INI CET Radiology

Sample Paper – 1

Duration: 14 Minutes **Maximum Marks: 15**

Instructions

- This paper contains **15** Multiple Choice Questions (Single Best Response), modelled on the Radiodiagnosis (Radiology) content of **INI CET** (Institutes of National Importance Combined Entrance Test) conducted by AIIMS New Delhi.
- The **15-question** length matches the number of Radiology items you actually meet in the real 200-question paper.
- Each correct answer carries **+1 mark**. There is **negative marking of one-third (0.33) mark** for every incorrect answer; unattempted questions carry no penalty.
- Every question has **exactly one best answer**. Choose the single most appropriate option.
- Attempt this practice paper in one timed sitting of about **14 minutes**, the pace the real computer-based test demands.

Physics and Radiation Safety

Q1. Diagnostic X-rays are produced in the X-ray tube when high-speed electrons strike the target and decelerate. The two processes that generate them are:

(A) Gamma decay and internal conversion from the nucleus

(B) Radio-wave emission from the anode

(C) Bremsstrahlung (braking) radiation and characteristic X-rays

(D) Emission of visible light only

Q2. The SI unit of *absorbed* radiation dose is the:

(A) Gray (Gy)

(B) Sievert (Sv)

(C) Becquerel (Bq)

(D) Roentgen (R)

Q3. In radiation protection, the principle abbreviated 'ALARA' means keeping doses:

(A) At the legal maximum permitted limit

(B) As high as reasonably achievable

(C) As low as reasonably achievable

(D) Above the natural background level

Imaging Modalities and Contrast Media

Q4. Magnetic resonance imaging (MRI) forms its images mainly from the behaviour, in a strong magnetic field, of which nuclei?

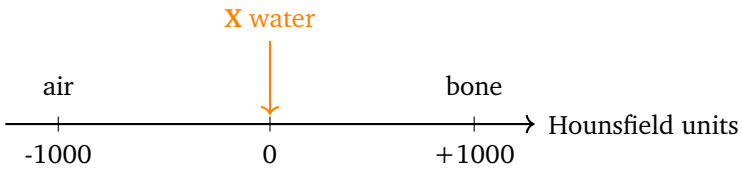
(A) Hydrogen nuclei (protons) in water and fat

(B) Carbon-14 nuclei

(C) Iodine atoms

(D) Free electrons

Q5. On the CT Hounsfield-unit scale shown below, the value assigned to *water* (marked **X**) is:



(A) -1000 HU

(B) 0 HU

(C) $+1000$ HU

(D) $+100$ HU

Q6. Gadolinium-based MRI contrast is relatively contraindicated in a patient with severe renal failure because of the risk of:

(A) Anaphylaxis alone

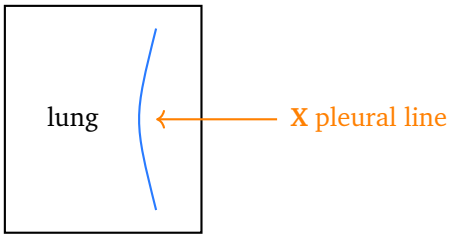
(B) Contrast-induced nephropathy

(C) Thyroid storm

(D) Nephrogenic systemic fibrosis

Chest and Cardiovascular Radiology

Q7. The erect chest radiograph sketched below shows a visible visceral pleural white line (marked **X**) with absent lung markings peripheral to it. This indicates:



(A) Lobar consolidation

(B) Pneumothorax

(C) Pleural effusion

(D) Cardiomegaly

Q8. Blunting of the costophrenic angle with an upward-curving meniscus on an erect chest radiograph suggests:

(A) Pneumothorax

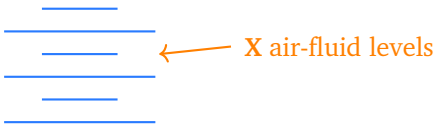
(B) Lobar collapse

(C) Pneumoperitoneum

(D) Pleural effusion

Gastrointestinal and Genitourinary Radiology

Q9. The erect abdominal radiograph below shows several centrally placed dilated bowel loops with multiple air-fluid levels in a step-ladder pattern (marked **X**). This indicates:



(A) Large-bowel volvulus

(B) A normal bowel gas pattern

(C) Small-bowel obstruction

(D) Free intraperitoneal air

Q10. Free gas seen under the diaphragm on an erect chest radiograph (pneumoperitoneum) most commonly indicates:

(A) Perforation of a hollow abdominal viscus

(B) Lobar pneumonia

(C) Congestive cardiac failure

(D) An isolated rib fracture

Q11. A grossly dilated, inverted-U ‘coffee-bean’ loop arising from the pelvis and pointing to the right upper quadrant on an abdominal radiograph is characteristic of:

(A) Small-bowel obstruction

(B) Caecal volvulus

(C) Sigmoid volvulus

(D) Toxic megacolon

Musculoskeletal and Neuroradiology

Q12. The first-line imaging investigation in a patient with a suspected acute stroke, performed before any thrombolysis to exclude haemorrhage, is:

(A) Contrast-enhanced MRI of the brain

(B) Carotid Doppler ultrasound

(C) Catheter cerebral angiography

(D) Non-contrast CT of the head

Q13. A biconvex (lens-shaped) hyperdense collection that does not cross the cranial suture lines, seen on a non-contrast CT of the head after trauma, indicates:

(A) Extradural (epidural) haematoma

(B) Subdural haematoma

(C) Subarachnoid haemorrhage

(D) An acute cerebral infarct

Interventional, Nuclear and Emergency Radiology

Q14. The Focused Assessment with Sonography for Trauma (FAST) scan is used in the emergency setting mainly to detect:

(A) Long-bone fractures

(B) Free intraperitoneal or pericardial fluid (blood)

(C) Pulmonary embolism

(D) Small-bowel obstruction

Q15. The radiotracer most commonly used in oncological PET imaging to identify metabolically active tumour tissue is:

(A) Technetium-99m pertechnetate

(B) Fluorine-18 fluorodeoxyglucose (FDG)

(C) Iodine-131

(D) Gadolinium chelate

Detailed Solutions

Q1.

Solution

Concept – how diagnostic X-rays are produced: X-rays are generated in the tube when accelerated electrons hit the anode target.

Step 1 – name the processes: Most X-rays come from **bremsstrahlung** (braking radiation) as electrons decelerate in the nuclear field, plus **characteristic X-rays** from inner-shell electron transitions.

Step 2 – the spectrum: Bremsstrahlung gives a continuous spectrum; characteristic radiation gives discrete peaks specific to the target (usually tungsten).

Why the other options are wrong:

- A, gamma decay: gamma rays arise from the nucleus, not from the X-ray tube.
- B, radio waves: are far lower-energy and not produced this way.
- D, visible light only: some light and heat are produced, but the diagnostic beam is X-rays.

Final Answer: Bremsstrahlung and characteristic X-rays $\Rightarrow$ C

Answer: (C) Go Back to Q1

Q2.

Solution

Concept – radiation dose units: Different quantities of radiation have distinct SI units.

Step 1 – name the absorbed-dose unit: The **Gray (Gy)** is the SI unit of *absorbed* dose (joules per kilogram of tissue).

Step 2 – contrast the others: The Sievert is the equivalent/effective dose, the Becquerel is radioactivity (decays per second), and the Roentgen is an old unit of exposure.

Why the other options are wrong:

- B, Sievert: measures biological (equivalent) dose, not absorbed dose.
- C, Becquerel: measures activity of a source.
- D, Roentgen: is a legacy exposure unit, not the SI absorbed-dose unit.

Final Answer: Gray (Gy) ⇒ A

Answer: (A) Go Back to Q2

Q3.

Solution

Concept – the ALARA principle: ALARA guides safe use of ionising radiation.

Step 1 – expand the acronym: ALARA means keeping doses **As Low As Reasonably Achievable**, considering economic and social factors.

Step 2 – how it is applied: Through the three pillars of time, distance and shielding, and by justifying every exposure.

Why the other options are wrong:

- A, at the legal maximum: the aim is to stay well below limits, not at them.
- B, as high as reasonably achievable: is the opposite of the principle.
- D, above background: is never a radiation-safety goal.

Final Answer: As Low As Reasonably Achievable ⇒ C

Answer: (C) Go Back to Q3

Q4.

Solution

Concept – the physical basis of MRI: MRI exploits nuclear magnetic resonance of abundant nuclei in the body.

Step 1 – name the nucleus: Images come mainly from **hydrogen nuclei (protons)** in the water and fat of tissues, which are plentiful and have a strong magnetic moment.

Step 2 – the mechanism: Protons align in the magnetic field, are excited by a radiofrequency pulse, and emit signals as they relax (T1 and T2).

Why the other options are wrong:

- B, carbon-14: is a radioactive tracer, not the MRI signal source.
- C, iodine: is used in CT and X-ray contrast, not MRI signal generation.
- D, electrons: MRI images nuclei, not free electrons.

Final Answer: Hydrogen nuclei (protons) ⇒ A

Answer: (A) Go Back to Q4

Q5.

Solution

Concept – the Hounsfield scale: CT densities are quantified relative to water and air.

Step 1 – read the scale: By definition, **water** is **0 HU** (marked **X**), air is -1000 HU and dense bone is about $+1000$ HU.

Step 2 – the use: Fat is negative (about -100 HU), and acute blood is high (about $+60$ to $+90$ HU), which helps characterise tissues.

Why the other options are wrong:

- A, -1000 HU: is air.
- C, $+1000$ HU: is cortical bone.
- D, $+100$ HU: is denser than water (for example contrast or bone edge).

Final Answer: 0 HU $\Rightarrow$ B

Answer: (B) Go Back to Q5

Q6.

Solution

Concept – gadolinium and the kidney: Gadolinium contrast carries a specific risk in renal impairment.

Step 1 – name the risk: In severe renal failure, gadolinium can trigger **nephrogenic systemic fibrosis**, a debilitating fibrosing disorder of skin and organs.

Step 2 – the precaution: The estimated GFR is checked before giving gadolinium, and macrocyclic agents or alternatives are used when it is low.

Why the other options are wrong:

- A, anaphylaxis alone: can occur with any contrast but is not the specific renal-failure risk.
- B, contrast-induced nephropathy: is linked to *iodinated* CT contrast, not gadolinium.
- C, thyroid storm: relates to iodinated contrast in hyperthyroidism.

Final Answer: Nephrogenic systemic fibrosis $\Rightarrow$ D

Answer: (D) Go Back to Q6

Q7.

Solution

Concept – radiographic signs of a pneumothorax: Air in the pleural space separates the lung from the chest wall.

Step 1 – read the film: A visible **visceral pleural white line** (X) with **no lung markings peripheral to it** is diagnostic of a pneumothorax.

Step 2 – look for tension: Mediastinal shift away from the side and a depressed hemidiaphragm suggest a tension pneumothorax needing urgent decompression.

Why the other options are wrong:

- A, consolidation: shows air bronchograms and opacity, not a peripheral lucent zone.
- C, pleural effusion: causes a dependent opacity with a meniscus, not absent peripheral markings.
- D, cardiomegaly: is an enlarged cardiac silhouette, unrelated to a pleural line.

Final Answer: Pneumothorax $\Rightarrow$ B

Answer: (B) Go Back to Q7

Q8.

Solution

Concept – radiographic signs of a pleural effusion: Fluid collects in the dependent pleural space.

Step 1 – read the film: Blunting of the costophrenic angle with an upward-curving **meniscus** indicates a pleural effusion.

Step 2 – the threshold: About 200 to 300 mL is needed to blunt the angle on an erect PA film; smaller effusions show on a lateral or decubitus view.

Why the other options are wrong:

- A, pneumothorax: gives a peripheral lucency, not a dependent meniscus.
- B, lobar collapse: shows volume loss and shift towards the opacity.
- C, pneumoperitoneum: is free air under the diaphragm, not a pleural meniscus.

Final Answer: Pleural effusion $\Rightarrow$ D

Answer: (D) Go Back to Q8

Q9.

Solution

Concept – small-bowel obstruction on plain film: Obstruction causes proximal bowel to dilate and fill with gas and fluid.

Step 1 – read the film: Central dilated loops with multiple **air-fluid levels** in a **step-ladder** pattern (**X**) and valvulae conniventes crossing the full width indicate small-bowel obstruction.

Step 2 – the distinction: Small-bowel loops are central with complete (coil-spring) mucosal folds; large-bowel loops are peripheral with incomplete haustra.

Why the other options are wrong:

- A, large-bowel volvulus: shows a peripheral dilated colonic loop, not central ladder loops.
- B, normal gas: has no dilated loops or fluid levels.
- D, free air: is lucency under the diaphragm, not dilated loops.

Final Answer: Small-bowel obstruction $\Rightarrow$ C

Answer: (C) Go Back to Q9

Q10.

Solution

Concept – pneumoperitoneum: Free intraperitoneal gas rises to lie under the diaphragm on an erect film.

Step 1 – interpret the sign: Free gas under the diaphragm most often means **perforation of a hollow viscus** (for example a perforated peptic ulcer).

Step 2 – the caveat: It can also follow recent abdominal surgery; correlate with the clinical picture.

Why the other options are wrong:

- B, pneumonia: causes lung opacity, not subdiaphragmatic gas.
- C, cardiac failure: causes pulmonary oedema, not free air.
- D, rib fracture: does not itself produce pneumoperitoneum.

Final Answer: Perforated hollow viscus ⇒ A

Answer: (A) Go Back to Q10

Q11.

Solution

Concept – sigmoid volvulus: The sigmoid colon twists on its mesentery, producing a characteristic loop.

Step 1 – read the film: A grossly dilated inverted-U '**coffee-bean**' loop arising from the pelvis and pointing to the right upper quadrant is classic for sigmoid volvulus.

Step 2 – management: Initial treatment is endoscopic (flatus tube) decompression, with surgery for failure or ischaemia.

Why the other options are wrong:

- A, small-bowel obstruction: gives central ladder loops, not a single pelvic loop.
- B, caecal volvulus: the dilated loop lies in the left upper quadrant, the reverse of sigmoid volvulus.
- D, toxic megacolon: shows a dilated, featureless transverse colon with mucosal oedema.

Final Answer: Sigmoid volvulus ⇒ C

Answer: (C) Go Back to Q11

Q12.

Solution

Concept – first imaging in acute stroke: Haemorrhage must be excluded before thrombolysis.

Step 1 – name the test: A **non-contrast CT of the head** is the first-line scan; it is fast and reliably detects acute haemorrhage.

Step 2 – why it matters: Thrombolysis is contraindicated in haemorrhagic stroke, so bleeding must be ruled out first; early ischaemia may show subtle signs.

Why the other options are wrong:

- A, contrast MRI: is more sensitive for early ischaemia but slower and not the

first step.

- B, carotid Doppler: assesses carotid stenosis later, not the acute decision.
- C, catheter angiography: is invasive and reserved for intervention, not first-line screening.

Final Answer: Non-contrast CT of the head $\Rightarrow$ D

Answer: (D) Go Back to Q12

Q13.

Solution

Concept – extradural (epidural) haematoma: Its shape and relation to sutures distinguish it on CT.

Step 1 – read the CT: A **biconvex (lens-shaped) hyperdense** collection that **does not cross suture lines** is an extradural haematoma, classically from a middle meningeal artery tear.

Step 2 – the clinical clue: A 'lucid interval' followed by rapid deterioration is characteristic; it is a neurosurgical emergency.

Why the other options are wrong:

- B, subdural haematoma: is crescent-shaped and *crosses* suture lines.
- C, subarachnoid haemorrhage: shows blood in the sulci and basal cisterns.
- D, cerebral infarct: is a hypodense (dark) region, not a hyperdense biconvex collection.

Final Answer: Extradural haematoma $\Rightarrow$ A

Answer: (A) Go Back to Q13

Q14.

Solution

Concept – the FAST scan: FAST is a rapid bedside ultrasound in trauma.

Step 1 – state its purpose: It looks for **free intraperitoneal or pericardial fluid** (blood) in the hepatorenal, splenorenal, pelvic and pericardial windows.

Step 2 – the value: A positive FAST in an unstable trauma patient prompts urgent laparotomy without delay for CT.

Why the other options are wrong:

- A, long-bone fractures: are assessed by plain radiographs.
- C, pulmonary embolism: is diagnosed by CT pulmonary angiography.
- D, bowel obstruction: is shown on plain films or CT, not the FAST windows.

Final Answer: Free intraperitoneal or pericardial fluid $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – the PET tracer: Positron emission tomography maps metabolic activity.

Step 1 – name the tracer: Fluorine-18 fluorodeoxyglucose (FDG) is the commonest oncological PET tracer, taken up by metabolically active (glucose-avid) tumour cells.

Step 2 – the principle: FDG is trapped after phosphorylation, so avid uptake highlights tumour, and PET is fused with CT for localisation.

Why the other options are wrong:

- A, technetium-99m: is used in conventional gamma-camera (SPECT) scans, not PET.
- C, iodine-131: is used for thyroid imaging and therapy, not routine oncological PET.
- D, gadolinium: is an MRI contrast agent, not a PET tracer.

Final Answer: Fluorine-18 FDG $\Rightarrow$ B

Answer: (B) Go Back to Q15

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	C	2	A	3	C	4	A	5	B
6	D	7	B	8	D	9	C	10	A
11	C	12	D	13	A	14	B	15	B