Carpe Diem — Introduction to Medical Imaging — Study Bank

ANSWER & EXPLANATION UNDER EVERY QUESTION · INTRODUCTION TO MEDICAL IMAGING · INTRODUCTION TO MEDICAL IMAGING — LECTURES 1 & 2 · SONOGRAPHY PART 1

251 questions · Lectures 1 & 2 + Sonography Part 1 · Devil 62 · Easy 63 · Hard 62 · Medium 64

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Totals: 251 questions — Devil 62 · Easy 63 · Hard 62 · Medium 64.

Module 1: Lecture 1 — Introduction to Medical Imaging — 100 questions

1. Set 1 · Q1–10

X-ray history · Devil

1. Which statement about the history of X-ray is FALSE?

A Roentgen, a German physicist, discovered X-rays on 8 November 1895

B Early X-ray work caused skin burns, hair loss and anemia

C The first recorded clinical X-ray was made in Germany in November 1895

D The first X-ray film was a glass plate with photographic emulsion

> **Answer 1: C**
>
> False: the first recorded X-ray was in February 1896 at Dartmouth College, USA; November 1895 is the discovery.

Resolution limits · Hard

2. According to the table comments, what limits the resolution of digital radiography and digital mammography?

A The wavelength of sound in tissue

B The distance from the patient to the detector

C The size of the detector elements

D The strength of the magnetic field

> **Answer 2: C**
>
> Correct: the table says digital radiography and mammography are limited by detector element size.

Choosing modality · Medium

3. How does a referring doctor generally choose among X-ray, CT, MRI and ultrasound?

A The simplest, cheapest and safest test able to answer the question

B The newest and most expensive scanner available

C The modality with the highest radiation dose

D The test that takes the longest to perform

> **Answer 3: A**
>
> Correct: the lecture states this rule.

Detector problems · Devil

4. Which of these is a detector response named as causing image artifacts, rather than a source specification?

A Focal spot size

B Maximum tube voltage

C Long decay time

D Beam collimator width

> **Answer 4: C**
> Correct: non-linearity, low efficiency and long decay time are detector responses that cause artifacts.

Ultrasound frequency · Hard

5. Why does raising ultrasound frequency from 3.5 MHz to 10 MHz improve spatial resolution?

A The wavelength becomes longer, giving wider coverage

B The speed of sound rises in proportion to frequency

C The beam becomes ionising and more penetrating

D The wavelength, the fundamental limit, becomes shorter

> **Answer 5: D**
> Correct: the lecture gives 0.50 mm at 3.5 MHz and 0.15 mm at 10 MHz.

Collimator · Medium

6. Which device restricts the size of the X-ray beam?

A The cathode filament

B The image receptor

C The high-tension cable

D The collimator

> **Answer 6: D**
> Correct: the lecture states the size of the beam is restricted by the collimator.

X-ray discovery · Easy

7. Who discovered X-rays, and on what date?

A Wilhelm Conrad Roentgen, 8 November 1895

B Henri Becquerel, 8 November 1895

C Marie Curie, 22 December 1895

D Wilhelm Conrad Roentgen, 8 February 1896 KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 4

> **Answer 7: A**
> Correct: Roentgen, a German physicist, discovered X-rays on 8 November 1895.

Contrast · Easy

8. In MRI, contrast is related primarily to which properties?

A Proton density and relaxation phenomena

B X-ray absorption coefficient of the tissue

C Acoustic properties of the tissues

D Distribution of radiopharmaceutical in the organ

> **Answer 8: A**
> Correct: how many protons there are and how fast they give up absorbed energy.

Radiation field · Medium

9. What is the radiation field?

A The region of the tube where electrons are produced

B The cross section of the X-ray beam at the point where it is used

C The photon at the beam centre perpendicular to the tube axis

D The total area of the room exposed to scatter

> **Answer 9: B**
>
> Correct: this is the lecture's definition of the radiation field.

Scatter radiation · Medium

10. Which statement about scattered radiation matches the lecture?

A It generally has less energy than the primary beam and is not easily controlled

B It has more energy than the primary beam and is easily controlled

C It forms the useful image and is harmless to staff

D It is produced only in the tube and cannot leave the housing

> **Answer 10: A**
>
> Correct: scatter is lower in energy, travels in all directions and is hard to control.

2. Set 2 · Q11–20

Ultrasound wavelength · Devil

11. Taking 1500 m/s as the speed of sound, what frequency gives a 0.1 mm wavelength, and how does it compare with the lecture's 10 MHz?

A 1.5 MHz, which is lower than 10 MHz

B 15 kHz, which is far below 10 MHz

C 15 MHz, which is higher than 10 MHz

D 150 MHz, which is far above 10 MHz

> **Answer 11: C**
>
> Correct: $f = v \div \lambda = 1500 \div 0.0001 = 1.5 \times 10^7$ Hz = 15 MHz.

Imaging classification · Devil

12. Which pairing of modality and imaging type is FALSE, based on the lecture's modality slide?

A Ultrasound as transmission imaging

B CT as transmission imaging

C Doppler ultrasound as reflection imaging

D Nuclear medicine (PET, SPECT) as emission imaging

> **Answer 12: A**
>
> False: ultrasound is reflection imaging.

Contrast basis · Hard

13. Which pairing of modality and basis of contrast is correct?

A X-ray with the proton density of the tissues

B MRI with the local X-ray absorption coefficient

C Ultrasound with the relaxation of absorbed energy

D Ultrasound with the acoustic properties of the tissues

> **Answer 13: D**
>
> Correct: ultrasound contrast is largely determined by acoustic tissue properties.

Physics of imaging · Medium

14. How does SPECT differ from X-ray imaging in its imaging principle?

A SPECT uses transmission of gamma rays; X-ray uses emission

B SPECT detects reflected sound; X-ray uses emission

C SPECT detects gamma emission from a radiopharmaceutical; X-ray uses transmission

D SPECT uses radio waves; X-ray uses reflection

> **Answer 14: C**
>
> Correct: X-ray relies on transmission, SPECT on emission of gamma rays from tracer-tissue interaction.

Static vs dynamic · Medium

15. Which pairing of property and type is correct, based on the lecture?

A Tissue density is dynamic; blood flow is static

B Tissue density is static; blood flow is dynamic

C Cardiac motion is static; perfusion is static

D Blood flow is static; cardiac motion is static KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 5

> **Answer 15: B**
>
> Correct: density is static and flow, perfusion and cardiac motion are dynamic.

Fluoroscopy · Easy

16. How does the lecture describe fluoroscopy?

A A still image of bone taken on a glass plate

B A cross-sectional study built from rotating projections

C A study of moving body structures, like an X-ray movie

D A sound-wave scan of the heart showing blood flow

> **Answer 16: C**
>
> Correct: a continuous beam passes through the body to a TV-like monitor to show motion.

MRI safety · Easy

17. Which statement about MRI and ultrasound is correct?

A They use low-dose X-rays to avoid harm

B They do not produce any ionising radiation

C They use gamma rays from injected tracers

D They emit ionising radiation only above 1.5 tesla

> **Answer 17: B**
>
> Correct: the safety slide states this explicitly.

Photon energy · Devil

18. Gamma rays at 1/1000 nm are on the spectrum chart. Using $E \approx 1.24\ \text{keV·nm} \div \lambda$, what is the photon energy?

A About 12.4 keV

B About 1.24 MeV

C About 124 keV

D About 1.24 keV

> **Answer 18: B**
>
> Correct: $1.24\ \text{keV·nm} \div 10^{-3}\ \text{nm} = 1240\ \text{keV} = 1.24\ \text{MeV}$.

Ultrasound wavelength · Hard

19. At 10 MHz, the lecture gives a wavelength of 0.15 mm in soft tissue. What speed of sound does this imply?

A About 150 m/s

B About 15 000 m/s

C About 1500 m/s

D About 1.5 m/s

> **Answer 19: C**
>
> Correct: $v = f\lambda = 10 \times 10^{6}\ \text{Hz} \times 0.15 \times 10^{-3}\ \text{m} = 1500\ \text{m/s}$, close to the accepted value for soft tissue.

First X-ray film · Easy

20. According to the lecture, what was the first X-ray film?

A A flexible celluloid roll with a screen cassette

B A glass plate coated with a photographic emulsion

C A digital detector panel with photodiodes

D A metal plate coated with fluorescent paint

> **Answer 20: B**
>
> Correct: the earliest X-ray images were recorded on glass plates carrying a photographic emulsion.

3. Set 3 · Q21–30

Fluoroscopy uses · Medium

21. Why is fluoroscopy suited to angiography and interventional procedures?

A It allows dynamic imaging of blood vessels in real time

B It produces a single high-resolution still of bone

C It needs no X-rays and avoids radiation exposure

D It images the brain without any contrast differences

> **Answer 21: A**
>
> Correct: continuous imaging shows moving vessels and instruments.

Heat in tube · Hard

22. A tube converts 250 J of electron kinetic energy at the anode; using the lecture's figures, how much appears as heat?

A About 5 J

B About 125 J

C About 200 J

D About 245 J

> **Answer 22: D**
>
> Correct: 98% of 250 J is 245 J, leaving about 5 J as X-ray energy.

Central ray · Medium

23. How is the central ray defined?

A Any photon leaving the target at the steepest angle

B The cross section of the beam at the image receptor

C A photon in the centre of the primary beam, perpendicular to the long axis of the tube

D The electron stream moving from cathode to anode KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 6

> **Answer 23: C**
>
> Correct: this matches the slide definition.

Temporal resolution · Easy

24. Temporal resolution is compared to which camera setting in the lecture?

A Lens aperture

B Shutter speed

C Flash intensity

D Memory card size

> **Answer 24: B**
>
> Correct: it is the ability to resolve fast-moving objects, like a fast shutter.

MRI vs CT · Medium

25. The lecture gives which reason for MRI's advantage over CT in the spine?

A MRI uses higher doses of X-rays to see the cord

B MRI scans faster, so patients cannot move

C MR images are insensitive to bone, which in CT obscures the spinal cord

D MRI relies on iodine contrast to outline the cord

> **Answer 25: C**
>
> Correct: bone near the cord makes CT difficult, whereas MRI is insensitive to bone.

MRI limitations · Medium

26. Which patient could not usually be scanned with MRI, according to the lecture?

A A patient with a wrist fracture

B A patient with a mild headache

C A patient who wears a cotton gown

D A patient with a pacemaker

> **Answer 26: D**
>
> Correct: pacemakers, artificial joints and surgical clips are contraindications. KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 29

CT statement · Devil

27. Which statement about CT, as shown in the lecture diagram, is correct?

A A stationary patient, rotating tube and rare-earth ceramic detectors with photodiodes

B A fixed tube while a superconducting magnet rotates around the patient

C A rotating patient while the detectors stay fixed beneath the couch

D A single pencil beam read by one gas-filled detector at the couch

> **Answer 27: A**
>
> Correct: this matches the CT diagram labels.

Primary beam · Medium

28. Where do X-rays form, and what shape does the primary beam take as it leaves?

A In a small focal spot on the anode, diverging as a cone

B In the whole filament, travelling as a parallel sheet

C In the collimator, forming a narrow pencil beam

D In the glass envelope, spreading as a flat disc

> **Answer 28: A**
>
> Correct: X-rays arise in the focal spot and diverge into a cone-shaped primary beam.

Contrast media · Medium

29. Why does imaging the kidneys, bladder or gut with X-ray often require an artificial contrast medium?

A Their atomic number is so high that all X-rays are blocked

B These soft tissue organs are poorly resolved by X-ray alone

C They move too quickly for any X-ray exposure

D They emit gamma rays that need to be cancelled

> **Answer 29: B**
>
> Correct: soft tissue organs absorb X-rays similarly, so contrast helps portray them.

Detector response · Hard

30. A detector's output does not change in proportion to the change in input. Which term does the lecture use, and what is the consequence?

A Non-linearity, which can cause artifacts in the image

B Linearity, which improves the signal-to-noise ratio

C Decay time, which increases the patient's radiation dose

D Efficiency, which reduces temporal motion of the patient

> **Answer 30: A**
>
> Correct: non-linear response is listed among the detector responses that cause artifacts.

4. Set 4 · Q31–40

Ultrasound numbers · Devil

31. The lecture gives 0.50 mm at 3.5 MHz and 0.15 mm at 10 MHz. Which comparison of the implied sound speeds v = fλ is correct?

A 1750 m/s and 1500 m/s, so tissue speed rises with lower frequency

B 175 m/s and 150 m/s, so both figures are consistent in tissue

C 2000 m/s and 1500 m/s, so the 10 MHz figure is the outlier

D 1750 m/s and 1500 m/s, so the 0.50 mm figure is a rounded approximation KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 7

> **Answer 31: D**
>
> Correct: $3.5 \times 10^6 \times 0.5 \times 10^{-3} = 1750$ m/s and $10 \times 10^6 \times 0.15 \times 10^{-3} = 1500$ m/s; at about 1540 m/s the 3.5 MHz wavelength is about 0.44 mm.

CT · Easy

32. What does CT imaging combine to produce multiple images of the inside of the body?

A A strong magnet and radiofrequency pulses

B Radioactive tracers and gamma cameras

C High-frequency sound and a gel-coupled probe

D Special X-ray equipment and sophisticated computers

> **Answer 32: D**
>
> Correct: the CT slide states this combination produces cross-sectional images.

Modality selection · Devil

33. A surgeon must guide a catheter through blood vessels in real time. Which modality and justification fit the lecture best?

A Plain radiography, because one exposure shows motion in detail

B MRI, because its large magnet allows free access for instruments

C Fluoroscopy, because continuous X-ray imaging shows moving vessels and instruments

D CT, because a stationary patient allows continuous live motion

> **Answer 33: C**
>
> Correct: fluoroscopy provides dynamic imaging for angiography and interventional procedures.

Remnant vs scatter · Devil

34. A student says scatter radiation forms the radiographic image because it exits the patient. Which rebuttal is best?

A Scatter has more energy than the primary beam, so it overexposes the receptor and forms the image

B The image comes from remnant radiation; scatter goes in all directions and only adds fog and hazard

C Scatter is only produced in air, so it never exits the patient or reaches the receptor

D Scatter is controlled by the kilovoltage setting, so its direction is not random

> **Answer 34: B**
>
> Correct: remnant radiation carries tissue density patterns, whereas scatter's direction is random.

Ionizing boundary · Devil

35. Which list contains only radiations the lecture chart classes as nonionizing?

A Gamma rays, ultraviolet, visible light, radar

B Diagnostic X-ray, ultraviolet, infrared, radio

C Therapeutic X-ray, visible light, radar, television

D Ultraviolet, visible light, infrared, radar, television, radio

> **Answer 35: D**
>
> Correct: the dividing line on the chart falls between 1 nm and 10 nm, so UV and longer are nonionizing.

Ultrasound table · Devil

36. At 5 MHz the table gives a limiting ultrasound resolution of 0.3 mm. With v = 1500 m/s, what is the wavelength, and what does it show?

A 3 mm, so the wavelength is ten times worse than the limit

B 0.03 mm, so the wavelength is finer than the quoted limit

C 0.3 mm, so resolution is set by the focal spot

D 0.3 mm, so resolution is set by the wavelength

Answer 36: D

Correct: $\lambda = 1500 \div 5 \times 10^{6} = 3 \times 10^{-4}$ m = 0.3 mm, equal to the tabulated limit.

Professional attributes · Medium

37. Which of these is listed among the attributes of a medical imaging professional?

A Competitiveness

B Memorisation only

C Problem-solving

D Working in isolation

Answer 37: C

Correct: self-confidence, critical thinking, problem-solving, teamwork, communication skills and fast learning are listed.

EM spectrum · Easy

38. On the lecture's electromagnetic spectrum chart, which radiation is classed as nonionizing?

A Visible light

B Gamma rays

C Diagnostic X-rays

D Therapeutic X-rays

Answer 38: A

Correct: visible light, infrared, radar, TV and radio lie below the line, in the nonionizing group.

Scatter radiation · Devil

39. Which statement about X-ray beam attenuation is FALSE?

A Primary radiation has energy controlled by the kilovoltage setting

B Remnant radiation's intensity pattern creates the radiographic image

C Scatter exposes everyone in the room and is a radiation hazard

D Scatter radiation travels in predictable, easily controlled directions KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 8

Answer 39: D

False: scatter travels in all directions and is difficult to control.

Cardiac CT · Devil

40. A coronary CT blurs because the heart moves during acquisition. Which statement best explains how to fix the blur, using the lecture's ideas?

A Improve spatial resolution only, by using smaller detectors

B Lower the kilovoltage so scatter is reduced

C Improve temporal resolution so each image is captured with the least cardiac motion

D Switch to a bone-sensitive window to see the arteries

> **Answer 40: C**
>
> Correct: temporal resolution is like shutter speed and is vital for coronary arteries.

5. Set 5 · Q41–50

Choosing modality · Hard

41. A suspected rib fracture needs investigating in a clinic where the doctor wants the simplest, cheapest and safest suitable test. Which is best?

A MRI with gradient coils, because it is non-ionising

B A plain X-ray of the chest wall, as bone contrast is high

C Cardiac CT, because it has good temporal resolution

D Doppler ultrasound, because it shows blood flow

> **Answer 41: B**
>
> Correct: a plain X-ray is cheap, simple and well suited to skeletal contrast.

Data acquisition · Hard

42. Which pair of factors decides the best temporal and spatial resolution, according to the data acquisition slide?

A The patient's age together with the department's budget

B Data collection methods optimised with imaging instrumentation

C Image archiving software together with report format

D Tissue density together with blood flow only

> **Answer 42: B**
>
> Correct: acquisition methods, optimised with instrumentation, determine temporal and spatial resolution.

Beam attenuation table · Medium

43. In the X-ray beam attenuation table, what controls the energy of primary radiation?

A The thickness of the patient

B The kilovoltage setting

C The type of image receptor

D The distance from the tube to the table

> **Answer 43: B**
>
> Correct: primary radiation energy is controlled by the kV setting.

MRI vs resolution table · Devil

44. The table shows MRI at 1.0 mm and CT at 0.4 mm, yet MRI better shows subtle cord changes. Which reconciliation is best?

A MRI's 1.0 mm figure means it resolves finer detail than CT's 0.4 mm

B MRI has strong soft tissue contrast and is insensitive to bone, despite coarser Δ

C CT cannot image soft tissue at all because it uses no X-rays

D MRI uses ionising radiation to penetrate deeper into the tissue

> **Answer 44: B**
>
> Correct: limiting resolution is only one factor; MRI's soft tissue contrast and lack of bone interference help.

MRI resolution · Hard

45. The resolution table comment says MRI resolution (1.0 mm) can improve at higher magnetic fields. What does this indicate?

A The limit depends on the wavelength of sound used

B The limit depends on the focal spot of the tube

C The limit depends on the radiopharmaceutical half-life

D The limit depends on the scanner's field strength, e.g. beyond 1.5 tesla

> **Answer 45: D**
>
> Correct: stronger fields can improve MRI resolution beyond the typical 1.5 T value.

Imaging instrumentation · Hard

46. Which three image-quality aspects does the lecture say are defined by the imaging instrumentation?

A Patient age, report length and archive storage capacity

B Signal-to-noise ratio, resolution and ability to show diagnostic information

C Tissue density, blood flow and cardiac motion in the patient

D Radiopharmaceutical type, half-life and the injection route KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 9

> **Answer 46: B**
>
> Correct: instrumentation is one of the most important factors defining these three aspects of quality.

EM spectrum order · Hard

47. Which ordering runs from shortest to longest wavelength on the lecture chart?

A Gamma rays, therapeutic X-ray, diagnostic X-ray, ultraviolet, visible light, radar, radio

B Therapeutic X-ray, gamma rays, diagnostic X-ray, ultraviolet, visible light, radar, radio

C Therapeutic X-ray, gamma rays, ultraviolet, diagnostic X-ray, visible light, radar, radio

D Therapeutic X-ray, gamma rays, diagnostic X-ray, ultraviolet, radar, visible light, radio

> **Answer 47: B**
>
> Correct: 10^{-5} nm, then 10^{-3} to 10^{-2} nm, then 0.1 to 1 nm, then 10 nm and onward.

X-ray tube · Hard

48. In the X-ray production diagram, from where do the electrons travel and where do they strike?

A From the negative cathode filament to the positive rotating anode

B From the positive anode to the negative cathode filament

C From the glass envelope to the collimator opening

D From the collimator to the patient on the table

> **Answer 48: A**
>
> Correct: electrons leave the cathode and are accelerated to hit the rotating anode target.

Resolution table · Hard

49. Using the table of limiting spatial resolutions, roughly how many times larger is the CT value (0.4 mm) than the digital radiography value (0.17 mm)?

A About 2.4 times, so digital radiography resolves finer detail

B About 2.4 times, so CT resolves finer detail

C About 0.4 times, so digital radiography resolves finer detail

D About 24 times, so CT resolves finer detail

> **Answer 49: A**
>
> Correct: $0.4 \div 0.17 \approx 2.35$, and a smaller Δ means better resolution.

X-ray indications · Easy

50. Why is X-ray particularly useful for investigating the skeletal system?

A Bone gives off its own radio signal

B Soft tissue completely blocks the X-ray beam

C There is high contrast between bone and soft tissue

D X-ray resolves spinal cord and kidneys better than bone

> **Answer 50: C**
>
> Correct: bone absorbs far more than soft tissue, giving high contrast.

6. Set 6 · Q51–60

MRI contraindications · Devil

51. An unconscious ICU patient on a ventilator with surgical clips needs brain imaging. Which statement is most accurate based on the lecture?

A MRI is problematic here, as clips and ventilation monitoring both cause difficulties

B MRI is ideal, as it avoids ionising radiation and clips are harmless

C MRI is ideal, as ventilation equipment works well in the magnet

D MRI is impossible only because of the superconducting magnet's size

> **Answer 51: A**
>
> Correct: the lecture lists surgical clips and unconscious patients needing monitoring or ventilation as MRI problems.

EM spectrum conversion · Hard

52. The chart lists diagnostic X-rays at 1/10 nm. What is this wavelength in metres, given 1 nm = 10^{-9} m?

A 1×10^{-10} m

B 1×10^{-8} m

C 1×10^{-12} m

D 1×10^{-7} m

> **Answer 52: A**
>
> Correct: 0.1 nm × 10^{-9} m/nm = 10^{-10} m.

Image processing · Hard

53. What is the aim of image processing and analysis in the physiology-to-information chain?

A To enhance diagnostic information for manual or computer-assisted interpretation

B To generate X-rays with a lower tube voltage

C To measure the physical density of tissue directly

D To replace the detector when its response is non-linear

> **Answer 53: A**
>
> Correct: processing aims to improve interpretation, whether by readers or computers.

First recorded X-ray · Easy

54. The first recorded X-ray in February 1896 showed what, and where was it made?

A A man's chest infection, at a Berlin hospital

B A girl's skull injury, at Oxford University

C A boy's fractured femur, at Harvard Medical School

D A boy's fractured wrist, at Dartmouth College, USA KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 10

> **Answer 54: D**
>
> Correct: a young boy with a wrist fracture, imaged at Dartmouth College in the USA.

Resolution ranking · Devil

55. Which ordering from finest to coarsest limiting resolution is correct, according to the table?

A Screen-film mammography, screen-film radiography, fluoroscopy, digital radiography

B Screen-film radiography, screen-film mammography, fluoroscopy, digital radiography

C Screen-film mammography, fluoroscopy, screen-film radiography, digital radiography

D Digital radiography, fluoroscopy, screen-film radiography, screen-film mammography

> **Answer 55: A**
>
> Correct: Δ = 0.03, 0.08, 0.125 and 0.17 mm, increasing from finest to coarsest.

Temporal resolution in CT · Medium

56. Why is temporal resolution vital in cardiac CT but of little importance for most other CT studies?

A The heart is made of bone-dense tissue that blurs easily

B Other organs absorb too much radiation to need speed

C Cardiac CT uses a different principle than other CT scans

D Coronary arteries are only optimally imaged when cardiac motion is least

> **Answer 56: D**
>
> Correct: the heart moves, whereas most other imaged structures have minimal motion.

SPECT resolution · Devil

57. Which statement about nuclear medicine spatial resolution, from the table, is correct?

A Planar imaging improves as distance from the detector increases

B SPECT resolution is worst toward the centre of the cross-sectional slice

C PET is worse than SPECT, at 7 mm versus 5 mm

D SPECT is limited by the wavelength of sound

> **Answer 57: B**
>
> Correct: the comment says SPECT is worst toward the centre.

Spatial resolution · Easy

58. How does the lecture define an imaging system with higher spatial resolution?

A It can show larger objects with brighter pixels

B It can scan the patient faster than other systems

C It can use a lower radiation dose for each image

D It can show the presence of smaller objects in the image

> **Answer 58: D**
>
> Correct: higher spatial resolution means smaller objects can be demonstrated. KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 33

Early radiographers · Easy

59. Who were the earliest radiographers, and what were they first called?

A Physicists who could operate the new machine, called X-ray technicians

B Surgeons who owned the machine, called film doctors

C Nurses trained abroad, called imaging sisters

D Chemists who prepared plates, called plate assistants

> **Answer 59: A**
>
> Correct: physicists able to run the new technology were called X-ray technicians.

Remnant radiation · Medium

60. Which radiation forms the radiographic image?

A Primary radiation, because it is unattenuated by the patient

B Scatter radiation, because it travels in all directions

C Remnant (exit) radiation, because its intensity pattern reflects tissue densities

D Leakage radiation, because it passes through the tube housing

> **Answer 60: C**
>
> Correct: differential absorption gives remnant radiation an intensity pattern that creates the image.

7. Set 7 · Q61–70

Contrast reasoning · Devil

61. A patient needs assessment of the bladder and gut, but plain X-ray shows poor detail. What is the best explanation and remedy?

A High bone content masks the organ, so remove the bone with MRI

B The organs emit gamma rays, so use a longer exposure

C The organs move too fast, so raise the kilovoltage only

D Similar absorption coefficients among soft tissues, so give an artificial contrast medium

> **Answer 61: D**
>
> Correct: X-ray contrast depends on absorption differences, so contrast media portray the organ.

Objective of MI · Easy

62. What is the overall objective of medical imaging?

A To replace laboratory tests with photographs of blood and other body fluids

B To acquire useful information about organs or physiological processes using energy sources

C To treat disease by using only high-energy ionising radiation sources

D To store patient records and send reports to clinicians quickly KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 11

> **Answer 62: B**
>
> Correct: this is the lecture's definition of the objective of medical imaging.

Early X-ray injuries · Easy

63. Which set lists the early injuries from X-ray exposure named in the lecture?

A Cataracts, deafness and diabetes

B Bone fractures, bruising and fever

C Skin burns, hair loss and anemia

D Night blindness, jaundice and asthma

> **Answer 63: C**
>
> Correct: early workers and patients suffered skin burns, hair loss and anemia.

Fluoroscopy equipment · Medium

64. Which set of parts is shown for a fluoroscopy unit?

A Magnet, gradient coils and RF coil

B Fan-beam tube, ring detectors and patient couch only

C Transducer, gel and display monitor

D X-ray tube, image intensifier, and TV camera or CCD array

> **Answer 64: D**
>
> Correct: these are labelled on the fluoroscopy slide, with the CCD used for digital screening.

Heat vs X-ray · Easy

65. When electrons rapidly decelerate at the anode, roughly what proportion of the energy becomes X-rays?

A About 98%, with about 2% lost as heat

B About 50%, with about 50% lost as heat

C About 20%, with about 80% lost as heat

D About 2%, with about 98% lost as heat

> **Answer 65: D**
>
> Correct: the slide states heat is about 98% and X-rays about 2%.

CT geometry · Hard

66. In the CT diagram, how are multiple projections of a stationary patient obtained?

A The patient rotates inside a fixed tube and detector array

B A single parallel beam is used with one fixed detector

C The tube and detector array rotate, sending a thin fan beam from many angles

D A magnet rotates around the patient to realign protons

> **Answer 66: C**
>
> Correct: rotation of the tube and detector array gives multiple projections from different angles.

MRI equipment · Easy

67. Which components are listed for an MRI scanner?

A A superconducting magnet of about 1.5 tesla, gradient coils and RF coils

B An X-ray tube, an image intensifier and a TV camera

C A rotating gantry, fan beam and ceramic detector array

D A transducer, a coupling gel and a Doppler processor

> **Answer 67: A**
>
> Correct: these three components appear on the MRI slide.

Imaging principles · Easy

68. In the lecture's grouping, ultrasound belongs to which type of imaging?

A Transmission imaging

B Reflection imaging

C Emission imaging

D Absorption imaging

> **Answer 68: B**
>
> Correct: grey-scale and colour Doppler ultrasound are grouped as reflection imaging.

X-ray production · Easy

69. Which list gives the basic requirements for producing X-rays?

A A vacuum, a magnet, a detector and a low voltage

B Air, a proton source, a target and a high current

C A vacuum, an electron source, a target and a high voltage

D A gas, an electron source, a screen and a low voltage

> **Answer 69: C**
>
> Correct: these four requirements are listed on the X-ray production slide.

Nuclear medicine resolution · Hard

70. Among nuclear medicine methods in the table, which has the best limiting resolution?

A SPECT, at about 7 mm

B Planar imaging, at about 7 mm

C PET, at about 5 mm

D MRI, at about 1.0 mm KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 12

> **Answer 70: C**
>
> Correct: PET has $\Delta = 5$ mm, better than SPECT and planar imaging at 7 mm.

8. Set 8 · Q71–80

Radiographer education · Medium

71. How did radiographer education change over time, according to the lecture?

A From a 4-year degree down to short in-hospital apprenticeships

B From formal 2-year training to physicists-only practice

C From a 6-year degree to a 2-year diploma

D From on-the-job training in hospitals to formal training, first 2 years and later 4 years

> **Answer 71: D**
>
> Correct: training started in hospitals, then became formal, 2 years and later 4 years.

Resolution table · Hard

72. Screen-film mammography has Δ = 0.03 mm and SPECT has Δ = 7 mm. Roughly how many times finer is the mammography limit?

A About 23 times

B About 230 times

C About 2300 times

D About 4 times

> **Answer 72: B**
>
> Correct: 7 ÷ 0.03 ≈ 233.

MRI scanner · Easy

73. Which imaging modality is being used in the figure shown, with the patient lying on a table that slides into a large cylindrical magnet?

A Magnetic resonance imaging, which uses a strong magnet and radio waves

B Computed tomography, which uses a rotating x-ray tube and detectors

C Ultrasound, which uses a hand-held transducer on the skin

D Mammography, which uses a dedicated compression unit for the breast KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 13



> **Answer 73: A**
>
> Correct. The long tunnel (bore) of a magnet surrounding the patient is the hallmark of an MRI scanner, which forms images without ionising radiation.

CT scanner · Easy

74. The figure shown has a patient lying on a couch with the head passing into a short ring-shaped opening. Which modality is this?

A Mammography

B Bone densitometry

C Computed tomography

D General radiography



Answer 74: C

Correct. A couch moving the patient through a short doughnut-shaped gantry holding the rotating tube and detectors is characteristic of CT.

mammography · Easy

75. In the figure shown, a radiographer positions a patient at an upright unit with a small shelf and a compression plate. Which examination is this?

A Ultrasound of the abdomen

B Single photon emission computed tomography

C Computed tomography of the head

D Mammography of the breast KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 14



Answer 75: D

Correct. A breast-support shelf with a compression paddle on a dedicated upright tube-and-detector unit is a mammography machine. KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 35

ultrasound · Easy

76. The figure shown includes a monitor on a keyboard console with two operators beside it, and no x-ray tube or magnet in sight. Which modality does this suggest?

A Fluoroscopy

B Ultrasound imaging

C Magnetic resonance imaging

D Plain radiography



Answer 76: B

Correct. A compact console with keyboard and monitor, used with a hand-held transducer, is typical of ultrasound, which uses no ionising radiation.

bone densitometry · Easy

77. The figure shown has a patient lying on a low flat table with a scanning arm passing over the body, and the knees are raised on a block. Which examination does this equipment perform?

A Positron emission tomography of the brain

B Cardiac CT for the coronary arteries

C Bone densitometry (DXA) to assess bone mineral density

D Doppler ultrasound of the leg veins KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 15



Answer 77: C

Correct. A DXA scanner has an open flat table and an overhead arm, and the leg block flattens the lumbar spine for bone density scanning.

nuclear medicine · Easy

78. The figure shown has a large detector head positioned over a patient lying on a table, with no x-ray tube beside the patient. Which type of imaging is this?

A Nuclear medicine imaging with a gamma camera

B Mammography with a compression paddle

C Magnetic resonance imaging with a magnet

D General radiography with a ceiling tube



Answer 78: A

Correct. A gamma camera detects gamma rays emitted from a radiopharmaceutical inside the patient (planar imaging or SPECT), rather than sending x-rays through the body.

fluoroscopy · Easy

79. The figure shown is a C-shaped arm arching around a patient with the surgical team working beside it. Which modality uses this arrangement to give real-time x-ray images during procedures?

A Mammography

B Fluoroscopy with a C-arm

C Ultrasound

D Bone densitometry KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 16



Answer 79: B

Correct. A C-arm holds the x-ray tube and image receptor on opposite ends so moving images can be viewed while a procedure is performed.

general radiography · Medium

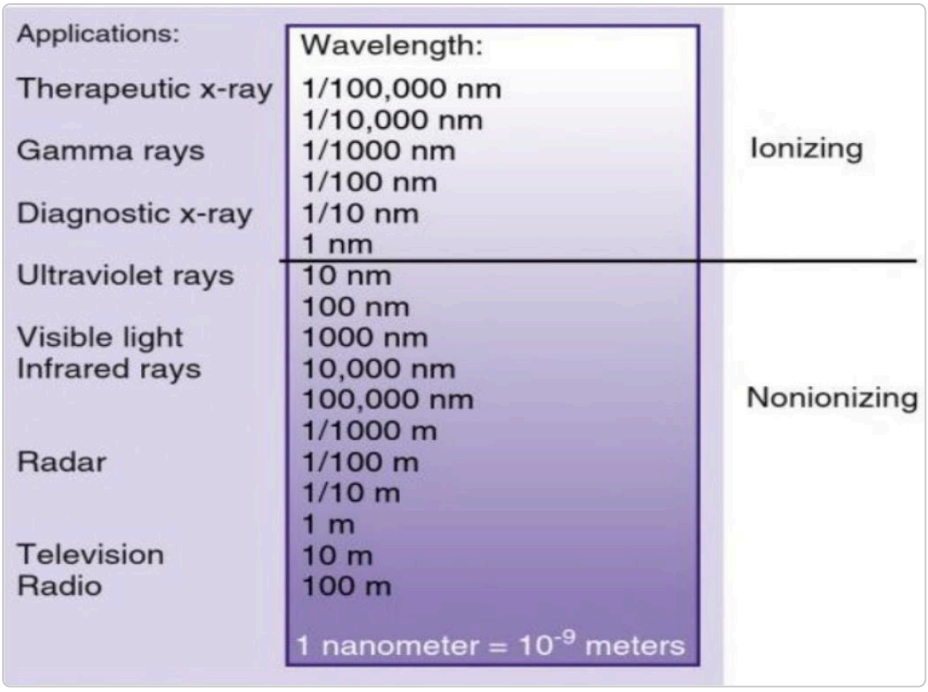
80. The figure shown has a radiographer positioning a supine patient on a table beneath a movable x-ray tube. Which modality is represented?

A Single photon emission computed tomography

B Magnetic resonance imaging

C Computed tomography

D General (plain) radiography



Answer 80: D

Correct. A tube on an overhead support aimed at a patient on a table, with a receptor beneath, is the basic arrangement for general radiography.

9. Set 9 · Q81–90

electromagnetic spectrum · Medium

81. In the figure shown, one line divides the table into ionizing and non-ionizing radiation. Which listed application lies on the ionizing side?

A Diagnostic x-ray

B Ultraviolet rays

C Infrared rays

D Radar KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 17



Answer 81: A

Correct. Diagnostic x-ray (wavelength about 1/10 nm to 1 nm) sits above the dividing line, in the ionizing group.

x-ray beam attenuation · Medium

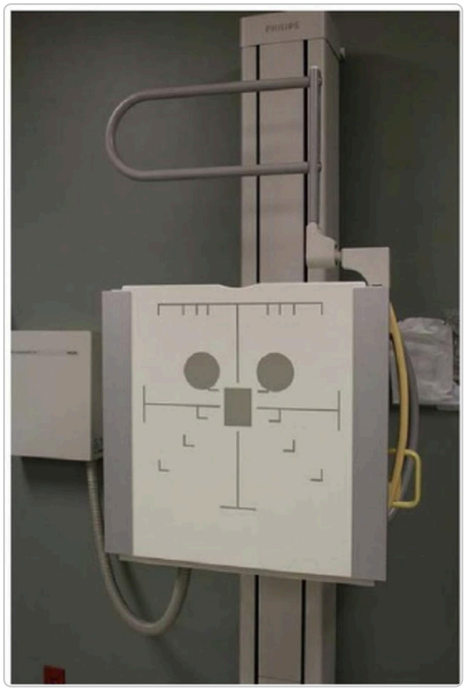
82. According to the table shown, which radiation is responsible for creating the radiographic image?

A Primary radiation, because its direction is controllable

B Remnant (exit) radiation, because its intensity pattern reflects the densities in the matter

C Scatter radiation, because it travels in all directions

D Leakage radiation, because it escapes the tube housing



> **Answer 82: B**
>
> Correct. The table states that the pattern of intensity of remnant radiation creates the radiographic image.

wall bucky · Medium

83. The figure shown is a wall-mounted unit on a vertical column with centring lines and a central square marked on its face. What is its main purpose?

A It generates the x-rays for the examination

B It compresses the breast during mammography

C It holds the image receptor upright for a standing or seated patient

D It rotates the detector around the patient for tomography KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 18

TABLE 1-1 X-Ray Beam Attenuation

	Definition	Travel Pattern	Energy Level
Primary Radiation	The x-ray beam that leaves the tube and is not attenuated, except by air.	Its direction and location are predictable and controllable.	Its energy is controlled by the kilovoltage setting.
Scatter Radiation	Radiation is scattered or created as a result of the attenuation of the primary x-ray beam by matter.	It travels in all directions from the scattering medium and is difficult to control.	Generally, it has less energy than the primary beam.
Remnant (Exit) Radiation	What remains of the primary beam after it has been attenuated by matter.	Because the pattern of densities in the matter results in differential absorption, this pattern is inherent in remnant radiation.	The pattern of intensity of remnant radiation creates the radiographic image.

Answer 83: C

Correct. An upright (wall) bucky holds the receptor behind the patient, with markings that help centre the x-ray beam, for examinations such as the chest.

primary x-ray beam · Medium

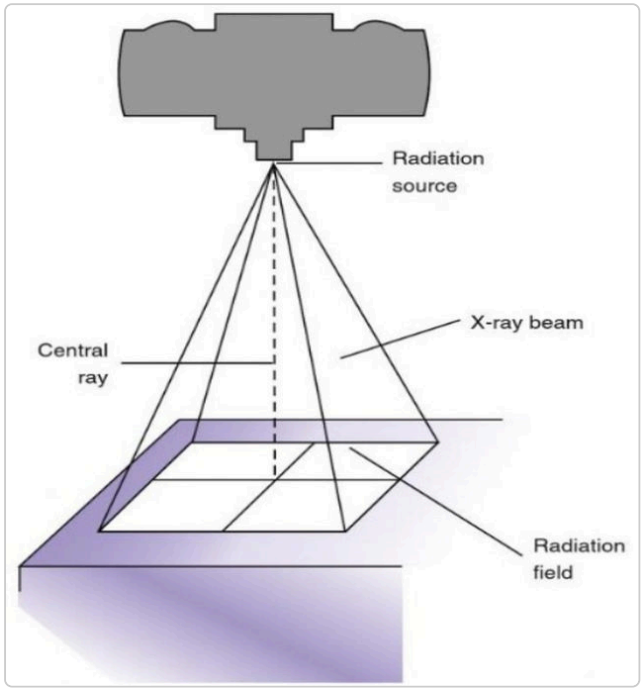
84. In the figure shown, the dashed line running from the radiation source down to the centre of the field is the term for which part of the beam?

A The central ray, the middle of the beam that defines its direction

B The remnant ray, which is the beam after attenuation

C The scatter ray, which is deflected from the beam

D The leakage ray, which escapes the tube housing



Answer 84: A

Correct. The central ray is the centre of the primary beam; the radiation field is the area it covers at the receptor.

x-ray production · Medium

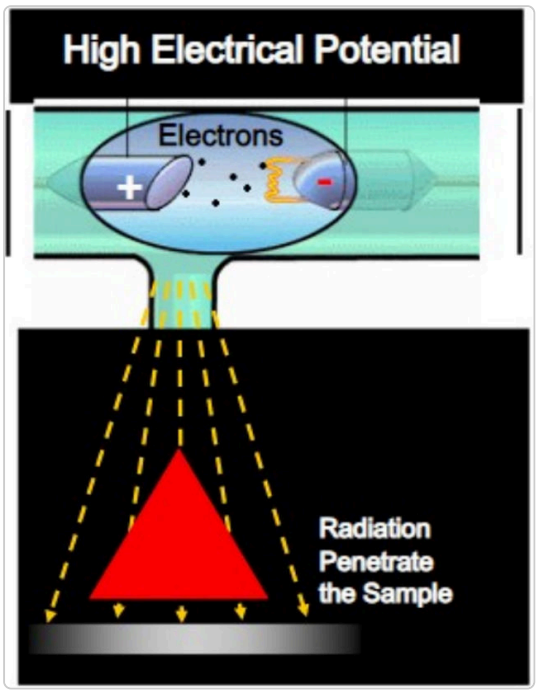
85. In the figure shown, electrons cross the gap between two electrodes inside the tube. Toward which electrode do they move?

A The negative electrode that carries the filament

B The glass envelope around the tube

C The collimator below the tube

D The positive electrode that carries the target KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 19



Answer 85: D

Correct. Electrons are released at the negative side (filament) and pulled across the high potential to the positive target, where x-rays are produced.

CT of the head · Medium

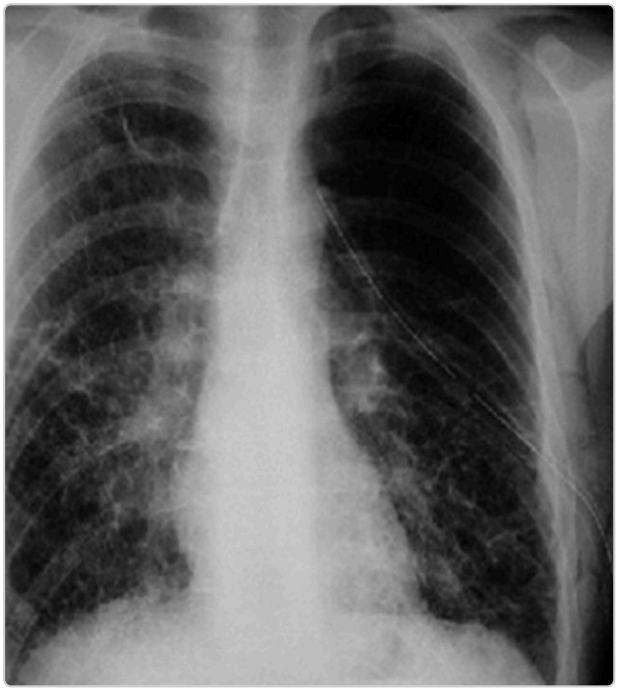
86. In the figure shown, the skull appears bright white while the brain tissue is grey. What explains the bright skull?

A Bone attenuates more x-rays than soft tissue

B Bone emits gamma rays that the detector records

C Bone contains more water than brain tissue

D Bone reflects sound waves strongly



Answer 86: A

Correct. Dense bone attenuates the beam strongly; in CT, tissues with high attenuation are displayed bright.

chest radiograph · Hard

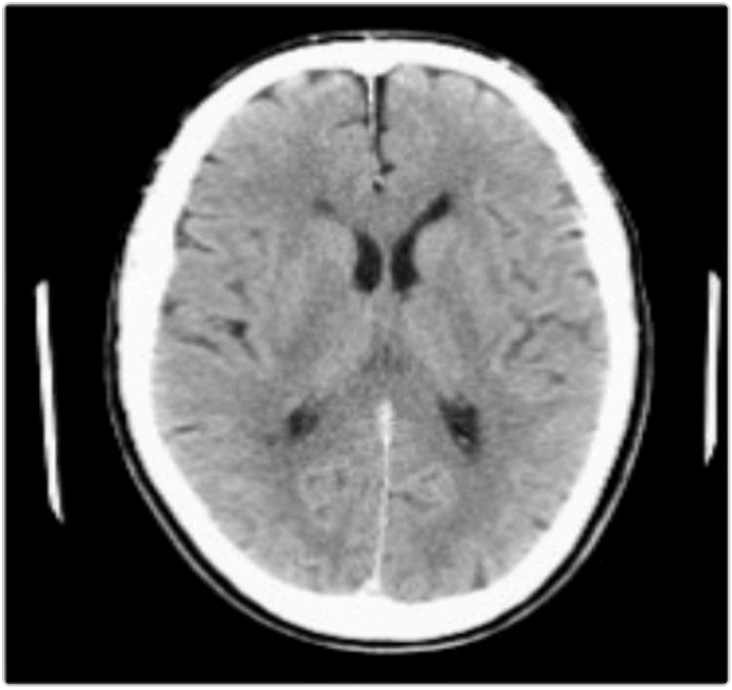
87. In the figure shown, the lung fields are dark while the heart and mediastinum are white. What best explains this difference?

A The lungs attenuate more x-rays than the heart does

B Air-filled lung attenuates few x-rays, while the heart and mediastinum attenuate more

C The heart emits radiation that exposes the receptor

D The mediastinum is thinner and lets more x-rays pass KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 20



Answer 87: B

Correct. Low-density, air-filled lung lets most x-rays through (dark on the image), whereas dense soft tissue and blood in the heart attenuate more (lighter).

MRI contrast · Hard

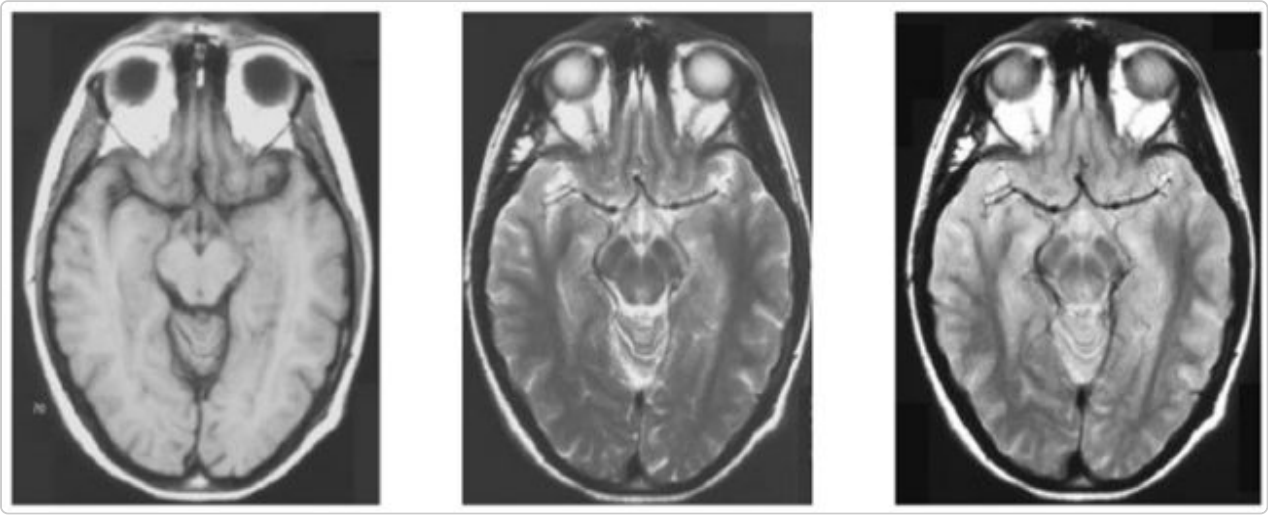
88. The figure shown has three MRI slices of the same head. In the left image the fluid-filled spaces are dark and the orbital fat is bright, while the middle image shows bright fluid. What does the left image represent, compared with the middle?

A A T1-weighted image, with the middle being T2-weighted

B A T2-weighted image, with the middle being T1-weighted

C A CT image, with the middle being an MRI image

D An ultrasound image, with the middle being an x-ray image



Answer 88: A

Correct. Dark fluid with bright fat is typical of T1 weighting, while bright fluid is typical of T2 weighting; the same MRI scanner can show different contrast.

spatial resolution · Hard

89. According to the table shown, which modality has the highest spatial resolution, meaning the smallest limiting value, in radiology?

A Digital mammography at 0.05 to 0.10 mm

B Screen film radiography at 0.08 mm

C Screen film mammography at 0.03 mm

D Computed tomography at 0.4 mm KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 21

TABLE 1-1. THE LIMITING SPATIAL RESOLUTIONS OF VARIOUS MEDICAL IMAGING MODALITIES: THE RESOLUTION LEVELS ACHIEVED IN *TYPICAL* CLINICAL USAGE OF THE MODALITY

Modality	Δ (mm)	Comments
Screen film radiography	0.08	Limited by focal spot and detector resolution
Digital radiography	0.17	Limited by size of detector elements
Fluoroscopy	0.125	Limited by detector and focal spot
Screen film mammography	0.03	Highest resolution modality in radiology
Digital mammography	0.05–0.10	Limited by size of detector elements
Computed tomography	0.4	About ½-mm pixels
Nuclear medicine planar imaging	7	Spatial resolution degrades substantially with distance from detector
Single photon emission computed tomography	7	Spatial resolution worst toward the center of cross-sectional image slice
Positron emission tomography	5	Better spatial resolution than with the other nuclear imaging modalities
Magnetic resonance imaging	1.0	Resolution can improve at higher magnetic fields
Ultrasound imaging (5 MHz)	0.3	Limited by wavelength of sound

Answer 89: C

Correct. The table's comment states screen film mammography is the highest resolution modality in radiology, with a limit of 0.03 mm.

scatter radiation · Hard

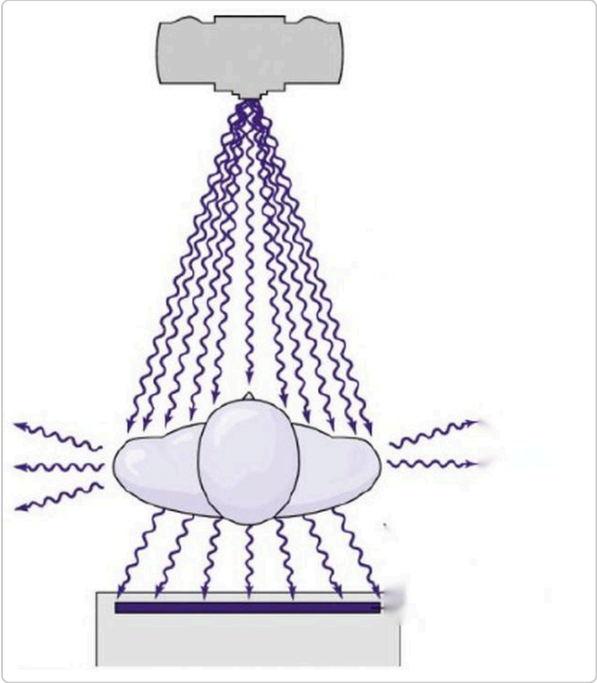
90. In the figure shown, wavy arrows leave the sides of the patient in directions away from the receptor. What do these arrows represent and why are they a problem?

A Primary radiation, which is fully predictable and controllable

B Remnant radiation, which creates the image pattern at the receptor

C Radio waves, which are non-ionizing and form MRI signals

D Scatter radiation, which travels in all directions and is hard to control



Answer 90: D

Correct. Scatter is created when the beam is attenuated by matter, travels in all directions, has less energy than the primary beam and is difficult to control.

10. Set 10 · Q91–100

CT geometry · Hard

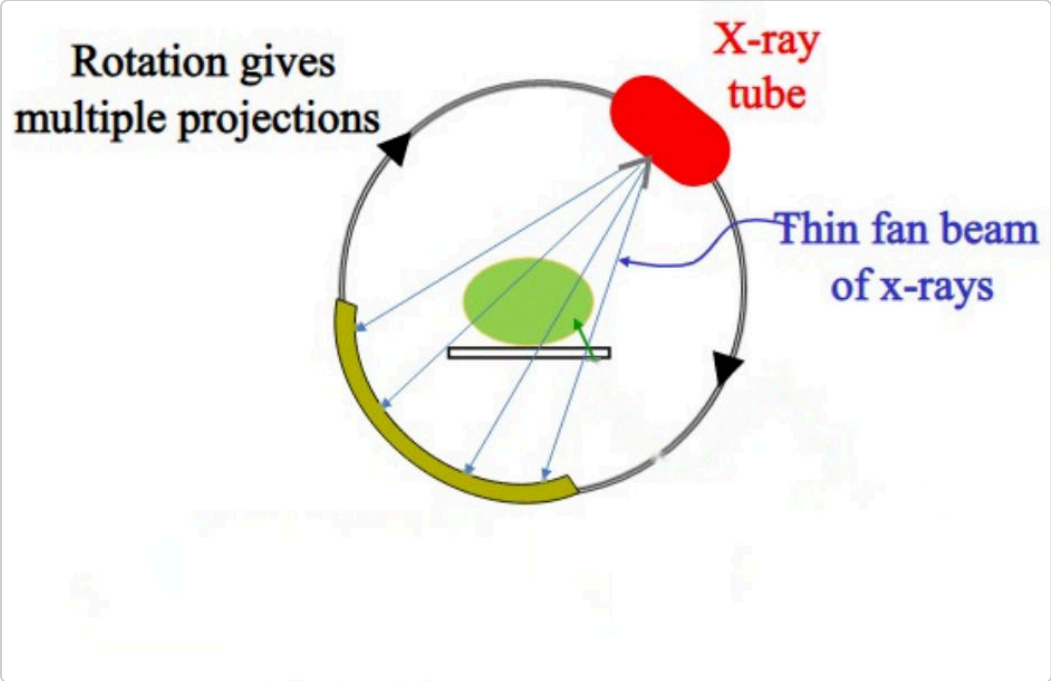
91. In the figure shown, the x-ray tube sits on a circular track and a curved strip is placed on the opposite side of the patient. What is the curved strip?

A The collimator that shapes the beam at the tube

B The detector array that records the transmitted beam

C The patient couch that supports the body

D The filament that releases electrons KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 22



Answer 91: B

Correct. In CT the fan beam passes through the patient and is recorded by detectors opposite the tube; rotation of the pair gives multiple projections.

beam attenuation · Hard

92. From the table shown, which radiation has an energy level that is controlled by the kilovoltage setting?

A Primary radiation

B Scatter radiation

C Remnant radiation

D Radiation attenuated by the patient

TABLE 1-1. THE LIMITING SPATIAL RESOLUTIONS OF VARIOUS MEDICAL IMAGING MODALITIES: THE RESOLUTION LEVELS ACHIEVED IN *TYPICAL* CLINICAL USAGE OF THE MODALITY

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Single photon emission computed tomography	7	Spatial resolution worst toward the center of cross-sectional image slice
Positron emission tomography	5	Better spatial resolution than with the other nuclear imaging modalities
Magnetic resonance imaging	1.0	Resolution can improve at higher magnetic fields
Ultrasound imaging (5 MHz)	0.3	Limited by wavelength of sound

Answer 92: A

Correct. The table says the energy of the primary beam is controlled by the kilovoltage setting.

MRI versus CT · Hard

93. The figure shown has two scanners side by side: a long-bore magnet on the left and a short ring gantry on the right. Which statement is correct?

A Both scanners form images with ionising x-rays

B Only the scanner on the left uses ionising x-rays

C Only the scanner on the right uses ionising x-rays to form images

D Neither scanner uses any form of electromagnetic energy



Answer 93: C

Correct. The right scanner is CT, which uses x-rays; the left is MRI, which uses a magnet and radio waves and no ionising radiation.

spatial resolution · Devil

94. Using the table shown, which list ranks these four modalities from best to worst limiting spatial resolution?

A Digital radiography, ultrasound at 5 MHz, CT, MRI

B Ultrasound at 5 MHz, digital radiography, MRI, CT

C CT, digital radiography, ultrasound at 5 MHz, MRI

D MRI, CT, ultrasound at 5 MHz, digital radiography KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 23

TABLE 1-1 X-Ray Beam Attenuation

	Definition	Travel Pattern	Energy Level
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Scatter Radiation	Radiation is scattered or created as a result of the attenuation of the primary x-ray beam by matter.	It travels in all directions from the scattering medium and is difficult to control.	Generally, it has less energy than the primary beam.
Remnant (Exit) Radiation	What remains of the primary beam after it has been attenuated by matter.	Because the pattern of densities in the matter results in differential absorption, this pattern is inherent in remnant radiation.	The pattern of intensity of remnant radiation creates the radiographic image.

Answer 94: A

Correct. The limits are 0.17 mm, 0.3 mm, 0.4 mm and 1.0 mm respectively; a smaller value means finer detail can be resolved.

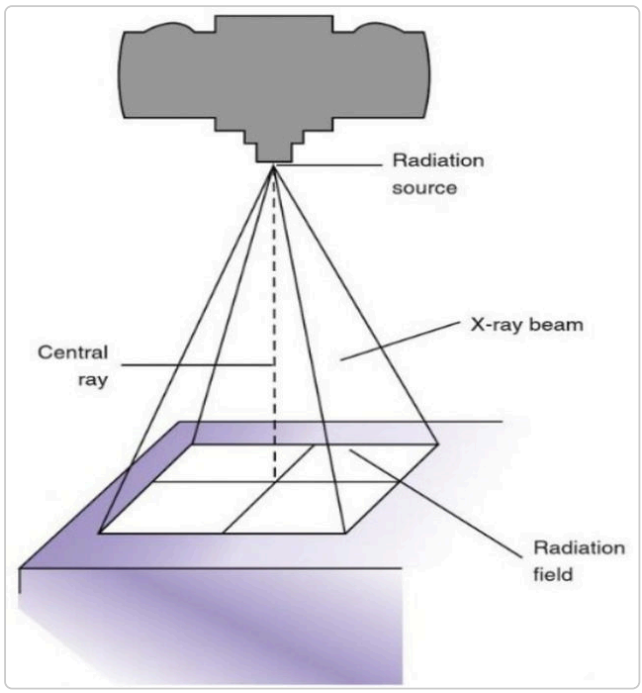
95. In the figure shown, the note states that 1 nanometer is 10 to the minus 9 meters. How many times longer is a wavelength of 1 m (television range) than 1 nm at the diagnostic x-ray end of the scale?

A About one thousand (10 to the power 3) times longer

B About one million (10 to the power 6) times longer

C About one million million (10 to the power 12) times longer

D About one thousand million (10 to the power 9) times longer



Answer 95: D

Correct. 1 m divided by 1 nm is 1 / 10 to the minus 9, giving 10 to the power 9, which shows why x-ray photons are so much more energetic than radio-range waves.

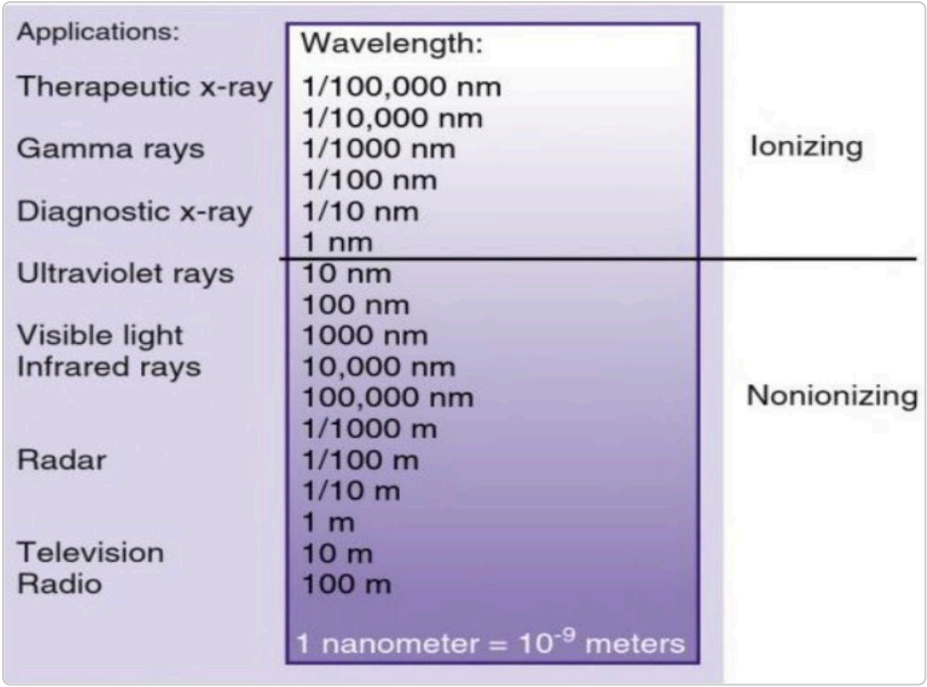
96. In the figure shown, the x-ray beam diverges from a point source above a square radiation field. If the same beam shape were used with the source moved farther from the receptor, what would happen to the radiation field?

A It would stay the same because the beam is parallel

B It would become smaller because the beam converges with distance

C It would become larger because the beam keeps diverging with distance

D It would disappear because primary radiation is absorbed by air KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 24



Answer 96: C

Correct. A divergent pyramid-shaped beam from a point source covers a larger area farther along its path; the central ray stays at the middle.

97. The figure shown has two hand radiographs. The left hand has few small rounded wrist bones, with gaps near the ends of the finger bones, and the right has a full set of wrist bones. Which interpretation is best supported?

A The left hand belongs to an adult with fully fused bones

B The left hand belongs to a child, whose bones are still growing

C The left hand is a different organ imaged with contrast medium

D The left hand is a surface photograph, not a radiograph



Answer 97: B

Correct. Gaps at growth plates and incompletely developed wrist bones indicate a child; this is the kind of diagnostic information x-ray reveals about the skeleton.

skeletal x-ray limits · Devil

98. The figure shown collects plain x-ray images in which bones are bright and clear. If the referrer needs the urinary bladder to be shown in the same type of image, what is required?

A An artificial contrast medium to outline the soft-tissue organ

B No extra step, since the bladder is as clear as bone

C A higher dose to remove the bones from the image

D Switching from x-rays to visible light KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 25



Answer 98: A

Correct. Bone contrasts strongly with soft tissue, but organs such as the bladder, kidneys and gut are poorly resolved by x-rays, so a contrast medium is administered.

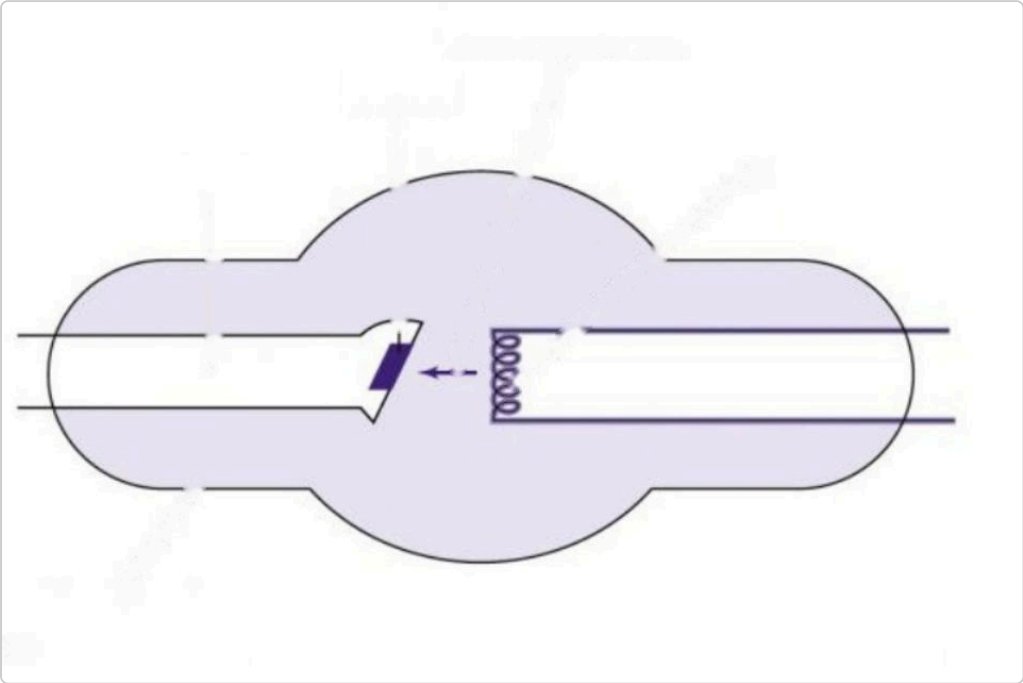
99. In the figure shown, a heated filament sits opposite an angled target inside an evacuated envelope. If the high voltage between them were switched off while the filament stayed hot, what would happen?

A X-rays would be produced at the same energy as before

B The vacuum would be lost, so the envelope would fill with air

C Electrons would be freed but not accelerated, so no useful x-rays would be produced

D Gamma rays would be produced by the target instead



Answer 99: C

Correct. The filament still provides a source of electrons, but without the high voltage they are not driven into the target, so useful x-rays are not produced.

bucky tray · Devil

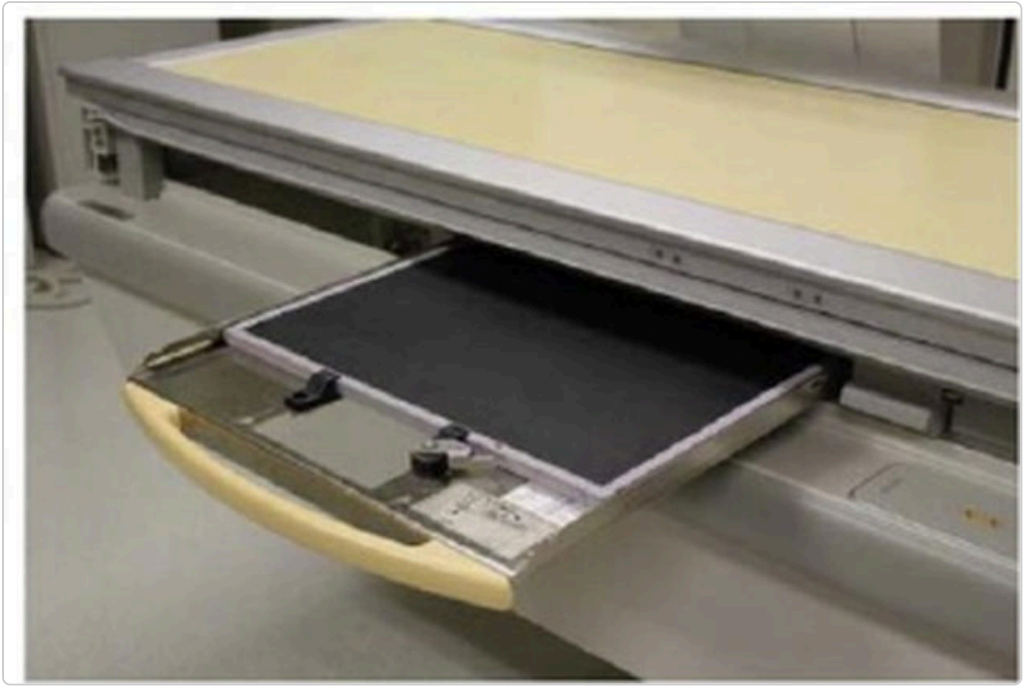
100. The figure shown has a flat tray pulled out from beneath the table top, holding a thin receptor with a black pad. Why is the receptor positioned there?

A To produce x-rays below the patient

B To lie directly under the patient and record the remnant radiation that exits the body

C To protect the patient from the primary beam

D To shape the beam before it enters the patient



Answer 100: B

Correct. The receptor is placed beneath the patient so that the remnant (exit) radiation, whose intensity pattern forms the image, strikes it after leaving the body.

Module 2: Lecture 2 — Radiography Education: From Classroom to Clinic — 46 questions

1. Set 1 · Q1–10

person-centred care · Devil

101. Which behaviour does NOT belong under respectful and compassionate diagnostic radiographers in the systematic review table?

A Involving patients in decision-making

B Being sensitive to patient cultural values and autonomy

C Prompt attention to patient needs (responsiveness)

D Educating patients on the diagnostic imaging procedure

> **Answer 101: D**
>
> Educating patients on the procedure is listed under effective communication and shared decision-making.

person-centred care · Hard

102. A radiographer tells a patient how long she will stay in the department and explains the procedure steps, then involves her in choosing a time slot. Which grouping is correct?

A Duration and explanation are communication; decision involvement is respectful care

B All three behaviours are respectful and compassionate care alone

C Duration is respectful care; explanation is decision-making

D Involving the patient is communication; duration is courtesy

> **Answer 102: A**
>
> The table places duration and education under effective communication and decision involvement under respectful care.

clinical experience · Medium

103. Which set best lists what clinical experience lets a student apply from classroom knowledge?

A Equipment design, pricing, procurement and sales

B Statistics, chemistry, botany and geography

C Communication, ethics, patient care, infection control and radiation safety

D Billing, advertising, recruiting and taxation

> **Answer 103: C**
>
> Slide 10 lists communication, ethics, patient care, infection control and radiation safety.

clinical participation · Easy

104. Clinical participation is the integration of which three aspects of medical imaging education?

A Cognitive, physical and financial

B Cognitive, affective and psychomotor

C Affective, theoretical and managerial

D Psychomotor, legal and technical

> **Answer 104: B**
>
> Slide 11 defines clinical participation as the integration of cognitive, affective and psychomotor aspects.

learning domains · Devil

105. A student apologises to a patient for a delay, then recalls Bucky operation steps and finally positions the patient while supervised. Which sequence of domains is correct for these three actions?

A Cognitive, affective, psychomotor

B Affective, cognitive, psychomotor

C Psychomotor, cognitive, affective

D Affective, psychomotor, cognitive

> **Answer 105: B**
>
> The apology shows values and interpersonal skill (affective), recalling steps is knowledge (cognitive), and positioning under supervision is hands-on (psychomotor).

classroom vs clinic · Devil

106. Which statement about the classroom-to-clinical transition is FALSE?

A In the clinic, students perform examinations on real patients

B In the lab, phantoms may stand in for patients

C Learning becomes more integrated and complex in the clinic

D In the classroom, students should deliver real radiation exposures to colleagues for realism

> **Answer 106: D**
>
> This is false: in the classroom, everything occurs except exposure in radiography, though sonography is not limited by this.

library resources · Easy

107. Which is listed under the virtual or online library in the lecture?

A Searching with keywords and using YouTube videos

B Browsing printed shelves in a reading room

C Borrowing bound textbooks at the circulation desk

D Photocopying older journals in the stacks

Answer 107: A

The virtual library slide lists searching with keywords and using YouTube videos, with e-books, databases, e-journals and more.

clinical checklist · Hard

108. After the radiograph is taken and the patient is dismissed courteously, what does the checklist expect from the student next?

A Leave all image review to the radiologist alone

B Skip the image critique and rest until the next case

C Begin the next exposure before any critique

D Critique images with the radiographer and prepare the room

Answer 108: D

After dismissal, the student critiques images with the radiographer, identifies pertinent anatomy and immediately prepares for the next patient.

classroom to clinic transition · Medium

109. As learning becomes more integrated and complex in the clinic, which question should the student ask?

A Can I avoid the registered technologist's questions?

B How soon can I skip lab practice altogether?

C Can I apply the classroom information in the clinical setting?

D Which exposure can I use without any supervision?

Answer 109: C

The slide lists: What do I know, What must I learn, How well have I learned the basic material, Can I apply classroom information in the clinical setting?

person-centred care · Medium

110. Which behaviour belongs to effective communication and shared diagnostic imaging decision-making?

A Greeting politely, introducing oneself and educating the patient on the procedure

B Protecting dignity, privacy and confidentiality

C Showing courtesy and friendliness at all times

D Involving patients in decision-making only

Answer 110: A

Introductions, polite greetings, stating duration and educating on the procedure fall under effective communication.

2. Set 2 · Q11–20

psychomotor learning · Devil

111. Which statement about psychomotor learning is FALSE?

A It is mainly classroom lectures on theory before any clinical contact

B It includes assisting and observing procedures by a professional

C It includes performing assigned tasks after becoming familiar

D It ends with independent performance under supervision

> **Answer 111: A**
>
> This is false: lectures on theory are cognitive; psychomotor is the actual hands-on phase.

clinical checklist · Hard

112. A student is unsure of an exposure technique while the patient is on the table. According to the checklist, what is the correct approach?

A Ask aloud so the patient understands the uncertainty

B Guess the setting to avoid delay

C Ask the registered technologist later, not in front of the patient

D Consult notes at the control panel with the patient present

> **Answer 112: C**
>
> The checklist says to ask the registered technologist all questions but not in front of the patient, protecting the patient's confidence.

library resources · Devil

113. Which statement about library resources is FALSE?

A A virtual library includes e-books, databases and e-journals

B A physical library holds shelved books for study

C A virtual library contains only YouTube videos and no e-books or databases

D Online searching can use keywords to find resources

> **Answer 113: C**
>
> False: the virtual library lists e-books, databases, e-journals, reference books, tutorials, subject guides and electronic services.

introduction · Medium

114. Why does the lecture stress learning about the organisational structure and your role in a radiography department?

A The department is cheap, so roles matter much less to everyone

B Roles are fixed and never need to be understood by students

C Structure matters only for managers and never for students

D It is an expensive department, so know your role and setting KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 41

> **Answer 114: D**
>
> Slide 3 says you need to understand the organisational structure, environment and your role, noting that it is an expensive department. KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 51

introduction · Easy

115. According to the lecture introduction, delivering high-quality radiography services first requires what?

A A strong understanding of the subject matter you have chosen

B Ownership of the most expensive imaging equipment

C Many years of experience in another profession

D Memorising the department's staff rota and budget

> **Answer 115: A**
>
> The slide states that high-quality service needs a strong understanding of the subject matter chosen, including its technical aspects.

learning domains · Hard

116. In a ward, a student calms a frightened child by speaking gently and later feels proud that the parents thanked her. Which domain, and which lecture element, best fits?

A Cognitive: recalling theories and background facts

B Psychomotor: assisting and observing details of a procedure

C Cognitive: asking how well basic material was learned

D Affective: interpersonal skill and pride in work, treating the patient as a guest

> **Answer 116: D**
>
> Gentle interaction, pride and self-worth fall under affective learning, and the guest approach helps gain trust in children.

clinical checklist · Devil

117. Which statement about the sample clinical education checklist is FALSE?

A Courtesy matters at greeting, procedure and dismissal

B Students should become familiar with the wall Bucky and x-ray table

C Textbook study is encouraged at all times, including busy periods in the room

D Clinical hours generally exclude textbook study, apart from slow periods

> **Answer 117: C**
>
> This is false: textbook studying generally should not occur during clinical hours, except in slow periods or equipment breakdown.

cognitive learning · Easy

118. Which description matches cognitive learning?

A Developing pride in work and self-worth

B Performing procedures under supervision

C Building interpersonal relationships with patients

D Lectures and demonstrations of theories and facts

> **Answer 118: D**
>
> Cognitive learning refers to lectures and demonstrations of theories, facts and background information needed to understand a body of knowledge.

clinical checklist · Hard

119. A student has no assigned examination and the room is quiet. Which action is consistent with the checklist for free time during clinical hours?

A Leave the room and rest until someone calls you back

B Stock supplies, clean the table and practise positioning on a technologist

C Read a textbook as a routine, even when the room is busy

D Practise exposures on a classmate waiting in the room

> **Answer 119: B**
>
> The checklist advises stocking supplies, cleaning equipment, practising positioning on a technologist, reviewing notes and checking upcoming procedures.

teamwork and ethics · Devil

120. A student radiographer ignores a nurse's request for help during a busy list, saying it is not her job. Which lecture principles are most clearly breached?

A Only the requirement to use library resources

B Only the demand for psychomotor skill progression

C Only the guest approach to a patient

D Teamwork and cooperation and mutual respect between departments

> **Answer 120: D**
>
> The lecture stresses that total patient care depends on cooperation and mutual respect, and on building good relationships with team members.

3. Set 3 · Q21–30

psychomotor learning · Medium

121. In what order does the psychomotor phase progress for a student?

A Perform independently, then assist and observe, then watch lectures

B Assist and observe, then perform assigned tasks, then independent performance under supervision

C Perform assigned tasks, then observe, then attend classroom lectures

D Perform under supervision first, then assist, then observe

Answer 121: B

Slide 14 moves from assisting and observing, to performing assigned tasks once familiar, to independent clinical performance under supervision.

professional association · Easy

122. Why does the lecture say a radiographer should belong to a professional association?

A It replaces the need for formal clinical training

B It guarantees exemption from radiation safety rules

C It ensures continuous professional development and career advancement

D It allows the radiographer to skip competency evaluation KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 42

Answer 122: C

The slide says associations ensure continuous professional development, leading to career advancement.

clinical education · Devil

123. A student passes lab competency on a phantom and says she needs no more supervised practice. Which response best reflects the lecture?

A Phantom success proves she is ready for unsupervised work

B Lab success is a start; real patients add ethics, infection control and radiation safety

C The clinic only repeats lab skills, so supervision is redundant

D Real patients matter only for exposure, never for ethics

Answer 123: B

Clinical experience applies classroom knowledge to real patients, including communication, ethics, patient care, infection control and radiation safety.

affective learning · Easy

124. Affective learning in clinical education involves which of the following?

A Facts and background information

B Hands-on performance of procedures

C Attitudes, values and feelings

D Memorisation of exposure factors

Answer 124: C

The slide defines affective learning as attitude, values and feelings, such as pride and self-worth.

teamwork · Medium

125. Which question set matches the teamwork slide?

A Who are the members, what do they do, and how do I build good relationships?

B Who owns the hospital, what are profits, and how do I outcompete staff?

C Who is the patient, what is the diagnosis, and how do I avoid peers?

D Who pays the staff, what are the fees, and how do I replace peers?

Answer 125: A

The slide lists team members, their responsibilities, and building good relationships with team members and with colleagues.

ethics and association · Easy

126. Which items does the radiography code of ethics include, according to the slides?

A Equipment sales and private marketing

B Radiation safety and public education

C Radiation safety and equipment pricing

D Public education and hospital fundraising

Answer 126: B

The slide says the profession follows a code of ethics that includes radiation safety and public education.

learning domains · Hard

127. During a lecture, a first-year student explains the function of the Bucky tray and its relation to image quality, answering a quiz correctly. Which domain is mainly demonstrated?

A Psychomotor, since it involves the actual hands-on phase

B Affective, since it shows attitude, values and feelings

C Cognitive, since it recalls theory, facts and background information

D Psychomotor, since it is independent clinical performance

Answer 127: C

Explaining theory and facts is cognitive learning, as defined by classroom lectures, facts and background information.

person-centred care · Medium

128. A radiographer in a busy Accra department asks an elderly patient how she prefers to be positioned and respects her wish for a female attendant. Which element of person-centred care is mainly shown?

A Effective communication: indicating duration of stay

B Respectful care: prompt attention to the next patient

C Effective communication: educating on the procedure

D Respectful and compassionate care: sensitivity to cultural values and autonomy

Answer 128: D

Respecting preferences and a female attendant shows sensitivity to cultural values and autonomy, under respectful and compassionate radiographers.

affective learning · Devil

129. Which outcome is NOT expected to be developed through affective learning in the clinical environment?

A Mastery of the factual theory behind exposure physics

B Pride in your work and feelings of self-worth

C Skills in interpersonal relationships

D Personal, moral and ethical beliefs for daily practice KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 43

> **Answer 129: A**
> Factual theory mastery is cognitive, so it is not an affective outcome.

clinical checklist · Medium

130. According to the sample clinical education checklist, when should a student consult their notes about a procedure?

A While the patient is on the table for reassurance

B Before bringing the patient into the room, never where the patient can see

C During positioning so the patient can watch

D Only after the examination has been dismissed

> **Answer 130: B**
> The checklist says to consult notes before bringing the patient into the room, and the patient should never see you doing so.

4. Set 4 · Q31–40

competency evaluation · Hard

131. A student feels anxious before a lab competency evaluation. Which statement fits the lecture's closing questions?

A The evaluation measures only recall and is never stressful

B The evaluation is optional and carries no purpose

C The evaluation checks performance of skills, and being assessed may be stressful

D The evaluation replaces all supervised clinical practice

> **Answer 131: C**
> The question slide asks students to describe the purpose of lab and clinical competency evaluation and why they may be stressful.

classroom practice · Easy

132. In classroom or lab practice, which step is left out when students use phantoms or colleagues as patients in radiography?

A The actual radiation exposure

B Positioning the patient

C Communicating with the patient

D Supervision by a lecturer or technician

> **Answer 132: A**
>
> Every detail takes place except exposure in radiography (though not in sonography), usually under supervision.

patient as guest · Easy

133. What does the lecture advise about how to regard the patient?

A Treat the patient as a case number to save time

B Treat the patient as a colleague who gives orders

C Treat the patient as a subject for practice only

D Treat the patient as a guest in your home, with respect

> **Answer 133: D**
>
> Slide 6 advises treating the patient as a guest in your home, being respectful, which builds trust, especially in children.

classroom to clinic transition · Hard

134. A student scores well in class but struggles to position real patients. Which transition question is most directly unanswered?

A What do I know about the subject area?

B Can I apply classroom information in the clinic?

C What must I learn about this topic?

D Who are the members of my own team?

> **Answer 134: B**
>
> Good theory but poor application indicates the question about applying classroom knowledge clinically has not been answered.

sonography lab · Medium

135. A KNUST student practises abdominal scanning on a classmate in the sonography lab. Based on the lecture, how does this differ from radiography practice?

A Scanning is banned because classmates cannot be patients

B Scanning can proceed fully because sonography needs no radiation exposure step

C Scanning must stop before the transducer touches skin

D Scanning needs a phantom because humans are never used

Answer 135: B

The slide notes that all details occur except exposure in radiography, but not in sonography, so sonography can be practised fully on colleagues.

psychomotor learning · Hard

136. In week two, a student positions a patient for a chest examination while the radiographer stands beside her and checks every step. Which phase is this?

A Independent clinical performance under supervision of a medical imaging professional

B Assisting and observing procedures performed by a professional

C Cognitive learning from theory and demonstrations

D Affective development of values and self-worth KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 44

Answer 136: A

Performing a procedure with a professional supervising matches the independent performance phase, the last stage of psychomotor learning.

learning domains · Easy

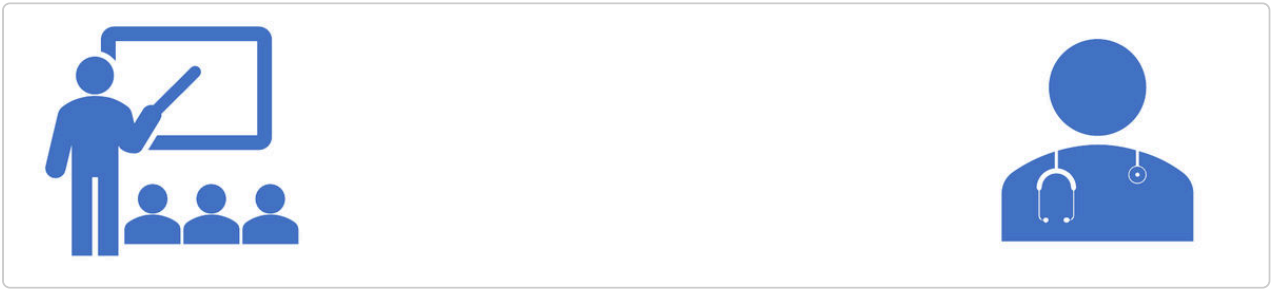
137. The figure shown is the icon used to illustrate one of the three learning domains in clinical education. Which domain does a smiley face with heart eyes represent?

A Didactic learning, covering lectures and demonstrations

B Cognitive learning, covering facts and theory

C Affective learning, covering attitudes, values and feelings

D Psychomotor learning, covering hands-on performance



Answer 137: C

Correct. The affective domain deals with attitude, values and feelings such as pride in work and self-worth, which the emotive icon represents.

cognitive learning · Easy

138. The figure shown pairs a lecturer at a board with a clinician. Which learning domain does the pairing illustrate, with the clinic as its application stage?

A Affective learning, where feelings of self-worth are developed

B Psychomotor learning, where students practise procedures independently

C Clinical competency evaluation, where performance is standardised

D Cognitive learning, where classroom knowledge is later applied in the clinical setting



Answer 138: D

Correct. Cognitive learning is classroom lectures and demonstrations; once the fundamentals are learned, the student applies the knowledge in the clinical setting.

library resources · Easy

139. The figure shown lists resources of a virtual library. Which of the following is one of the resources listed?

A Printed film archives

B E-journals

C Equipment service manuals

D Patient record folders KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 45



Answer 139: B

Correct. E-journals appear in the list alongside e-books, databases, reference books, tutorials, subject guides and electronic services.

person-centred care · Medium

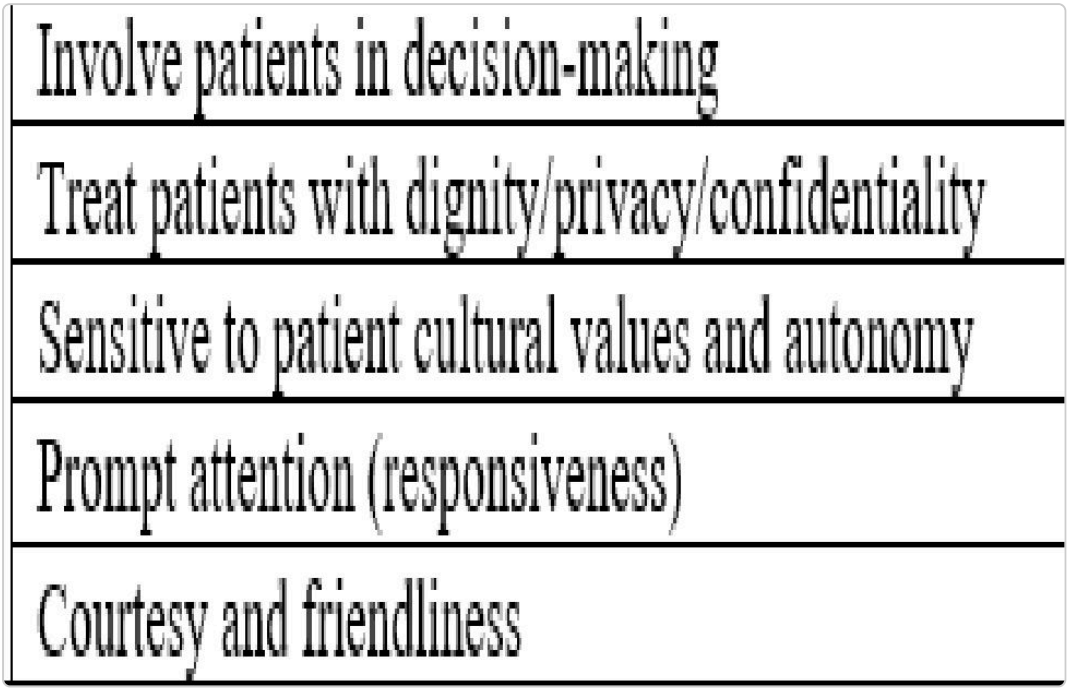
140. The figure shown lists five behaviours from a systematic review of person-centred imaging care. Which heading best covers all five?

A Efficient departmental resource management

B Technical competence of diagnostic radiographers

C Respectful and compassionate diagnostic radiographers

D Effective communication and shared diagnostic imaging decision-making



Answer 140: C

Correct. Involving patients in decisions, dignity, privacy, cultural sensitivity, prompt attention and courtesy are the behaviours listed under respectful and compassionate radiographers.

5. Set 5 · Q41–46

orientation to room · Medium

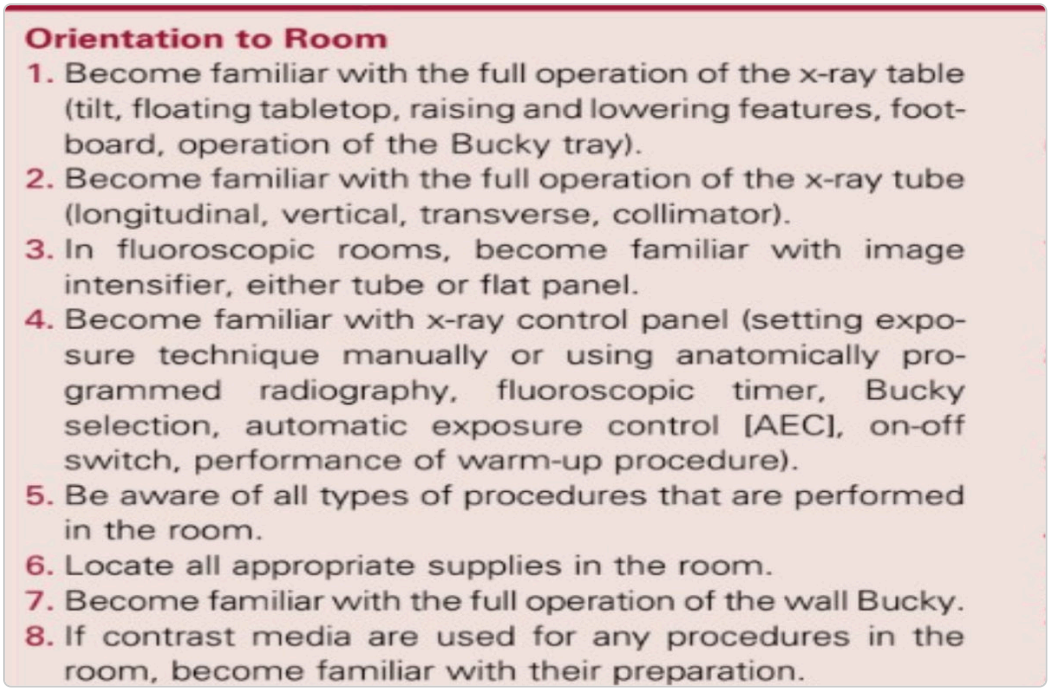
141. According to the checklist section shown, which task belongs to orientation to the room?

A Stocking additional supplies wherever necessary

B Becoming familiar with the full operation of the wall Bucky

C Cleaning the x-ray tabletop and control panel

D Critiquing the images with the radiographer KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 46



Orientation to Room

1. Become familiar with the full operation of the x-ray table (tilt, floating tabletop, raising and lowering features, footboard, operation of the Bucky tray).
2. Become familiar with the full operation of the x-ray tube (longitudinal, vertical, transverse, collimator).
3. In fluoroscopic rooms, become familiar with image intensifier, either tube or flat panel.
4. Become familiar with x-ray control panel (setting exposure technique manually or using anatomically programmed radiography, fluoroscopic timer, Bucky selection, automatic exposure control [AEC], on-off switch, performance of warm-up procedure).
5. Be aware of all types of procedures that are performed in the room.
6. Locate all appropriate supplies in the room.
7. Become familiar with the full operation of the wall Bucky.
8. If contrast media are used for any procedures in the room, become familiar with their preparation.

Answer 141: B

Correct. Item 7 of Orientation to Room is to become familiar with the full operation of the wall Bucky.

psychomotor learning · Medium

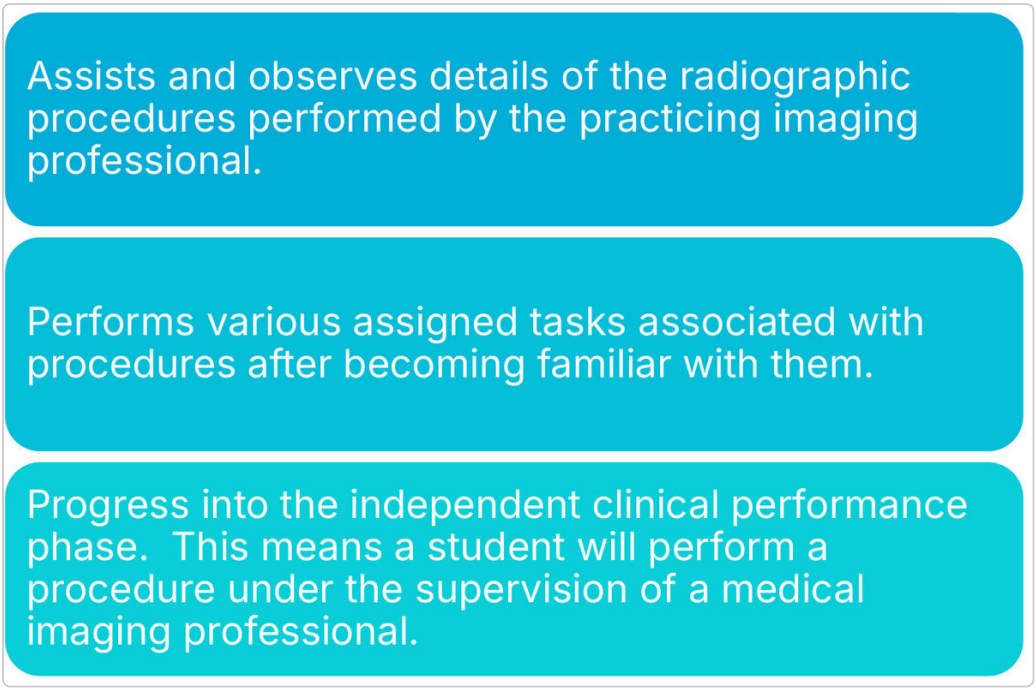
142. The three boxes shown are stages of one learning domain. What does the final stage represent?

A Classroom practice on phantoms without exposure

B Evaluation of attitudes and personal ethical beliefs

C Independent clinical performance, with a student performing a procedure under supervision

D Observation only, with no task assigned to the student



Answer 142: C

Correct. The last box describes progress into independent clinical performance, still under the supervision of a medical imaging professional.

person-centred care · Hard

143. The figure shown stacks two groups of behaviours (upper five rows, lower three rows). A radiographer introduces herself, tells a mother how long the visit will last and explains the examination. How do these actions relate to the groups, and what does the other group emphasise?

A They match the upper group; the lower group stresses prompt attention and courtesy

B They match both groups equally; the groups differ only in their number of items

C They match the lower group; the upper group stresses technical exposure selection

D They match the lower group; the upper group stresses dignity, privacy and cultural sensitivity KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 47



Answer 143: D

Correct. Introductions, stating duration and educating patients form the communication group (lower); the upper group stresses respect behaviours such as dignity, privacy and cultural sensitivity.

clinical hours · Hard

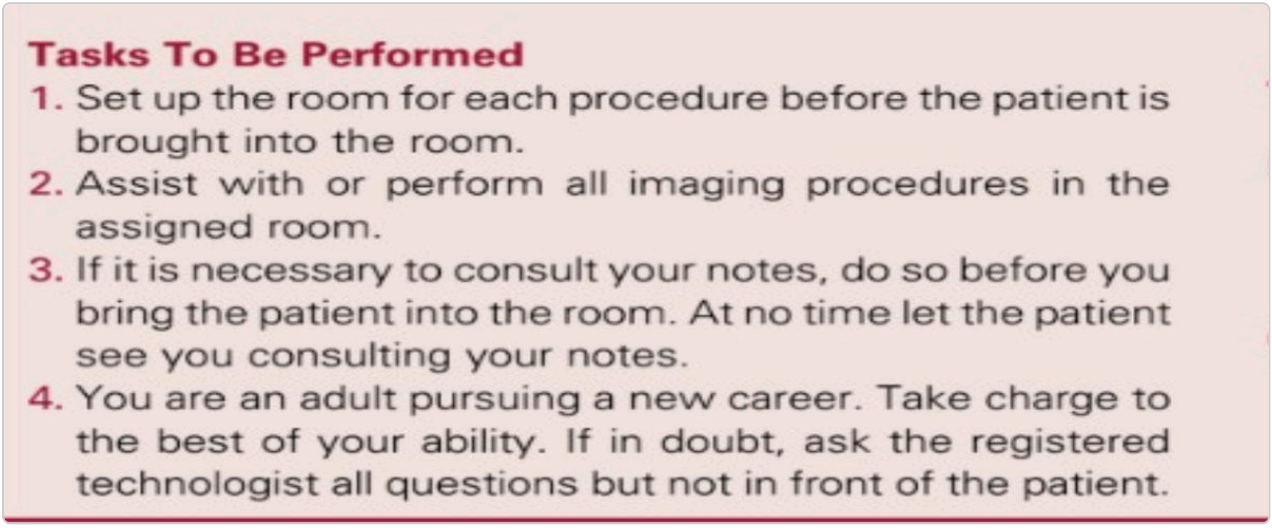
144. Based on the free-time list shown, which statement about studying during clinical hours is correct?

A Studying is allowed only after leaving the assigned area

B Textbook study generally should not occur, but is expected during slow periods or equipment breakdown in the assigned area

C Textbook study is encouraged whenever the student prefers

D Textbook study is always forbidden during clinical hours



Answer 144: B

Correct. The last item says clinical hours are for clinical education and textbook study generally should not occur, except during slow periods or equipment breakdown in the assigned area.

clinical checklist · Devil

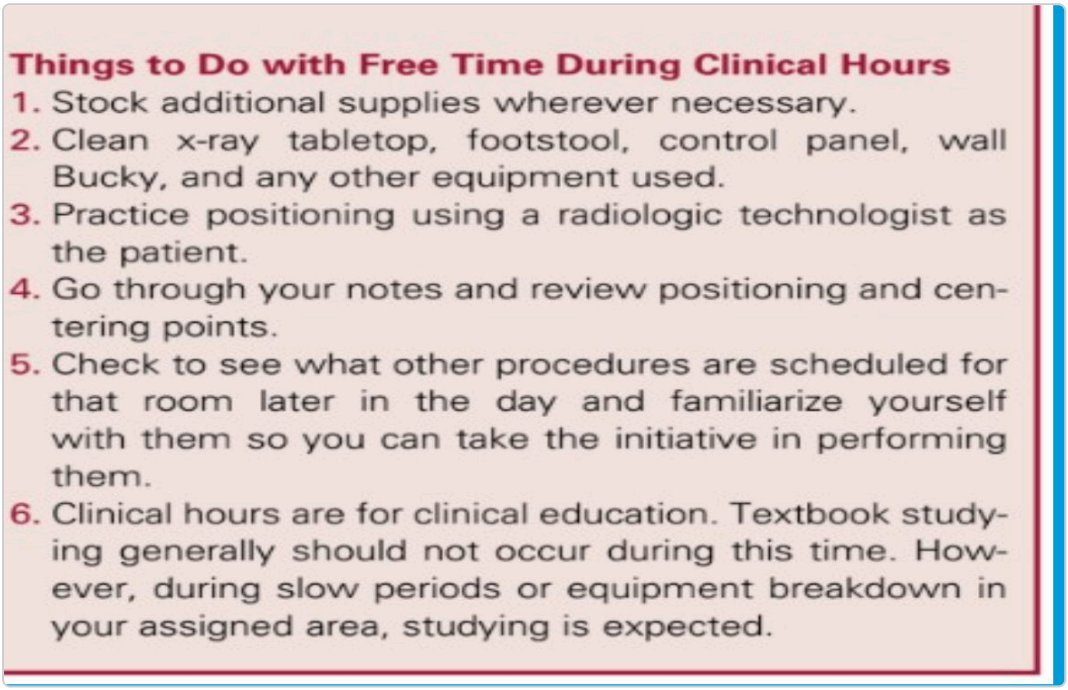
145. A student in the room realises she is unsure of a step with the patient already present. Using the checklist section shown, what is the best action and what should have prevented the problem?

A Check her notes briefly at the console so the patient is not kept waiting, as no rule limits this

B Ask the registered technologist aloud in front of the patient so the patient hears the reassurance

C Ask the registered technologist privately, away from the patient; notes should have been consulted before the patient was brought in

D Proceed on her own judgement, since an adult in a new career is expected never to ask KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 48



Things to Do with Free Time During Clinical Hours

1. Stock additional supplies wherever necessary.
2. Clean x-ray tabletop, footstool, control panel, wall Bucky, and any other equipment used.
3. Practice positioning using a radiologic technologist as the patient.
4. Go through your notes and review positioning and centering points.
5. Check to see what other procedures are scheduled for that room later in the day and familiarize yourself with them so you can take the initiative in performing them.
6. Clinical hours are for clinical education. Textbook studying generally should not occur during this time. However, during slow periods or equipment breakdown in your assigned area, studying is expected.

Answer 145: C

Correct. Notes are to be consulted before bringing the patient in, the patient must never see you consulting them, and questions go to the registered technologist but not in front of the patient.

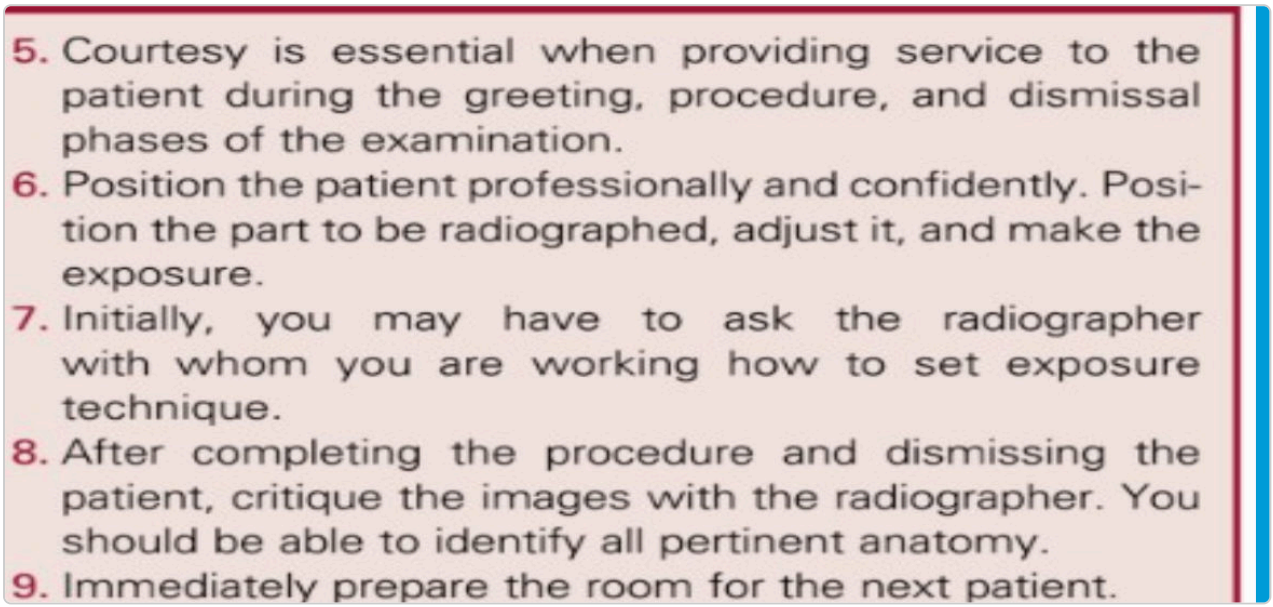
146. Using the items shown, which sequence is correct after the exposure has been made on a patient who is finished?

A Prepare the room for the next patient, dismiss the patient, then critique the images

B Dismiss the patient, prepare the room for the next patient, then discuss exposure technique with the radiographer

C Critique the images alone, skip the radiographer, then dismiss the patient

D Dismiss the patient, critique the images with the radiographer, then immediately prepare the room for the next patient


5. Courtesy is essential when providing service to the patient during the greeting, procedure, and dismissal phases of the examination.
6. Position the patient professionally and confidently. Position the part to be radiographed, adjust it, and make the exposure.
7. Initially, you may have to ask the radiographer with whom you are working how to set exposure technique.
8. After completing the procedure and dismissing the patient, critique the images with the radiographer. You should be able to identify all pertinent anatomy.
9. Immediately prepare the room for the next patient.

Answer 146: D

Correct. Item 8 follows dismissal with critiquing the images with the radiographer (identifying pertinent anatomy), and item 9 is to immediately prepare the room.

Module 3: Sonography Part 1 — Profession, Basics and Historical Overview — 105 questions

1. Set 1 · Q1–10

Clinical application · Devil

147. A sonographer scanning a patient with a full bladder sees two fluid-filled sacs behind the dark bladder. Which lecture content is being used?

A Dussik's transmission method for intracranial lesions

B The full bladder sonic window, found accidentally by Donald

C The Vidoson's parabolic mirror in a water tank

D Fry's ultrasound ablation of the basal ganglia

> **Answer 147: B**
>
> Correct: the slide shows twin gestation sacs seen under the dark bladder, using the bladder as a sonic window.

Definition · Easy

148. Sonography is best described as an imaging technique that uses which form of energy to produce images?

A Sound energy

B Ionizing radiation

C Radiofrequency energy

D Gamma emission

> **Answer 148: A**
>
> Correct: the slides define sonography as imaging technology that uses sound energy, created by a mechanical action that can be electronically stimulated.

Diffraction vs reflection · Hard

149. Which historical pairing correctly links a scientist to the principle most directly relevant to specular echo geometry in ultrasound?

A Galileo: first analytical speed of sound

B Fresnel: frequency determines musical pitch

C Newton: discovered echolocation in bats

D Da Vinci: angle of reflection equals angle of incidence

> **Answer 149: D**
>
> Correct: Da Vinci found the angle of reflection equals the angle of incidence, which governs specular echo direction.

History · Medium

150. What did Dr William Fry do that made him notable in diagnostic ultrasound?

A Invented the Galton whistle for hearing tests

B Designed the Siemens Vidoson water-tank scanner

C Found the sonic window of the full bladder

D First to introduce computers in diagnostic ultrasound

> **Answer 150: D**
>
> Correct: Fry, an electrical engineer, is credited as the first to introduce computers to diagnostic ultrasound.

Early experiments · Devil

151. Which statement about Donald's 1955 first experiments is TRUE?

A He built the Mk 2 as a purpose-made medical B-mode scanner

B He scanned live patients at the Western Infirmary in 1955

C He tested live fetuses at Renfrew in 1963

D He used a Henry Hughes Mk 2 industrial metal flaw detector

> **Answer 151: D**
>
> Correct: Donald used an industrial metal flaw detector at Babcock and Wilcox, Renfrew, on excised tumours and cysts.

Pulse timing · Devil

152. If a scanner waits for the echo from 15 cm depth (c = 1540 m/s) before sending the next pulse, what is the maximum pulse repetition frequency?

A About 10.3 kHz

B About 2.6 kHz

C About 5.1 kHz

D About 51 kHz

> **Answer 152: C**
>
> Correct: round trip 0.30 m ÷ 1540 ≈ 195 µs, so PRF ≈ 1/195 µs ≈ 5.1 kHz.

History · Medium

153. Which scientist is linked with a theory of wave diffraction?

A Augustin Fresnel

B Galileo Galilei

C Robert Boyle

D Leonardo da Vinci KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 57

> **Answer 153: A**
>
> Correct: Fresnel contributed significantly to the theory of wave diffraction.

Limitations · Medium

154. Why is ultrasound of limited use for diagnosing fractures?

A Ultrasound is absorbed by blood vessels

B Bone is too soft to reflect sound

C Ultrasound does not pass well through bone

D Fractures only show on Doppler

> **Answer 154: C**
>
> Correct: bone blocks ultrasound transmission.

History · Easy

155. Who made one of the earliest applications of ultrasound to medical diagnosis using two transducers on opposite sides of the head?

A Dr. Karl Dussik

B Dr. Tom Brown

C Dr. Richard Soldner

D Dr. John MacVicar

> **Answer 155: A**
>
> Correct: Karl Dussik measured ultrasound transmission profiles across the head and detected intracranial lesions.

History logic · Hard

156. Which ordering of technology milestones is correct?

A Sonic boom articulated-arm contact scanners, then Vidoson real-time (1963), then linear array real-time by mid 1970s

B Linear array real-time, then Vidoson, then articulated-arm contact scanners

C Vidoson, then Polaroid-recorded bistable scanners, then A-scan metal flaw detector

D Colour Doppler, then A-scan, then Vidoson

> **Answer 156: A**
>
> Correct: contact B scanners spread first, the Vidoson of 1963 introduced real-time, and linear arrays followed by the mid 1970s.

2. Set 2 · Q11–20

Sonographer role · Medium

157. Which activity best illustrates a sonographer using independent judgment?

A Adjusting the protocol to answer the clinical question

B Following the protocol without any change in every case

C Handing the probe to the physician before scanning

D Waiting for the radiologist to choose the scan planes

> **Answer 157: A**
>
> Correct: independent judgment means recognizing the need to adjust the sonographic protocol to answer the clinical question.

Numerical depth · Devil

158. An echo returns 195 µs after the pulse is emitted. Assuming 1540 m/s, what is the reflector depth?

A 15 cm
B 30 cm
C 7.5 cm
D 1.5 cm

> **Answer 158: A**
>
> Correct: depth = (1540 × 195e-6) ÷ 2 ≈ 0.150 m = 15 cm.

History · Medium

159. In 1955 Donald and Barr scanned excised tumours and cysts at a factory in Renfrew. What did they find?

A A clear difference in A-scan traces between solid and cystic tumours
B No difference between solid and cystic tissue
C Cysts produced more echoes than solid tumours
D Only bone could be distinguished

> **Answer 159: A**
>
> Correct: A-scan traces clearly differed between solid and cystic tumours.

Wavelength ratio · Devil

160. How many times shorter is the soft tissue wavelength at 15 MHz than at 2 MHz (same medium)?

A 15 times
B 2 times
C 13 times
D 7.5 times

> **Answer 160: D**
>
> Correct: wavelength is inversely proportional to frequency, so 15 ÷ 2 = 7.5.

Employment logic · Devil

161. A sonographer wants a career with a commercial company that does not involve scanning patients. Which roles from the lecture fit?

A Chief sonographer and clinical instructor

B Department head and Dean of Allied Health

C Clinical application specialist, sales, service or marketing

D Director of imaging and technical director KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 58

> **Answer 161: C**
>
> Correct: these are among the commercial world roles listed.

Scan depth · Hard

162. Using 1540 m/s as the speed of sound in soft tissue, what is the approximate round-trip time for an echo from a structure 12 cm deep?

A 78 µs

B 312 µs

C 15.6 µs

D 156 µs

> **Answer 162: D**
>
> Correct: round trip 0.24 m ÷ 1540 m/s ≈ 156 µs (about 13 µs per cm of depth).

Safety roles · Medium

163. How do sonographers and radiographers each promote safe imaging, according to the lecture?

A Radiographers limit exposure to necessary levels; sonographers use ultrasound to avoid further radiation tests

B Radiographers use ultrasound to avoid dose; sonographers regulate X-ray exposure levels

C Both professions aim to increase the number of repeat examinations

D Sonographers set X-ray tube factors while radiographers reduce Doppler intensity

> **Answer 163: A**
>
> Correct: this restates the slide on the complementary duties of the two professions.

FALSE statement · Devil

164. Which statement about the Galton whistle and Doppler is FALSE?

A Galton (1822-1911) was Austrian and described the Doppler effect

B The Galton whistle is ultrasonic and also called a dog or silent whistle

C Doppler (1803-1853) was an Austrian mathematician and physicist

D The Doppler effect is the apparent change in frequency and wavelength for a moving observer relative to the source

> **Answer 164: A**
> Correct (the false one): Galton invented the whistle; Doppler was the Austrian who described the effect.

Organizations · Easy

165. Which body is the Allied Health Professions Council listed under for Ghana?

A AIUM
B ARDMS
C AHPC
D BMUS

> **Answer 165: C**
> Correct: AHPC stands for Allied Health Professions Council, Ghana.

History · Easy

166. Which Greek philosopher began the story of acoustics and led to the invention of the sonometer?

A Archimedes
B Pythagoras
C Aristotle
D Hippocrates

> **Answer 166: B**
> Correct: Pythagoras, in the sixth century BC, experimented on vibrating strings.

3. Set 3 · Q21–30

History · Medium

167. Which pairing of scientist and discovery is correct?

A Galton: described the Doppler effect
B Spallanzani: bats navigate in the dark using sound
C Newton: discovered piezoelectricity
D Rayleigh: invented the sonometer

> **Answer 167: B**
> Correct: Spallanzani discovered echolocation in bats.

Unique features · Medium

168. A sonographer follows a tortuous vessel and a moving fetus to capture the images needed. Which unique feature of ultrasound does this show?

A Spectral Doppler quantification
B Flexible multiplanar imaging capability
C Superior cost analysis
D Absence of ionizing radiation

Answer 168: B

Correct: multiplanar flexibility lets the operator follow tortuous vessels, moving cardiac structures or a moving fetus.

History · Easy

169. Who discovered piezoelectricity?

A Christian Doppler

B Paul Langevin

C Francis Galton

D Pierre and Paul-Jacques Curie KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 59

Answer 169: D

Correct: the Curie brothers discovered that pressure on a crystal creates an electric potential. KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 82

History · Medium

170. What is the significance of the 1956 bed-table scanner built by Tom Brown?

A First fully automatic scanner of 1959

B First contact B scanner built on a bed-table

C First 2D real-time scanner (Vidoson)

D First colour Doppler duplex system

Answer 170: B

Correct: it was the first contact B scanner, with its first picture showing skin and bowel echoes.

Vidoson · Hard

171. Which statement about the Vidoson is correct?

A A handheld linear array with a digital converter

B Revolving transducer in a water tank with a parabolic mirror

C A one-ton manual scanner on a hospital trolley

D Two transducers on opposite sides of the head

Answer 171: B

Correct: this is the description on the 1963 real-time revolution slide, drawing on Siemens' X-ray equipment expertise.

Terminology · Easy

172. Which set of terms was listed as describing ultrasound instrumentation?

A Radiography, fluoroscopy and conventional tomography

B Diagnostic medical ultrasound, ultrasound and ultrasonography

C Scintigraphy, SPECT and positron emission imaging

D Echolocation, sonometer and sonar instrumentation

> **Answer 172: B**
>
> Correct: the slide lists diagnostic medical ultrasound, ultrasound and ultrasonography as terms used for the instrumentation.

Grey scale · Hard

173. The lecture notes 64 shades of gray in grey scale imaging. How many bits of information per pixel does this represent?

A 4 bits
B 8 bits
C 6 bits
D 64 bits

> **Answer 173: C**
>
> Correct: $2^6 = 64$, so six bits per pixel.

Attenuation · Hard

174. Which combination accurately describes attenuation as presented in the lecture?

A Frequency increases steadily with depth
B Amplitude, power and intensity all decrease along the path
C Speed of sound drops steadily with depth
D Impedance becomes zero at the skin surface

> **Answer 174: B**
>
> Correct: attenuation is the decrease in amplitude, power and intensity along the path.

Sonographer vs radiographer · Medium

175. Why can a sonographer be stationed in obstetrics, paediatrics or internal medicine, unlike a radiographer?

A Sonographers are medical doctors who diagnose independently
B Ultrasound machines cannot be used in radiology departments
C Sonographer training is tailored for various clinical settings, not only radiology departments
D Radiographers are barred from using any imaging equipment

> **Answer 175: C**
>
> Correct: the slide states training prepares sonographers to work in many clinical settings.

Ultrasound basics · Easy

176. What frequency range of sound does the lecture give for diagnostic ultrasound?

A 20-20 000 Hz
B 2-15 MHz
C 50-100 kHz
D 200-500 MHz

> **Answer 176: B**
>
> Correct: ultrasound uses high-frequency sound waves of 2-15 MHz.

4. Set 4 · Q31–40

History logic · Hard

177. Which sequence of events is in correct chronological order?

A Automatic scanner (1959), A-scan study (1955), Lancet paper (1958), bed-table scanner (1956)

B Lancet paper (1958), A-scan study (1955), bed-table scanner (1956), automatic scanner (1959)

C Bed-table scanner (1956), automatic scanner (1959), A-scan study (1955), Lancet paper (1958)

D Donald and Barr A-scan study (1955), bed-table B scanner (1956), Lancet paper (1958), automatic scanner (1959) KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 60

> **Answer 177: D**
>
> Correct: 1955, 1956, 1958, 1959 in order. KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 83

Sonographer role · Medium

178. A sonographer notices an unexpected new finding during a scan that may be critical. What is the expected action?

A Delete the images and repeat later

B Prescribe treatment directly

C Wait for the next routine report

D Alert the physician

> **Answer 178: D**
>
> Correct: key responsibilities include alerting the physician when critical findings or new changes are found.

Timeline arithmetic · Devil

179. Leonardo da Vinci (1452-1519) and Galileo (1564-1642): how many years did Galileo outlive Da Vinci by (death years)?

A 112 years

B 123 years

C 45 years

D 67 years

> **Answer 179: B**
>
> Correct: 1642 - 1519 = 123.

Sub-specialties · Devil

180. Which list contains only sub-specialties named under abdomen/small parts in the lecture?

A Liver, kidneys, aorta, pancreas, spleen, thyroid

B Cardiac, vascular, MSK and breast imaging

C Obstetrics, gynecology and early OB only

D Lung, stomach, intestinal gas and skull

> **Answer 180: A**
>
> Correct: these appear in the abdomen/small parts list on the sub-specialties slide.

Role boundaries · Devil

181. Which task falls OUTSIDE the key responsibilities of a sonographer as listed in the lecture?

A Reviewing previous sonograms before scanning

B Giving an oral or written summary of technical findings to the physician

C Explaining the procedure to the patient

D Issuing the final medical diagnosis and prescribing treatment

> **Answer 181: D**
>
> Correct: the sonographer provides technical findings; the physician makes the medical diagnosis.

Scatter terminology · Hard

182. Which statement about sound-matter interactions in the lecture is accurate?

A Scatter is any change of wave direction, including reflection and diffraction

B Scatter means only reflection at a smooth boundary

C Absorption redirects the wave without energy loss

D Attenuation refers only to refraction of the beam

> **Answer 182: A**
>
> Correct: the slide defines scatter generally and subdivides it into reflection, refraction, scattering and diffraction.

Doppler · Hard

183. A sonographer must explain the Doppler effect. Which description matches the lecture?

A Real change in the speed of sound in tissue

B Change in amplitude only, with frequency fixed

C Apparent change in frequency and wavelength for a moving observer

D Conversion of sound energy into electrical energy

> **Answer 183: C**
>
> Correct: Doppler's effect is the apparent change in frequency and wavelength perceived by an observer moving relative to the wave source.

Advances · Medium

184. Which group of developments expanded the utility of ultrasound imaging, per the lecture?

A Film cassettes, grids, intensifying screens and processors

B Colour Doppler, harmonics, tissue characterization, spectral analysis

C Gamma cameras, collimators, PET detectors and cyclotrons

D Magnets, gradient coils, RF coils and shimming

> **Answer 184: B**
>
> Correct: the slide names colour Doppler, harmonics, tissue characterization and spectral analysis as expanding ultrasound's utility.

Sonographer knowledge · Hard

185. Why must a sonographer interpret laboratory values and review other diagnostic examinations?

A To correlate findings with the clinical picture

B To replace the clinical laboratory service

C To issue the final medical diagnosis alone

D To avoid explaining procedures to patients KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 61

> **Answer 185: A**
>
> Correct: the sonographer reviews records, labs and other tests to correlate findings and adapt the exam to the clinical question.

History · Medium

186. How was the full bladder's usefulness in obstetric scanning discovered?

A By a planned experiment on bladder tumours at Babcock

B Through X-ray correlation studies in obstetrics

C Accidentally, when a patient with a full bladder showed a gestation sac

D By Siemens engineers testing the Vidoson

> **Answer 186: C**
>
> Correct: the sonic window was an accidental discovery during one of Donald's patient scans.

5. Set 5 · Q41–50

Sonic window logic · Devil

187. Why is a full bladder helpful for imaging the uterus, in terms of the lecture's physics?

A Gas in the bladder amplifies the returning echoes

B Bone in the bladder wall reflects the beam

C The bladder absorbs all sound, leaving a shadow

D Fluid transmits sound well, giving a window past gas-filled bowel

Answer 187: D

Correct: ultrasound passes through fluid readily while gas-filled bowel reflects it strongly; the full bladder acts as a window.

Employment · Medium

188. A sonographer with an MPhil wants to move into academia. Which post is mentioned for such advanced-degree holders?

A Sales manager for an equipment company

B Quality control manager in industry

C Program Director of a sonography programme

D Clinical application specialist with a vendor

Answer 188: C

Correct: advanced degrees (MSc/MPhil or PhD) may lead to faculty roles such as Program Director, Department Head or Dean of Allied Health.

Advantages · Easy

189. Which is an advantage of ultrasound compared with fibre optic endoscopy?

A It images gas-filled bowel well

B It has higher resolution than X-ray

C It is non-invasive

D It needs no operator skill

Answer 189: C

Correct: ultrasound does not require opening the body or inserting an instrument.

Operator control · Devil

190. Which of these is NOT something the sonographer controls according to the lecture?

A How much sound is transmitted into the body

B Which beam shape and focus suit the examination

C Generating X-ray photons for the examination

D Transducer selection and system controls

Answer 190: C

Correct: X-ray photons are not part of ultrasound.

Numerical depth · Devil

191. A scanner assumes 1540 m/s, but the reflector sits in a medium where the true speed is 1450 m/s. The machine shows the reflector at 10.0 cm. What is the true depth?

A 10.6 cm

B 9.4 cm

C 10.0 cm

D 9.0 cm

Answer 191: B

Correct: displayed depth uses assumed speed, so true depth = 10.0 × 1450/1540 ≈ 9.4 cm.

Safety · Easy

192. The first reason given for ultrasound becoming a valuable imaging technique is the:

A Ability to image bone in detail

B Ability to image the lungs

C Lack of ionizing radiation

D Use of radioactive tracers

Answer 192: C

Correct: the first reason is the absence of ionizing radiation compared with CT or nuclear medicine.

FALSE statement · Devil

193. Which statement about Tom Brown's scanners is FALSE?

A The 1956 scanner was built on a hospital bed-table frame

B The bed-table scanner was manually operated and used compound sector scanning

C His 1956 contact B scanner was fully automatic with consistent scanning pattern

D The 1959 scanner was made to give a consistent scanning pattern KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 62

Answer 193: C

Correct (the false one): the 1956 scanner was manual; full automation came in 1959.

Early B-scan · Hard

194. Which feature set characterised the early large-scale B-scan equipment of the sonic boom era?

A Digital scan converters with 64 gray shades

B Colour Doppler duplex scanning displays

C Matrix array 3D volume transducers

D Bistable articulated arms, oscilloscope images, Polaroid recording

Answer 194: D

Correct: Picker's machines were bistable articulated-arm contact scanners; images were photographed with Polaroid after each scan.

Career · Medium

195. Which statement correctly reflects the employment outlook for certified sonographers?

A Supply far exceeds demand

B Demand exceeds supply

C Jobs exist only in research

D Only physicians are hired

> **Answer 195: B**
> Correct: the slide states demand for certified sonographers exceeds supply.

FALSE statement · Devil

196. Which statement about the history of sound theory is FALSE?

A Galileo (1564-1642) linked frequency to pitch

B Newton (1643-1727) gave the first analytical determination of the speed of sound

C Pierre Curie, born 1859, was older than his brother Paul-Jacques, born 1856

D Lord Rayleigh (1842-1919) wrote the Theory of Sound

> **Answer 196: C**
> Correct (the false one): Paul-Jacques, born 1856, was older than Pierre, born 1859.

6. Set 6 · Q51–60

Resolution trade-off · Hard

197. Which statement combines the lecture's resolution and patient-factor limitations correctly?

A Resolution always exceeds X-ray; obese patients scan best

B Resolution is often limited; slim patients scan better than obese

C Resolution is limited only in paediatric patients

D Patient build has no effect on ultrasound image quality

> **Answer 197: B**
> Correct: both points appear in the disadvantages slides.

FALSE statement · Devil

198. Which statement about ultrasound advantages and limitations is FALSE?

A Ultrasound is relatively inexpensive and portable compared with MRI

B Ultrasound is non-invasive compared with fibre optic endoscopy

C Ultrasound is highly operator dependent

D Ultrasound gives excellent imaging of lung parenchyma because gas transmits sound well

> **Answer 198: D**
> Correct (the false one): gas reflects ultrasound very strongly, so lung imaging is limited.

Production · Medium

199. How does a transducer produce ultrasound?

A Heating the crystal until it emits sound

B Electrically stimulated crystals expand and contract

C Bombarding tissue with a fast electron beam

D Rotating a magnet around the patient's body

> **Answer 199: B**
>
> Correct: electronic stimulation of crystals produces mechanical waves via the piezoelectric effect.

Lancet paper · Hard

200. The first Donald, MacVicar and Brown diagnostic ultrasound paper appeared in The Lancet in 1958. How many years later was the Diasonograph designed (1963)?

A 3 years

B 8 years

C 5 years

D 1 year

> **Answer 200: C**
>
> Correct: 1963 minus 1958 is 5 years.

Wavelength · Hard

201. At 5 MHz in soft tissue (1540 m/s), the wavelength is approximately:

A 0.31 mm

B 3.1 mm

C 0.031 mm

D 0.77 mm KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 63

> **Answer 201: A**
>
> Correct: $\lambda = c/f = 1540 \div 5\,000\,000 \approx 0.000308$ m = 0.31 mm.

History · Easy

202. What is SONAR an acronym for?

A SOund Normal Amplitude Reading

B SOund Neuro-Acoustic Response

C SOund Navigation and Ranging

D SOnic Navigation and Radiation

> **Answer 202: C**
>
> Correct: SONAR stands for SOund Navigation and Ranging.

Applying advances · Devil

203. Which advance directly improved recognisability of ultrasound for those unfamiliar with it?

A Polaroid photographs of static images

B The heavy one-ton Diasonograph gantry

C The A-scan metal flaw detector traces

D Real-time gray scale imaging with better resolution

Answer 203: D

Correct: the slides say improved resolution, real-time and gray scale made ultrasound more believable and recognisable.

Physics basics · Medium

204. Which property actually distinguishes two media acoustically?

A Acoustic impedance

B Attenuation

C Frequency

D Wavelength

Answer 204: A

Correct: acoustic impedance distinguishes two media acoustically.

Dussik · Hard

205. What principle did Dussik's head experiment rely on?

A Transmission between opposed transducers; lesions alter the transmission profile

B Reflection of pulses from one transducer shown as B-mode

C Doppler shift from cerebral blood flow velocities

D Piezoelectric generation of X-rays in the skull

Answer 205: A

Correct: two transducers on opposite sides measured transmission profiles, revealing intracranial lesions.

Unique features · Easy

206. Which feature lets the sonographer view the transition from one organ system to another?

A Use of a fixed film cassette

B Static single-exposure images

C Use of contrast barium swallow

D Real-time cine clip presentation

Answer 206: D

Correct: ultrasound is presented in real-time cine clip format, so transitions between organ systems can be seen.

7. Set 7 · Q61–70

Sound-matter · Devil

207. A beam passes through tissue and returns weaker. Which explanation fits the lecture best?

A Frequency rises with depth, so the beam loses power

B Absorption and scatter remove energy, causing attenuation

C Impedance disappears at every tissue interface

D Crystal contraction after the pulse weakens the beam

> **Answer 207: B**
>
> Correct: energy absorbed and redirected by scatter reduces amplitude, power and intensity.

Physics basics · Medium

208. Which statement correctly describes how ultrasound images are built from echoes?

A Return time gives tissue density; echo colour gives depth

B Only transmitted sound is used, never reflected echoes

C Echoes give information only about bone surfaces

D Return time gives depth; echo strength reflects absorption and interfaces

> **Answer 208: D**
>
> Correct: return time determines depth; interface echoes yield size, shape and internal structure.

Sonographer role · Easy

209. Sonographers are popularly known as:

A Film readers

B Image makers

C Dose managers

D Specimen analysts KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 64

> **Answer 209: B**
>
> Correct: the slides call sonographers image makers who create images of soft tissue structures and organs.

History · Medium

210. What did Paul Langevin develop during World War I using the piezoelectric effect?

A Diagnosis of brain tumours

B The first real-time scanner

C Submarine detection by echolocation

D A compound sector scanner

> **Answer 210: C**
>
> Correct: Langevin began using ultrasound to detect submarines through echolocation.

Career · Easy

211. Which is listed as a disadvantage of the sonography career?

A Tendinitis, arm and shoulder pain, and back strain

B High doses of ionizing radiation exposure

C Very few employment opportunities available

D No interaction with patients at all

> **Answer 211: A**
>
> Correct: hours of continual scanning may lead to tendinitis, arm and shoulder pain and back strain.

Fry and Meyers · Hard

212. Which description of the Fry and Meyers work is accurate?

A Non-invasive diagnosis of bladder tumours

B Ultrasound ablation of basal ganglia during craniotomy

C First B-mode obstetric scanning in Glasgow

D Detection of submarines using sonar pings

> **Answer 212: B**
>
> Correct: this is therapeutic use of ultrasound on the basal ganglia in parkinsonism.

Advantages reasoning · Hard

213. A pregnant patient in a rural Ghanaian clinic needs repeated imaging over weeks. Which advantage of ultrasound best justifies its choice?

A Superior bone resolution compared with X-ray

B Ability to image through gas-filled bowel

C Independence from operator skill and training

D No harmful effects detected at diagnostic intensities

> **Answer 213: D**
>
> Correct: the slide notes no harmful effects at diagnostic intensities, particularly relevant for expectant mothers.

Sound basics · Easy

214. Sound is described in the slides as which type of wave?

A Transverse electromagnetic wave

B Ionizing photon beam

C Standing light wave

D Longitudinal mechanical wave

> **Answer 214: D**
>
> Correct: sound is a longitudinal mechanical wave.

Unique features · Easy

215. Doppler techniques in sonography allow evaluation of which of the following?

A Blood flow hemodynamics within a vessel

B Bone mineral density

C Radiation dose to the patient

D Serum enzyme levels

> **Answer 215: A**
>
> Correct: Doppler allows qualitative and quantitative evaluation of blood flow hemodynamics within a vessel.

Titles · Medium

216. Which set lists alternative professional titles used for cardiac-focused sonographers?

A Vascular scientist, vascular technologist, ultrasound specialist

B Obstetric sonographer, fetal echocardiographer

C Clinical instructor, technical director, supervisor

D Cardiac sonographer, clinical echocardiographer, cardiac physiologist

> **Answer 216: D**
>
> Correct: these are the titles listed for cardiac work.

8. Set 8 · Q71–80

Attribution trap · Devil

217. Which attribution of historical work is correct?

A Langevin used the Curies' piezoelectric effect for submarine detection

B The Curies invented sonar for WWII; Langevin discovered piezoelectricity

C Doppler used piezoelectric crystals to find submarines

D Galton applied sonar to medical diagnosis in 1955 KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 65

> **Answer 217: A**
>
> Correct: this matches the slides on Langevin and the Curies; WWII sonar advances then influenced medical ultrasound.

Advances · Easy

218. Which development allows 2D ultrasound information to be recreated as real-time 4D images?

A Invention of the sonometer

B Discovery of echolocation

C Introduction of Polaroid recording

D Advances in ultrasound technology

Answer 218: D

Correct: the slides list 3D and 4D (real-time) reconstruction of 2D data among advances in ultrasound technology.

Echo information · Hard

219. Which statement about echo information is most accurate?

A Return time sets intensity, while absorption sets depth

B Both depth and intensity come from frequency alone

C Return time sets depth, while the degree of absorption sets returning intensity

D Neither depth nor intensity is recoverable from echoes

Answer 219: C

Correct: the slides say time to return determines depth and beam absorption determines returning wave intensity.

Sound basics · Easy

220. Sound below the range of human hearing is called:

A Infrasound

B Ultrasound

C Audible sound

D Sonar

Answer 220: A

Correct: sound below human hearing is infrasound.

Role comparison · Devil

221. Which comparison of the sonographer and radiographer best matches the slides?

A Sonographer performs examinations and provides preliminary findings; radiographer acquires images while a radiologist interprets

B Sonographer only acquires images; radiographer provides preliminary findings

C Both interpret images and diagnose independently

D Sonographers are limited to radiology departments, radiographers work anywhere

Answer 221: A

Correct: this restates the slide contrasting the two professions.

Employment · Easy

222. Which of these is a staffing position listed for sonographers within a hospital?

A Radiation protection officer

B Chief sonographer

C Blood bank supervisor

D Pharmacy director

Answer 222: B

Correct: chief sonographer is on the list, along with director of imaging, technical director, supervisor and others.

Sonographer role · Easy

223. Which professional is primarily responsible for acquiring images, with interpretation and diagnosis done by a radiologist?

A Chief sonographer

B Clinical application specialist

C Diagnostic radiographer

D Research sonographer

Answer 223: C

Correct: the slide states the radiographer is primarily responsible for acquiring images while the radiologist interprets.

Diasonograph · Hard

224. Why was the Diasonograph's gantry made heavy, giving it the nickname Dinosaurograph?

A To shield staff from radiation

B To keep the patient immobile with magnets

C A stable scanning platform was needed

D To house a water bath

Answer 224: C

Correct: the heavy gantry provided the stable scanning platform needed (about one ton).

Disadvantages · Easy

225. Why can ultrasound not be used to examine the lung or digestive system?

A Ultrasound is fully absorbed by water

B Ultrasound causes tissue ionization

C Ultrasound cannot travel through soft tissue

D Ultrasound is reflected very strongly at tissue-gas interfaces KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 66

Answer 225: D

Correct: strong reflection at tissue-gas boundaries prevents useful imaging of gas-containing regions.

Wavelength range · Hard

226. Across the lecture's range of 2-15 MHz, how does soft tissue wavelength change (c = 1540 m/s)?

A From about 0.10 mm at 2 MHz to about 0.77 mm at 15 MHz

B From about 0.77 mm at 2 MHz to about 0.10 mm at 15 MHz

C From about 7.7 mm at 2 MHz to about 1.0 mm at 15 MHz

D It stays near 0.31 mm across the range

> **Answer 226: B**
>
> Correct: 1540/2e6 = 0.77 mm and 1540/15e6 ≈ 0.103 mm; wavelength falls as frequency rises.

9. Set 9 · Q81–90

speed of sound in media · Easy

227. Using the speed-of-propagation table in the figure shown, which medium transmits ultrasound most slowly?

A Air, at 330 m/s

B Fat, at 1440 m/s

C Water, at 1480 m/s

D Liver, at 1550 m/s



> **Answer 227: A**
>
> Correct. Air has the lowest velocity in the table, far below the 1540 m/s soft-tissue average, which is why tissue-gas interfaces reflect sound so strongly.

scanner components · Easy

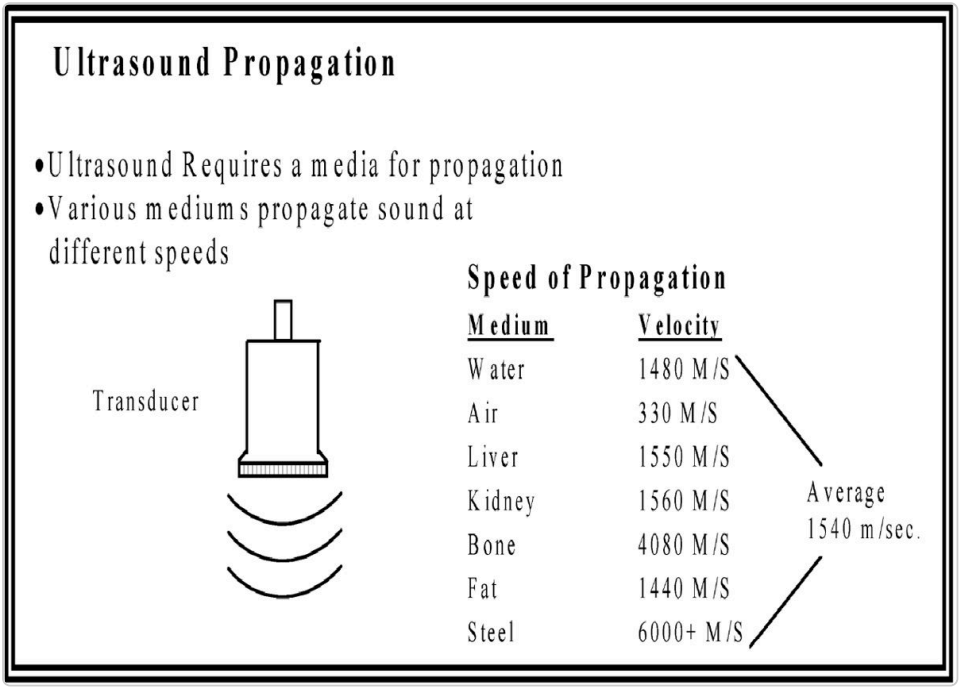
228. The figure shown is a portable ultrasound system with an arrow pointing at the hand-held part on the right. What is that component and what does it contain?

A The scanner, which holds the crystals that vibrate to make the sound

B The transducer, which holds the piezoelectric crystals that produce the sound

C The transducer, which processes the echoes and draws the final image

D The scanner, which is only a cable guide with no role in the image KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 67



Answer 228: B

Correct. The two major components are the transducer and the scanner. The crystals in the transducer expand and contract when electrically stimulated (piezoelectric effect), creating the ultrasound wave.

history: first experiments · Easy

229. The figure shown is the Henry Hughes Mk 2 instrument Ian Donald used in his first experiments in 1955. For what job was this type of instrument originally built?

A Locating submarines through underwater echoes

B Testing the hearing ability of patients

C Recording electrical activity of the heart

D Detecting internal flaws in metal using sound echoes



Answer 229: D

Correct. It was an industrial metal flaw detector; Donald borrowed the echo principle to examine excised tumours and cysts.

early obstetric ultrasound · Easy

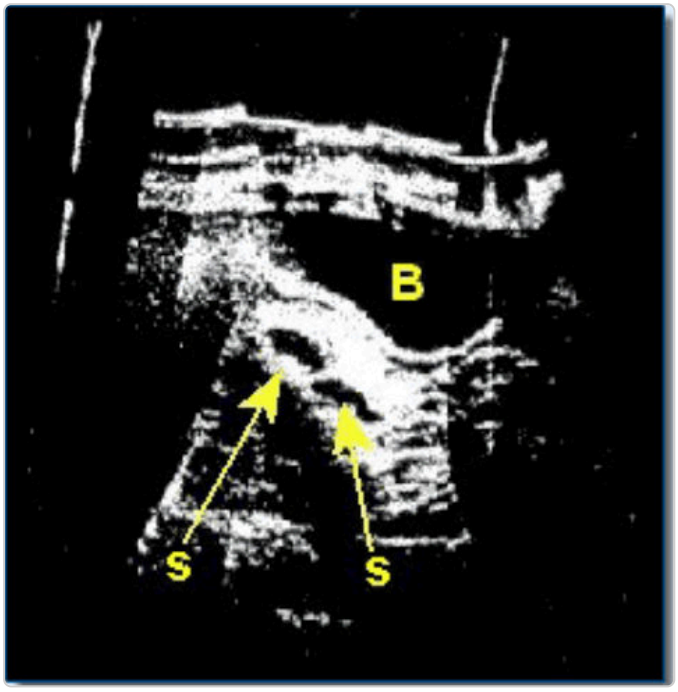
230. In the early contact B-scan shown, what do the two arrows labelled S point to?

A Two loops of bowel just under the skin surface

B Two reflections from the posterior bladder wall

C Two gestation sacs (twins) lying beneath the large dark bladder

D Two solid tumours with a cystic centre KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 68



Answer 230: C

Correct. The large dark area B is the full bladder, and the two sacs below it show a twin gestation, found when a full bladder was accidentally scanned.

renal sonography · Easy

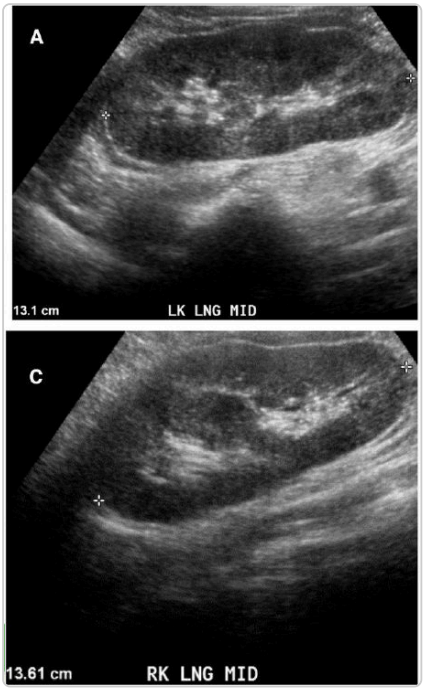
231. The figure shown has long-axis scans of the left and right kidney, each with a printed measurement. Which statement matches the figure?

A The left kidney is clearly longer than the right kidney

B The right kidney (13.61 cm) is slightly longer than the left (13.1 cm)

C Both kidneys have exactly the same measured length

D Both kidneys are shorter than 12 cm



Answer 231: B

Correct. The calipers give 13.61 cm for the right kidney and 13.1 cm for the left, about 0.5 cm difference.

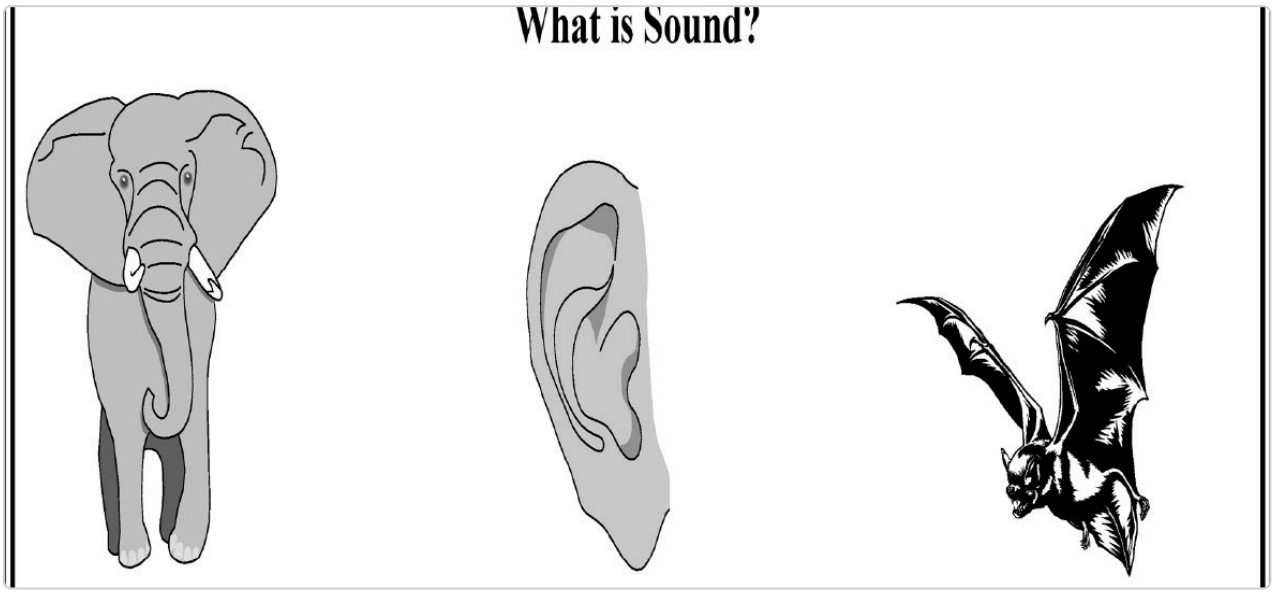
232. The figure shown pairs an elephant, a human ear and a bat under the title 'What is Sound?'. Which statement fits the figure?

A Elephant: ultrasound above hearing; ear: infrasound; bat: the audible range

B Elephant: the audible range only; ear: ultrasound; bat: infrasound

C Elephant: infrasound below hearing; ear: the audible range; bat: ultrasound above hearing

D All three animals communicate only inside the audible band KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 69



Answer 232: C

Correct. Sound below human hearing is infrasound, sound the ear detects is audible, and sound above it is ultrasound; the bat's echolocation (Spallanzani) is the ultrasound example.

scan planes · Medium

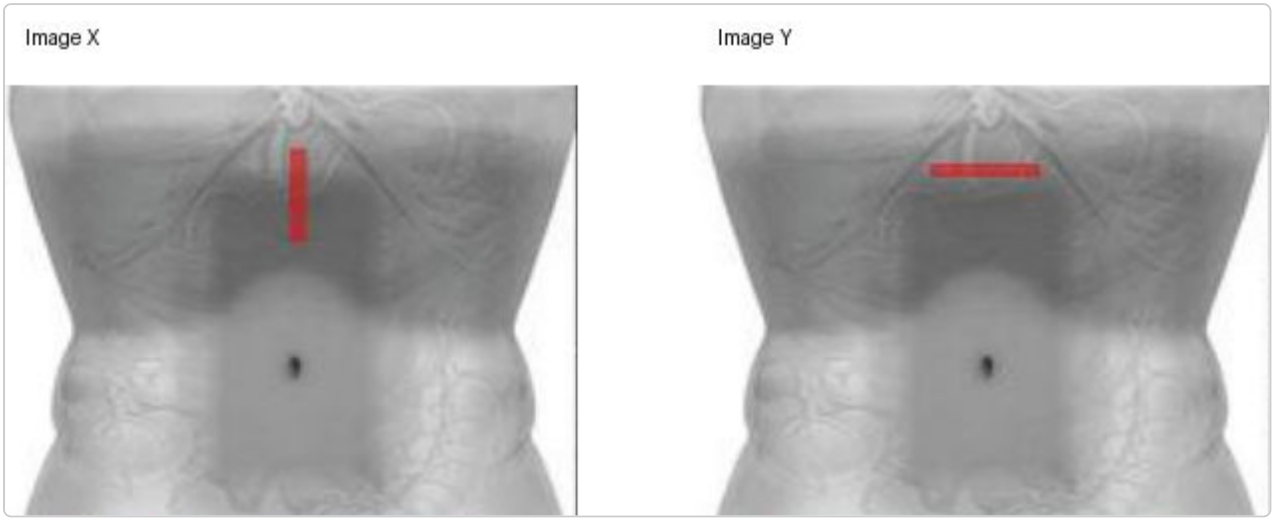
233. The red bars in the figure show where the transducer is placed on the upper abdomen for Image X and Image Y. Which pairing of scan planes is correct?

A X is a transverse scan and Y is a longitudinal scan

B X is a coronal scan and Y is a sagittal scan

C X and Y are both transverse scans with different depth

D X is a longitudinal (sagittal) scan and Y is a transverse scan



Answer 233: D

Correct. A transducer aligned with the long axis of the body gives a longitudinal plane, and one turned across the body gives a transverse plane. Free choice of plane is the multiplanar strength of sonography.

A-scan display · Medium

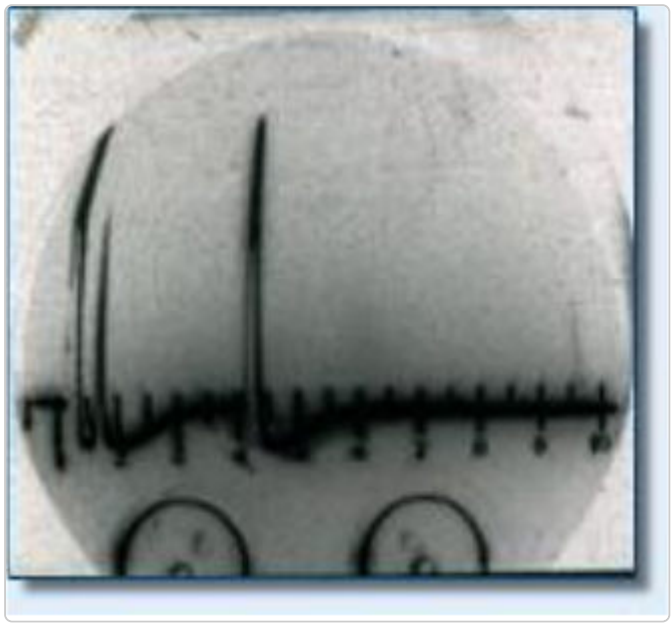
234. The figure shows an early oscilloscope display from the period of Donald's experiments with spikes rising from a baseline scale. What is this display and what does the spike height represent?

A An A-scan; spike height shows echo amplitude along a depth axis

B A B-scan; spike height shows echo brightness at each pixel

C An M-mode trace; spike height shows organ motion over time

D A Doppler spectrum; spike height shows blood velocity KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 70



Answer 234: A

Correct. Donald saw clear differences in A-scan traces between solid and cystic tumours: each spike is an echo whose height is its amplitude and whose position gives depth.

first B-scan picture · Medium

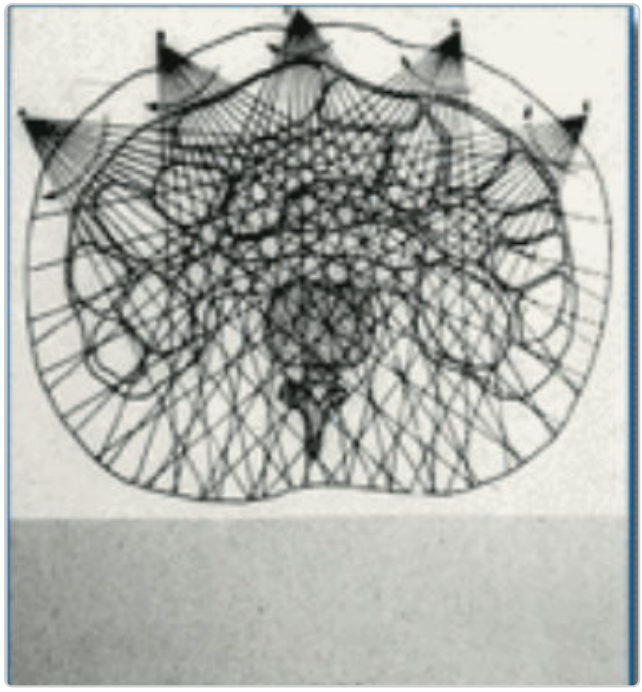
235. The figure is the first picture from the first contact B scanner (1956). The bright curved band along the top edge arises from echoes from which structure?

A The bowel deep inside the abdomen

B The bladder with fluid beneath

C The skin, nearest the transducer

D The posterior wall of the uterus



Answer 235: C

Correct. Echoes returning first come from the shallowest structure, so the skin appears at the top of the picture; the bowel echoes appear below it.

compound scanning · Medium

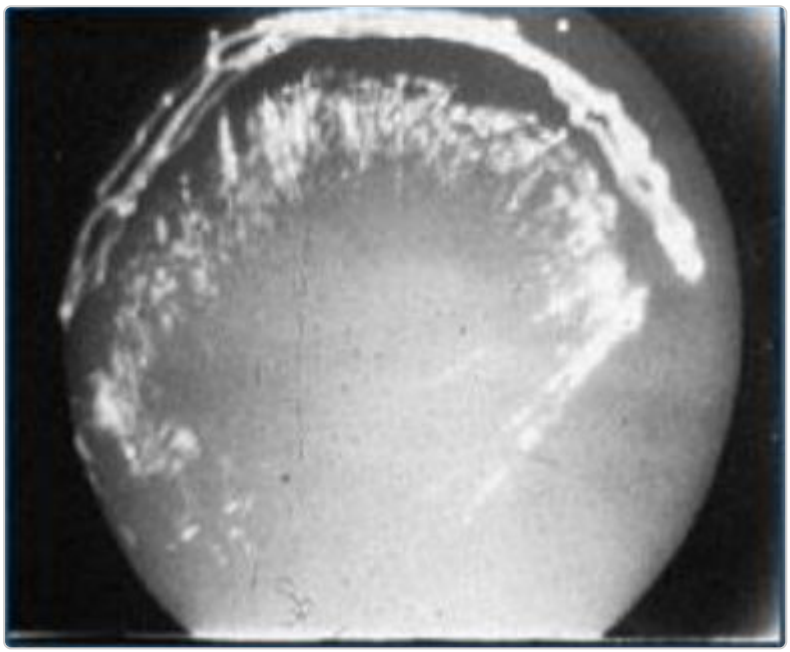
236. The line drawing shown has many beam lines crossing from several positions around a cross-section of the body. Which scanning technique does it represent?

A A single-line A-scan taken from one fixed point

B Compound sector scanning, building a 2D grey-scale image from many angles

C A real-time linear array with fixed parallel beams

D Spectral Doppler sampling at one depth KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 71



Answer 236: B

Correct. A compound sector technique built up a two-dimensional image with grey scaling by combining beams that crossed the same region from different directions.

10. Set 10 · Q91–100

nuchal translucency · Medium

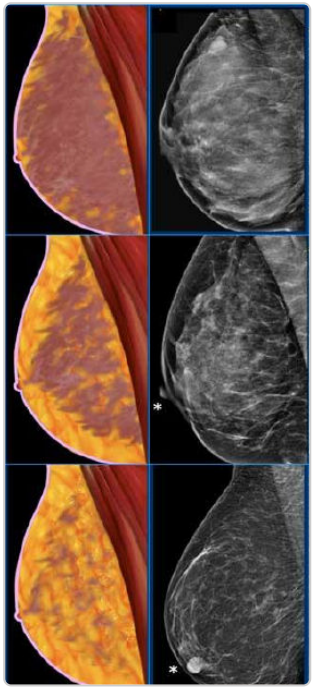
237. In the early obstetric image shown, the paired calipers labelled NT sit at the back of the fetal neck. What is being measured?

A The crown-rump length of the whole fetus

B The width of the fetal skull between the parietal bones

C The diameter of the fetal spinal canal

D The thickness of the fluid-filled nuchal translucency behind the neck



Answer 237: D

Correct. NT is the nuchal translucency, a thin fluid-filled space under the skin at the nape, measured in the first-trimester profile view as an early screening marker.

breast tissue composition · Medium

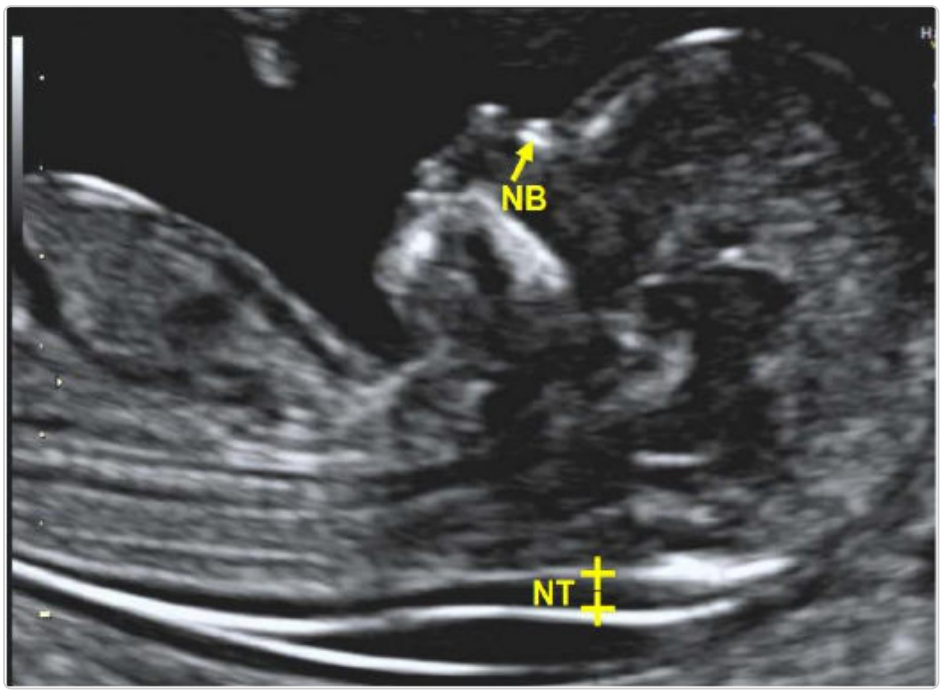
238. The anatomy and mammogram panels in the figure show three breasts. Compared with the top breast, what does the bottom breast show?

A Mostly fatty tissue, typical of older women

B Mostly glandular tissue, typical of lactation

C Mixed tissue, which is the most common pattern

D A breast with the pectoral muscle removed KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 72



Answer 238: A

Correct. The bottom anatomy panel is dominated by yellow fat and the mammogram is darker with sparse white strands, the fatty pattern seen in older women.

Diasonograph design · Medium

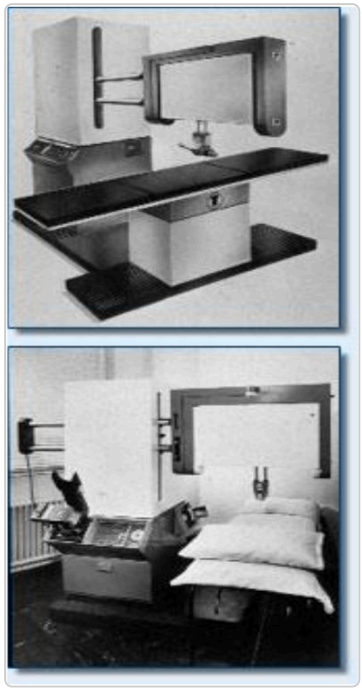
239. The figure shows two views of an early scanner whose probe hangs from a huge gantry above a simple couch. Why was the gantry built so heavy?

A To shield the operator from ionising radiation

B To store the large Polaroid photographs

C To give a stable scanning platform

D To move the patient through the machine



Answer 239: C

Correct. The one-ton machine, nicknamed the 'Dinosaurograph', needed a stable scanning platform so that the probe stayed accurately positioned.

gas and shadowing · Hard

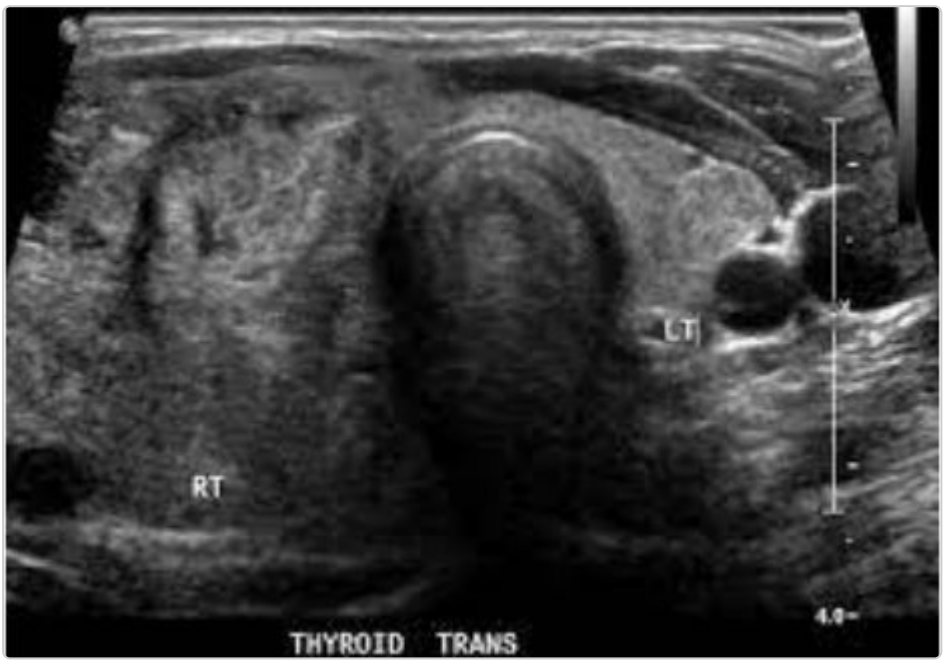
240. The figure is a transverse thyroid scan. Why is the midline region under the bright curved line at the centre dark and featureless?

A Bone in the neck absorbs the beam, so nothing returns

B The air in the trachea reflects almost all of the beam, so nothing is transmitted deeper

C Fluid in the trachea transmits the beam so well that echoes vanish

D The thyroid gland is too dense for the beam to penetrate KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 73



Answer 240: B

Correct. Ultrasound is reflected very strongly at a tissue-gas interface, so the air-filled trachea returns a bright surface echo and leaves a shadow behind it.

renal artery Doppler indices · Hard

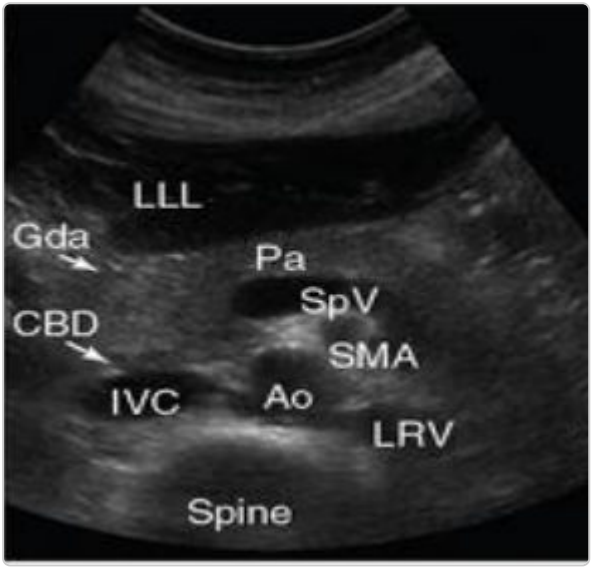
241. Using the peak systolic velocity (PSV 40.6 cm/s) and end-diastolic velocity (EDV 15.2 cm/s) on the figure shown, what is the resistive index (PSV - EDV)/PSV of this intrarenal artery?

A About 0.37

B About 0.82

C About 0.63

D About 2.67



Answer 241: C

Correct. (40.6 - 15.2) / 40.6 = 25.4 / 40.6, which is 0.63.

upper abdominal vascular anatomy · Hard

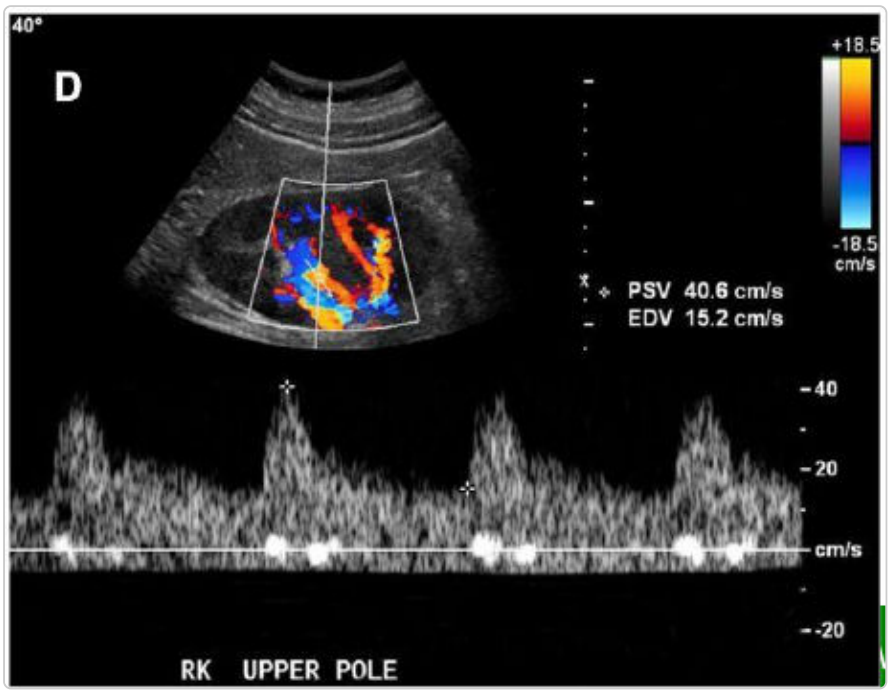
242. In the transverse upper-abdominal scan shown, the left renal vein (LRV) crosses the midline to reach the IVC. Between which two labelled vessels does it pass?

A Between the pancreas and the splenic vein

B Between the IVC and the spine

C Between the CBD and the gastroduodenal artery

D Between the superior mesenteric artery and the aorta KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 74



Answer 242: D

Correct. The LRV travels in the narrow gap between the SMA in front and the aorta behind before entering the IVC.

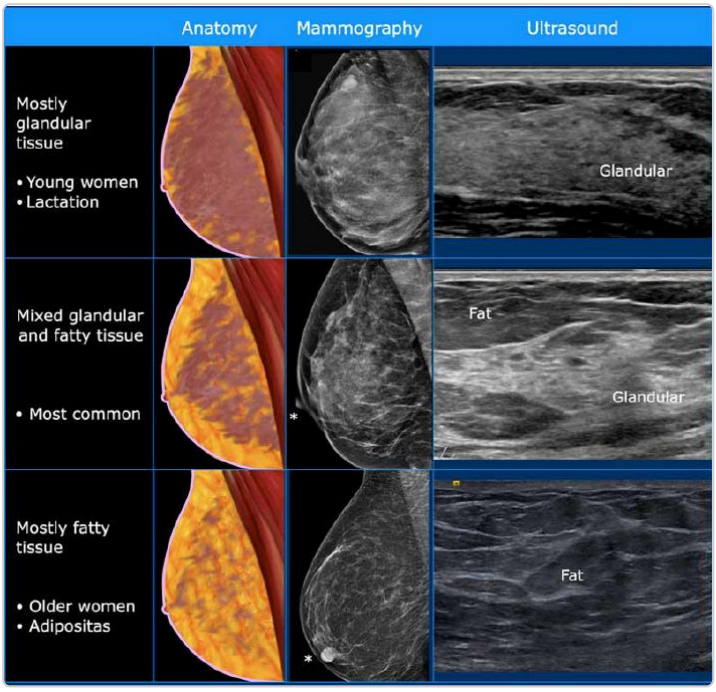
243. From the figure shown, which breast pattern would be expected to hide a small lesion most on the mammogram, so that ultrasound adds useful information?

A The mostly glandular breast, because dense tissue appears white on the mammogram

B The mostly fatty breast, because fat appears bright white on the mammogram

C The mixed breast, because gland and fat cancel out in the image

D None, because mammograms are unaffected by tissue composition



Answer 243: A

Correct. Glandular tissue is dense and shows as extensive white, like many lesions, so lesions are easily masked; ultrasound can still show them against glandular tissue.

Vidoson mechanism · Hard

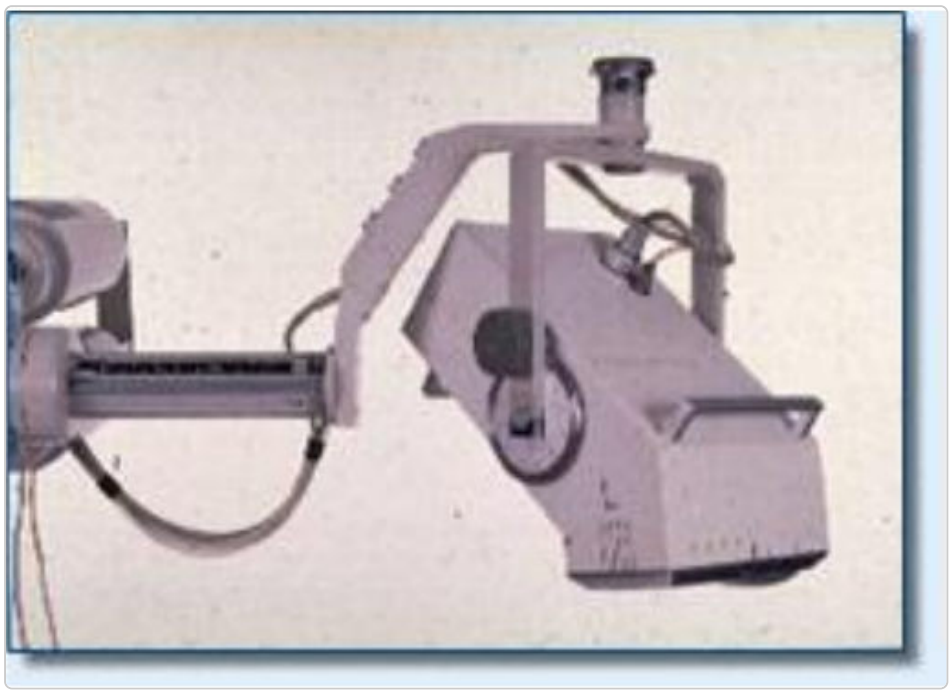
244. The scan head shown belonged to the first 2D real-time scanner (Siemens, 1963). How did it produce a real-time sweep?

A A row of fixed crystals switched electronically in sequence

B A transducer revolving in a water tank that was aimed by a parabolic mirror

C An articulated arm moved by hand across the skin

D A single crystal vibrated by a heavy gantry over the couch KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 75



Answer 244: B

Correct. The scanning head used a revolving transducer in a water tank with a parabolic mirror, drawing on Siemens' X-ray equipment expertise.

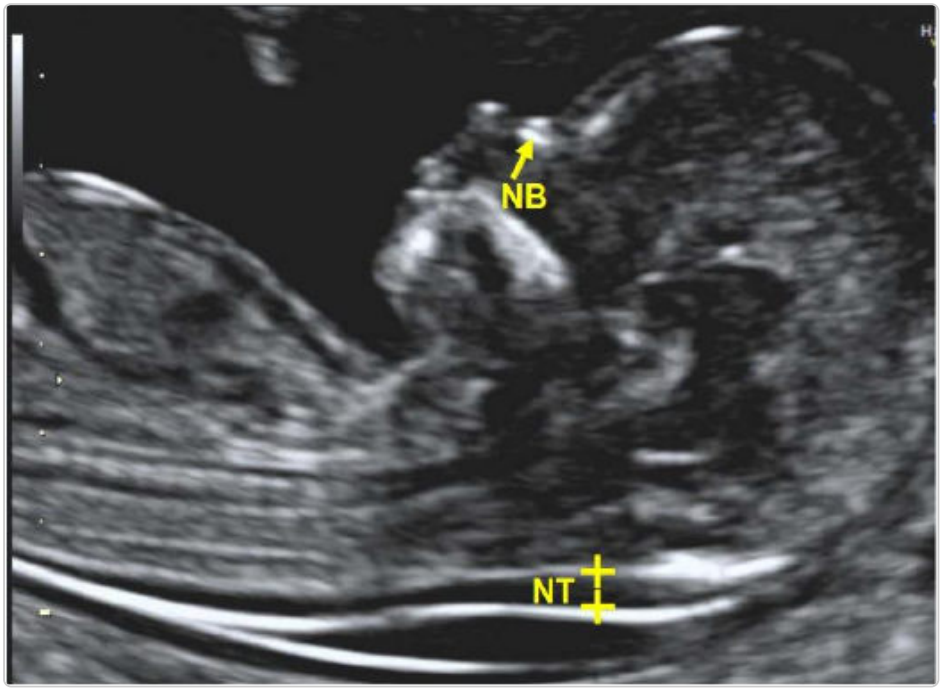
245. The arrow labelled NB in the figure points to the fetal nasal bone, assessed in the same view as the NT calipers. What is the significance of this assessment?

A A visible nasal bone confirms the fetus is male

B A thick NT and absent nasal bone confirm a normal fetus

C An absent nasal bone with a thick NT raises suspicion of a chromosomal abnormality

D Nasal bone visibility only measures gestational age to the day



Answer 245: C

Correct. In the first-trimester profile view an absent or short nasal bone together with an increased NT raises suspicion of aneuploidy such as trisomy 21, prompting further testing.

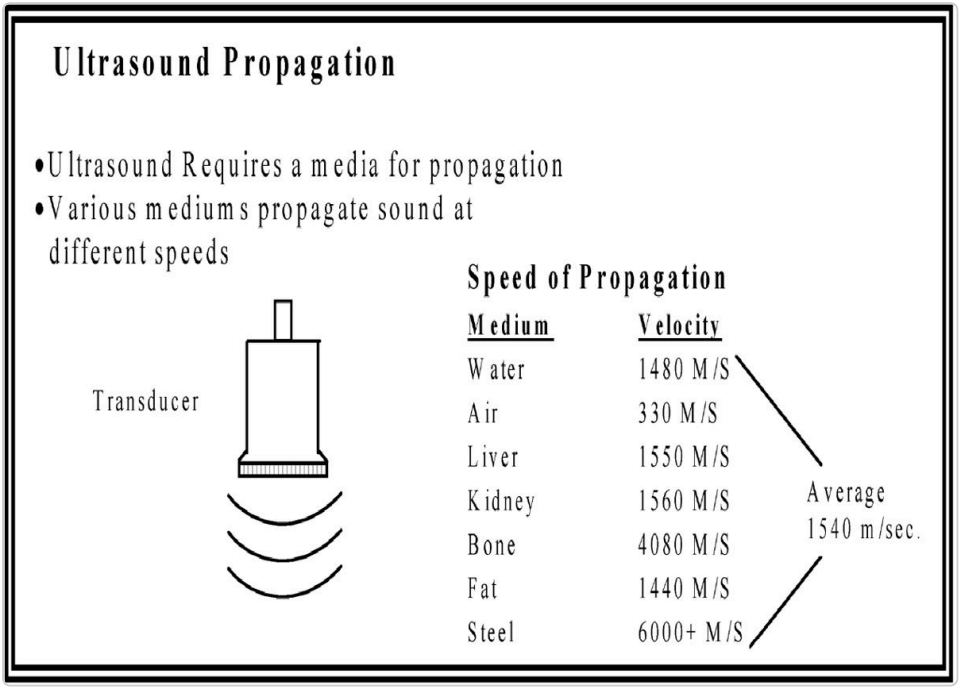
246. The scanner assumes 1540 m/s to convert echo time into depth. Using the table in the figure, how will a reflector lying beyond a thick layer of fat (1440 m/s) be displayed?

A Slightly shallower than its true position, because the sound goes faster

B At its true position, because only the amplitude changes in fat

C Sideways displaced, with the depth unchanged

D Slightly deeper than its true position, because the echo takes longer than assumed KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 76



Answer 246: D

Correct. At 1440 m/s the round trip takes longer than at 1540 m/s, and the scanner attributes the extra time to extra distance, so the structure is drawn too deep.

11. Set 11 · Q101–105

sonic window · Devil

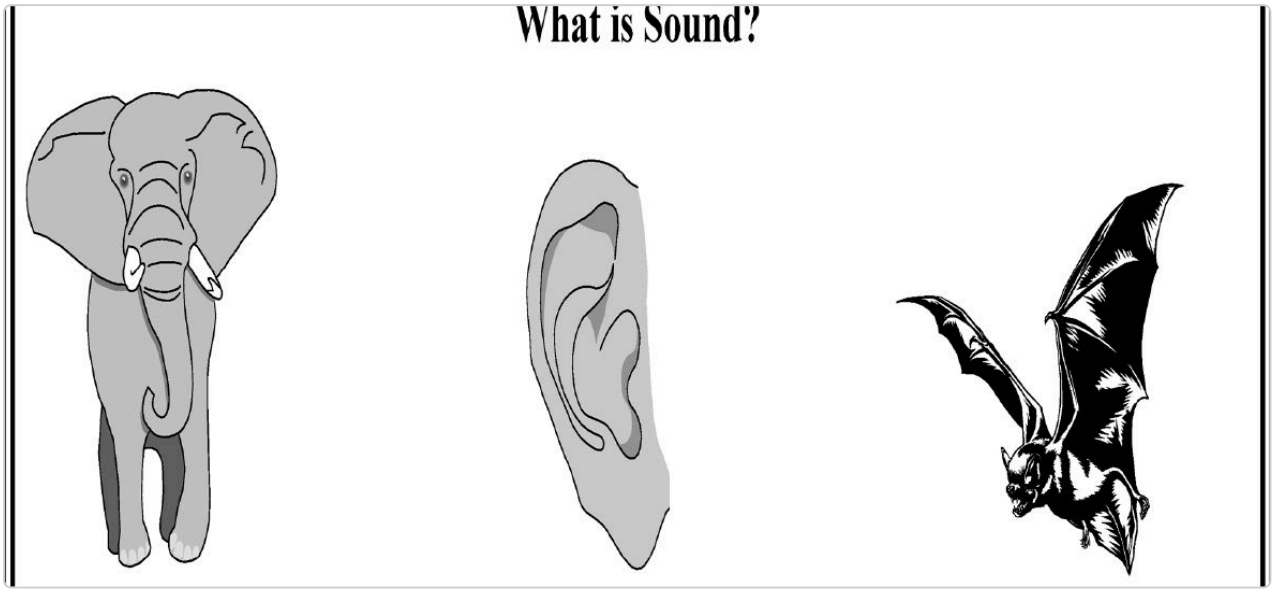
247. In the picture shown, twin sacs were visible beneath a large dark bladder (B). Why does a full bladder make a good 'sonic window'?

A Fluid transmits the beam with little loss and pushes gas-filled bowel out of the path

B Urine strongly reflects the beam, so it brightens the uterus behind it

C The bladder absorbs frequencies harmful to the fetus

D The bladder wall focuses the beam like a lens on any structure



Answer 247: A

Correct. Urine returns almost no echoes and attenuates little, and the distended bladder displaces bowel gas, which would otherwise reflect the beam strongly.

frequency scales · Devil

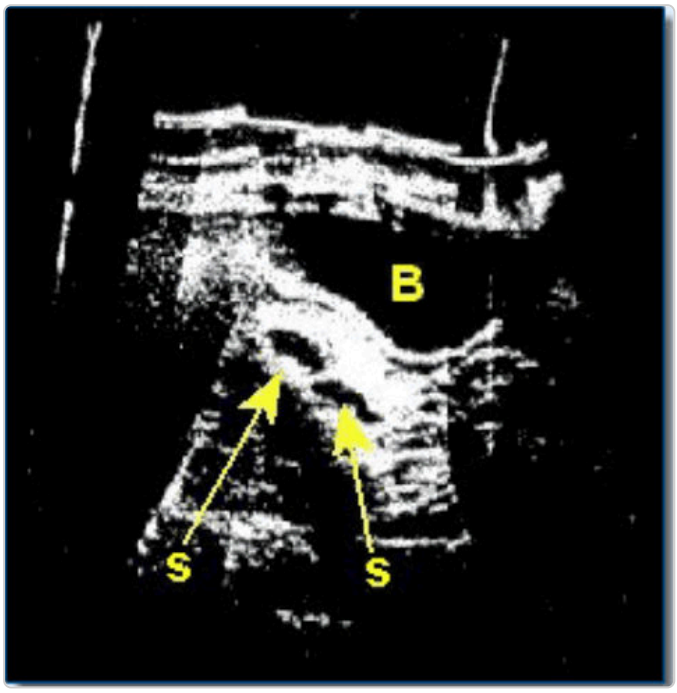
248. The bat in the figure navigates by echolocation (Spallanzani), yet its calls are typically tens of kHz. How does that compare with diagnostic ultrasound of 2-15 MHz?

A Diagnostic ultrasound is far lower, so it can penetrate air better

B Diagnostic ultrasound is far higher in frequency, around one hundred times, giving shorter wavelengths

C They are about equal, which is why bats could image the body

D Diagnostic ultrasound is audible while bat calls are not KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 77



Answer 248: B

Correct. Both are above the 20 kHz limit of hearing, but 2-15 MHz is roughly 100 times the bat's tens of kHz, so imaging wavelengths are far shorter and resolution finer.

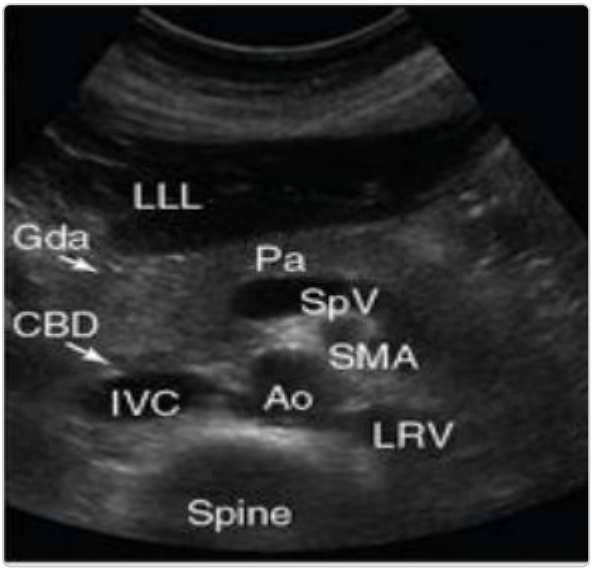
249. The spectral trace in the figure is angle-corrected at 40 degrees. Why would the resistive index stay almost unchanged if that angle were set a little wrong?

A Both velocities carry the same cosine factor, which cancels in the ratio

B The Doppler shift does not depend on the angle at all

C The colour box automatically re-corrects the spectral trace

D Resistive index is calculated from the vessel diameter, not velocity



Answer 249: A

Correct. Measured velocity is proportional to the cosine of the angle for both PSV and EDV, so the error cancels in (PSV - EDV)/PSV, although the velocities themselves would be wrong.

display orientation · Devil

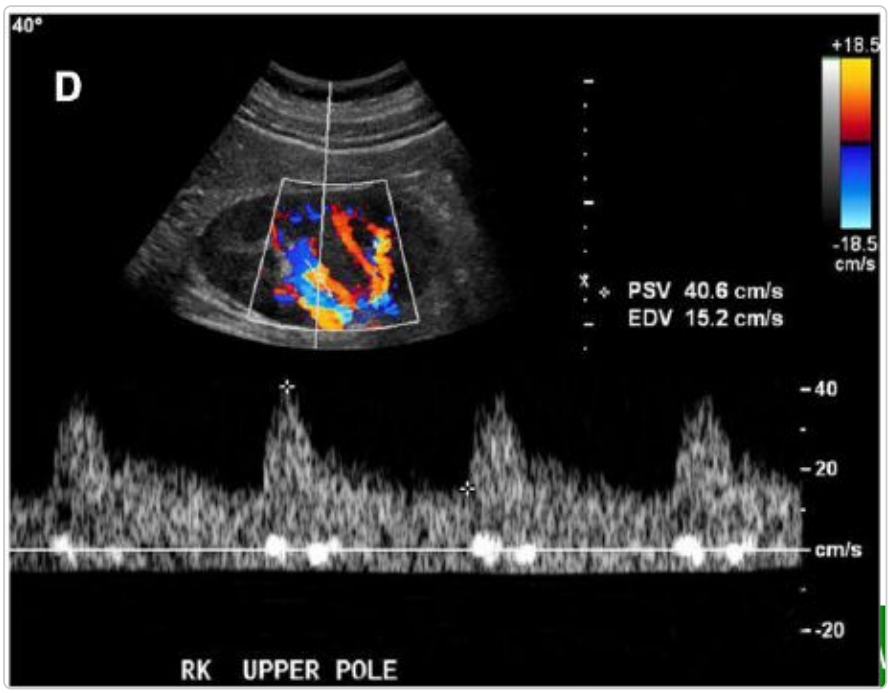
250. In this transverse upper-abdominal scan the IVC lies on the left of the image beside the aorta. What does this tell you about the display?

A The patient's left is on the viewer's left, as if viewed from the head

B The picture is flipped, since the IVC lies left of the aorta

C The patient's right is on the viewer's left, as if viewed from the patient's feet

D The orientation cannot be known without labels such as LLL KNUST · Department of Medical Imaging · Introduction to Medical Imaging · Practice Question Bank 78



Answer 250: C

Correct. The IVC lies to the patient's right of the aorta, so with the IVC on the left of the image, transverse scans are displayed as viewed from the feet.

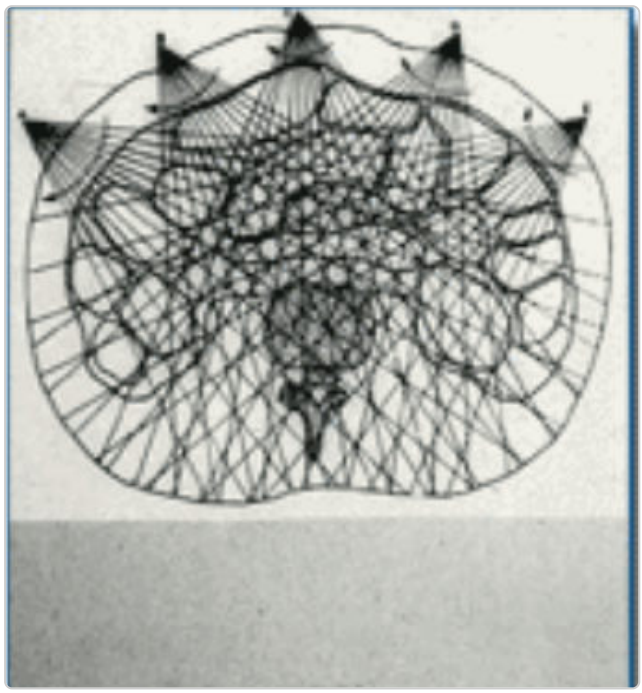
251. The figure shows crossing beams around a body outline. Why does viewing an interface from several directions improve the image?

A Crossing beams cancel noise because echoes subtract

B Each extra angle lowers the frequency and increases depth

C More angles make echoes arrive sooner, giving real-time display

D An interface returns a strong echo only when struck near-perpendicularly, so some beam always meets it squarely



Answer 251: D

Correct. Echoes from a smooth interface reflect away from the transducer unless the beam is near-perpendicular, so multiple angles ensure that each boundary is outlined.