent and attraction to the cellulose paper.
B: This is not stated. The right answer is: Solubility in the solvent and attraction to the cellulose paper.
C: This is not stated. The right answer is: Solubility in the solvent and attraction to the cellulose paper.
D: These two factors decide the rate.

Q1108 · Medium · *codex, slides 546 to 552*

What is two-way chromatography used for?

1. Measuring absorbance of spots
2. Separating spots that overlap
3. Staining the paper
4. Embedding the spots in wax

✓ **Answer: B** — A second run separates unresolved spots.

A: This is not its use. The right answer is: Separating spots that overlap in the first solvent.
B: A second run separates unresolved spots.
C: This is not its use. The right answer is: Separating spots that overlap in the first solvent.
D: This is not its use. The right answer is: Separating spots that overlap in the first solvent.

Q1109 · Hard · *codex, slides 546 to 552*

How is two-way chromatography carried out?

1. The paper is run twice in the same solvent in the same direction
2. The paper is turned 90° and run in a different solvent
3. The paper is cut in two and stained
4. The paper is dried and burned

✓ **Answer: B** — A second solvent separates overlapping spots.

A: This does not help. The right answer is: The paper is turned 90° and run in a different solvent.
B: A second solvent separates overlapping spots.
C: This is not stated. The right answer is: The paper is turned 90° and run in a different solvent.
D: This is not stated. The right answer is: The paper is turned 90° and run in a different solvent.

Q1110 · Hard · *codex, slides 546 to 552*

All of the following are true of paper chromatography EXCEPT which one?

1. It can measure any substance on the paper
2. Compounds move at different rates
3. The solvent rises by capillary action
4. The sample is placed as a small spot

✓ **Answer: A** — Correct choice.

A: Correct choice. Substances that bond with the paper cannot be measured.
B: This is true. The right answer is: It can measure any substance, including those that bond with the paper.
C: This is true. The right answer is: It can measure any substance, including those that bond with the paper.
D: This is true. The right answer is: It can measure any substance, including those that bond with the paper.

Rf values and interpreting data · Q1111–1120

Q1111 · Easy · *codex, slides 554 to 560*

What does Rf stand for?

1. Rate of flow
2. Ratio of fronts
3. Relative frequency
4. Radius of fixation

✓ **Answer: B** — Rf stands for ratio of fronts.

A: This is not the meaning. The right answer is: Ratio of fronts.
B: Rf stands for ratio of fronts.
C: This is not the meaning. The right answer is: Ratio of fronts.
D: This is not the meaning. The right answer is: Ratio of fronts.

Q1112 · Easy · *codex, slides 554 to 560*

How is the Rf value calculated?

1. Distance of the solvent front divided by distance of the spot
2. Width of the spot divided by the paper width
3. Time taken divided by distance travelled
4. Spot distance divided by solvent front distance

✓ **Answer: D** — This is the definition.

A: This inverts the ratio. The right answer is: Distance travelled by the spot divided by distance travelled by the solvent front.
B: This is not the definition. The right answer is: Distance travelled by the spot divided by distance travelled by the solvent front.
C: This is not the definition. The right answer is: Distance travelled by the spot divided by distance travelled by the solvent front.
D: This is the definition. It matches what the lecture slides state.

Q1113 · Easy · *codex, slides 554 to 560*

Is the Rf value characteristic for a given substance?

1. No, it varies at random each run
2. Yes, unique under the same conditions
3. No, it is the same for all substances
4. Only for coloured substances

✓ **Answer: B** — It is characteristic of the substance.

A: It is characteristic. The right answer is: Yes, it is unique under the same conditions.
B: It is characteristic of the substance.
C: It differs between substances. The right answer is: Yes, it is unique under the same conditions.
D: This is not stated. The right answer is: Yes, it is unique under the same conditions.

Q1114 · Easy · *codex, slides 554 to 560*

When will a compound give the same Rf value?

1. When run in any solvent at all
2. When run under identical conditions
3. When stained after running
4. When dried in the sun first

✓ **Answer: B** — Identical conditions give the same Rf.

A: The solvent changes Rf. The right answer is: When run under identical conditions.
B: Identical conditions give the same Rf.
C: This is not stated. The right answer is: When run under identical conditions.
D: This is not stated. The right answer is: When run under identical conditions.

Q1115 · Medium · *codex, slides 554 to 560*

The solvent front travelled 10 cm and a spot travelled 4 cm. What is the Rf?

1. 0.4
2. 2.5
3. 0.04
4. 14

✓ **Answer: A** — 4 divided by 10 is 0.4.

A: 4 divided by 10 is 0.4.
B: This inverts the ratio. The right answer is: 0.4.
C: This slips a factor of ten.
D: This adds the distances. The right answer is: 0.4.

Q1116 · Medium · *codex, slides 554 to 560*

The solvent front travelled 12 cm and a spot travelled 9 cm. What is the Rf?

1. 1.33
2. 0.75
3. 0.25
4. 21

✓ **Answer: B** — 9 divided by 12 is 0.75.

A: This inverts the ratio. The right answer is: 0.75.
B: 9 divided by 12 is 0.75.
C: This is not the ratio. The right answer is: 0.75.
D: This adds the distances. The right answer is: 0.75.

Q1117 · Medium · *codex, slides 554 to 560*

To which part of the spot is the distance travelled measured?

1. The top edge of the spot
2. The centre of the spot
3. The bottom edge of the spot
4. The edge of the paper

✓ **Answer: B** — Distance is measured to the centre.

A: It is measured to the centre.
B: Distance is measured to the centre.
C: It is measured to the centre.
D: It is measured to the centre.

Q1118 · Medium · *codex, slides 554 to 560*

Which of these Rf values is impossible?

1. 0.5
2. 0.8
3. 0.1
4. 1.2

> ✓ **Answer: D** — Correct choice.

A: This is possible. The right answer is: 1.2.
B: This is possible. The right answer is: 1.2.
C: This is possible. The right answer is: 1.2.
D: Correct choice. A spot cannot travel farther than the solvent front.

Q1119 · Hard · *codex, slides 554 to 560*

A spot travelled 5.2 cm while the solvent front travelled 13 cm. What is its Rf?

1. 0.4
2. 2.5
3. 0.52
4. 7.8

> ✓ **Answer: A** — 5.2 divided by 13 is 0.4.

A: 5.2 divided by 13 is 0.4.
B: This inverts the ratio. The right answer is: 0.4.
C: This is not the ratio. The right answer is: 0.4.
D: This subtracts the distances. The right answer is: 0.4.

Q1120 · Devil · *codex, slides 554 to 560*

A spot has an Rf of 0.60 and the solvent front travelled 15 cm. How far did the spot travel?

1. 9 cm
2. 25 cm
3. 0.9 cm
4. 15.6 cm

> ✓ **Answer: A** — 0.60 multiplied by 15 is 9.

A: 0.60 multiplied by 15 is 9.
B: This divides 15 by 0.6. The right answer is: 9 cm.
C: This slips a factor of ten.
D: This adds the values. The right answer is: 9 cm.