INI CET Radiology

Sample Paper – 3

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. The SI unit of radioactivity, which quantifies the activity of a source and has replaced the older Curie (Ci), is the:

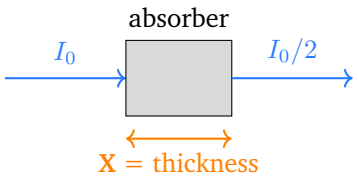
(A) Becquerel (Bq), equal to one disintegration per second

(B) Gray (Gy)

(C) Sievert (Sv)

(D) Roentgen (R)

Q2. In the beam-attenuation diagram below, the thickness of absorber that reduces the X-ray beam intensity to one half of its original value (marked **X**) is called the:



(A) Focal-spot size

(B) The inherent filtration limit

(C) Half-value layer (HVL)

(D) Tenth-value layer

Q3. Compared with a single posteroanterior chest radiograph (effective dose about 0.02 mSv), the effective dose delivered by a CT scan of the abdomen (about 8 to 10 mSv) is approximately:

(A) About the same

(B) Roughly one-tenth as much

(C) Slightly lower

(D) Several hundred times higher

Imaging Modalities and Contrast Media

Q4. Doppler ultrasound is able to assess blood flow within a vessel by detecting:

(A) The temperature of the flowing blood

(B) The absorption of X-rays by red cells

(C) Magnetic alignment of protons in the plasma

(D) The frequency shift of echoes reflected from moving red blood cells

Q5. When perforation of the gastrointestinal tract is suspected, the contrast agent of choice for a luminal study is:

(A) High-density barium sulphate suspension

(B) A gadolinium chelate

(C) Water-soluble iodinated contrast (gastrografin)

(D) Intravenous iodinated contrast alone

Q6. In computed tomography (CT), the cross-sectional image is reconstructed from:

(A) X-ray attenuation measured by detectors as the tube rotates around the patient

(B) Radiofrequency signals emitted by excited protons

(C) Reflected high-frequency sound waves

(D) Gamma rays emitted by an injected radiotracer

Chest and Cardiovascular Radiology

Q7. A chest radiograph showing innumerable tiny (1 to 3 mm), uniformly sized nodules distributed evenly throughout both lungs (a 'miliary' pattern) is most characteristic of:

(A) Miliary tuberculosis

(B) A single lobar pneumonia

(C) An isolated lung abscess

(D) A large unilateral pleural effusion

Q8. A hypertensive patient presents with sudden tearing chest pain and a widened mediastinum on the chest radiograph. The investigation of choice to confirm a suspected acute aortic dissection is:

(A) A plain abdominal radiograph

(B) CT angiography of the aorta

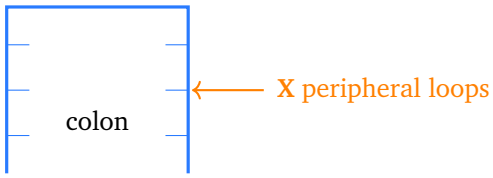
(C) A barium swallow

(D) A ventilation-perfusion lung scan

Gastrointestinal and Genitourinary Radiology

Q9. The abdominal radiograph below shows peripherally placed dilated loops carrying haustral folds that do not cross the full width of the lumen

(marked **X**). With a competent ileocaecal valve preventing decompression, this appearance indicates:



(A) Small-bowel obstruction

(B) A normal bowel gas pattern

(C) Free intraperitoneal air

(D) Large-bowel obstruction

Q10. On ultrasound of the right upper quadrant, the combination of gallstones, a thickened gallbladder wall (greater than 3 mm) and a positive sonographic Murphy sign indicates:

(A) Hepatic cirrhosis

(B) Acute cholecystitis

(C) A simple hepatic cyst

(D) Acute pancreatitis

Q11. Ultrasound of the kidney shows dilatation of the renal pelvis and calyces (hydronephrosis) with an echogenic focus casting an acoustic shadow at the pelvi-ureteric junction. This appearance indicates:

(A) A completely normal kidney

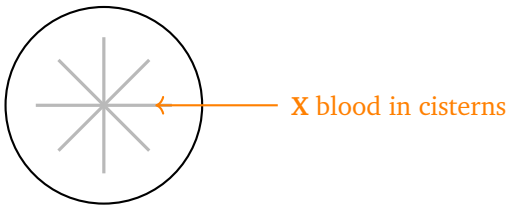
(B) An obstructing renal calculus with hydronephrosis

(C) A simple renal cyst

(D) Chronic pyelonephritic scarring

Musculoskeletal and Neuroradiology

Q12. The non-contrast CT of the head sketched below shows hyperdense (white) blood filling the basal cisterns and sulci in a star-shaped pattern (marked **X**). This indicates:



(A) An extradural haematoma

(B) An acute cerebral infarct

(C) Subarachnoid haemorrhage

(D) A subdural haematoma

Q13. A young adult falls on an outstretched hand and has tenderness localised to the anatomical snuffbox. The bone most likely to be fractured, and whose proximal pole is at particular risk of avascular necrosis, is the:

(A) Distal radius

(B) Lunate

(C) Scaphoid

(D) Fifth metacarpal

Interventional, Nuclear and Emergency Radiology

Q14. In a patient with active gastrointestinal or pelvic arterial bleeding, the interventional technique that both localises the bleeding point and allows treatment by occluding the culprit vessel is:

(A) Plain radiography

(B) Digital subtraction angiography (DSA) with embolisation

(C) A barium enema

(D) An oncological PET scan

Q15. The nuclear medicine renal scan that best demonstrates cortical scarring, for example after childhood pyelonephritis, is the:

(A) DMSA (dimercaptosuccinic acid) static cortical scan

(B) DTPA dynamic scan, which shows drainage only

(C) MAG3 dynamic scan, which shows split function only

(D) A technetium bone scan

Detailed Solutions

Q1.

Solution

Concept – the unit of radioactivity: Radioactivity describes how many nuclei in a source decay per unit time.

Step 1 – name the SI unit: The **Becquerel (Bq)** is the SI unit of activity, defined as **one disintegration per second**.

Step 2 – the older unit: The historical unit was the **Curie (Ci)**, where 1 Ci equals 3.7×10^{10} Bq (the activity of one gram of radium).

Why the other options are wrong:

- B, Gray: measures absorbed dose (joules per kilogram), not activity.
- C, Sievert: measures equivalent or effective (biological) dose.
- D, Roentgen: is a legacy unit of exposure in air.

Final Answer: Becquerel (Bq) $\Rightarrow$ A

Answer: (A) Go Back to Q1

Q2.

Solution

Concept – the half-value layer: As an X-ray beam passes through matter its intensity falls exponentially.

Step 1 – define the quantity: The **half-value layer (HVL)** is the thickness of a stated absorber (marked **X**) that reduces the beam intensity to **one half** of its original value.

Step 2 – link to filtration and quality: A thicker HVL means a more penetrating (higher-quality) beam. Added filtration removes soft, low-energy photons, hardens the beam and lowers patient skin dose.

Why the other options are wrong:

- A, focal-spot size: relates to geometric sharpness, not attenuation.
- B, inherent filtration limit: describes filtration within the tube, not a halving thickness.
- D, tenth-value layer: reduces intensity to one tenth, not one half.

Final Answer: Half-value layer (HVL) $\Rightarrow$ C

Answer: (C) Go Back to Q2

Q3.

Solution

Concept – comparing radiation doses: Different investigations deliver very different effective doses.

Step 1 – compare the two: A chest radiograph gives about **0.02 mSv**, whereas a CT of the abdomen gives about **8 to 10 mSv**.

Step 2 – the ratio: Dividing 10 by 0.02 gives roughly **500**, so an abdominal CT delivers **several hundred times** the dose of a single chest film.

Why the other options are wrong:

- A, about the same: a CT delivers far more dose than a plain film.
- B, one-tenth as much: reverses the true relationship.
- C, slightly lower: is wrong; CT dose is much higher.

Final Answer: Several hundred times higher $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q3

Q4.

Solution

Concept – the Doppler principle: Doppler ultrasound turns motion into a measurable signal.

Step 1 – state the principle: Sound reflected from **moving red blood cells** returns at a shifted frequency; this **Doppler frequency shift** is proportional to the flow velocity.

Step 2 – the clinical use: It shows the direction and speed of vascular flow, detecting stenoses, thrombosis and abnormal waveforms in arteries and veins.

Why the other options are wrong:

- A, temperature: ultrasound does not measure blood temperature.
- B, X-ray absorption: no ionising radiation is involved in ultrasound.
- C, magnetic alignment: that is the basis of MRI, not Doppler.

Final Answer: Frequency shift of echoes from moving red cells $\Rightarrow$ $\boxed{\text{D}}$

Answer: (D) Go Back to Q4

Q5.

Solution

Concept – contrast choice when perforation is suspected: The safety of the agent, should it leak, decides the choice.

Step 1 – choose the agent: When perforation is suspected the agent of choice is **water-soluble iodinated contrast (gastrografin)**, which is readily absorbed and cleared if it enters the peritoneum.

Step 2 – why not barium: Barium leaking into the peritoneal cavity provokes a severe, long-lasting **barium peritonitis** and adhesions, so it is avoided when a leak is possible.

Why the other options are wrong:

- A, barium sulphate: is contraindicated if perforation is suspected.
- B, gadolinium: is an MRI agent, not a luminal GI contrast.
- D, intravenous contrast alone: opacifies vessels, not the bowel lumen for a leak study.

Final Answer: Water-soluble iodinated contrast (gastrografin) $\Rightarrow$ C

Answer: (C) Go Back to Q5

Q6.

Solution

Concept – the physics of CT: CT builds a slice from many angular X-ray measurements.

Step 1 – state the mechanism: The X-ray **tube rotates** around the patient while opposing **detectors** record the **attenuation** of the beam along thousands of paths.

Step 2 – reconstruction: A computer applies filtered back-projection or iterative reconstruction to these attenuation profiles to build the cross-sectional image, expressed in Hounsfield units.

Why the other options are wrong:

- B, radiofrequency signals: describe MRI, not CT.
- C, reflected sound: describes ultrasound.
- D, emitted gamma rays: describe nuclear medicine (PET/SPECT).

Final Answer: Rotating-tube X-ray attenuation measured by detectors $\Rightarrow$ A

Answer: (A) Go Back to Q6

Q7.

Solution

Concept – the miliary pattern: Countless tiny nodules of uniform size scattered through both lungs define a miliary pattern.

Step 1 – read the film: Innumerable **1 to 3 mm**, uniformly distributed nodules throughout both lung fields are the hallmark of **miliary tuberculosis**, from haematogenous spread of infection.

Step 2 – confirm and treat: It is confirmed by sputum, culture or biopsy and treated with a full course of antitubercular therapy.

Why the other options are wrong:

- B, lobar pneumonia: gives a focal segmental or lobar opacity, not diffuse micronodules.
- C, lung abscess: is a single cavity, often with an air-fluid level.
- D, pleural effusion: is a dependent opacity, not a nodular pattern.

Final Answer: Miliary tuberculosis $\Rightarrow$ A

Answer: (A) Go Back to Q7

Q8.

Solution

Concept – imaging a suspected aortic dissection: A widened mediastinum with tearing chest pain raises concern for dissection.

Step 1 – choose the test: CT angiography of the aorta is the investigation of choice; it is fast, widely available and directly shows the intimal flap and the true and false lumens.

Step 2 – classify and plan: It defines the Stanford type (A or B), guiding urgent surgery for ascending (type A) disease versus medical management for type B.

Why the other options are wrong:

- A, abdominal radiograph: cannot assess the thoracic aorta or a flap.
- C, barium swallow: images the oesophagus, not the aorta.
- D, VQ scan: is for pulmonary embolism, not dissection.

Final Answer: CT angiography of the aorta ⇒ B

Answer: (B) Go Back to Q8

Q9.

Solution

Concept – large-bowel obstruction on plain film: Colonic obstruction dilates the large bowel peripherally.

Step 1 – read the film: Peripheral dilated loops with **haustra** that do not cross the full lumen (**X**) indicate **large-bowel obstruction**.

Step 2 – the valve matters: With a **competent** ileocaecal valve the colon cannot decompress backward into the small bowel, so it distends and the caecum is at risk of perforation; an **incompetent** valve lets small bowel dilate too, mimicking a small-bowel pattern.

Why the other options are wrong:

- A, small-bowel obstruction: gives central loops with valvulae conniventes crossing the full width.
- B, normal gas: shows no dilated loops.
- C, free air: is lucency under the diaphragm, not dilated loops.

Final Answer: Large-bowel obstruction ⇒ D

Answer: (D) Go Back to Q9

Q10.

Solution

Concept – ultrasound of acute cholecystitis: Ultrasound is the first-line test for gallbladder inflammation.

Step 1 – read the scan: Gallstones, a **thick-walled gallbladder** (greater than 3 mm) and a **positive sonographic Murphy sign** (maximal tenderness under the probe over the gallbladder) together indicate **acute cholecystitis**.

Step 2 – supporting signs: Pericholecystic fluid and gallbladder distension add weight; HIDA scanning is reserved for equivocal cases.

Why the other options are wrong:

- A, cirrhosis: gives a nodular, shrunken liver, not these gallbladder signs.

- C, simple hepatic cyst: is an anechoic lesion in the liver, not a thick-walled gallbladder.
- D, acute pancreatitis: shows a bulky, hypoechoic pancreas, not these gallbladder features.

Final Answer: Acute cholecystitis $\Rightarrow$ B

Answer: (B) Go Back to Q10

Q11.

Solution

Concept – hydronephrosis with an obstructing stone: An obstructing calculus backs urine up into the collecting system.

Step 1 – read the scan: Dilated renal pelvis and calyces (**hydronephrosis**) with an **echogenic focus casting an acoustic shadow** at the pelvi-ureteric junction indicate an **obstructing renal calculus with hydronephrosis**.

Step 2 – confirm and act: A non-contrast CT of the kidneys, ureters and bladder confirms and sizes the stone; management depends on stone size and the degree of obstruction.

Why the other options are wrong:

- A, normal kidney: would show no pelvicalyceal dilatation or shadowing stone.
- C, simple cyst: is an anechoic lesion without collecting-system dilatation.
- D, chronic pyelonephritis: causes cortical scarring and a small kidney, not an obstructing stone.

Final Answer: Obstructing renal calculus with hydronephrosis $\Rightarrow$ B

Answer: (B) Go Back to Q11

Q12.

Solution

Concept – subarachnoid haemorrhage on CT: Fresh blood in the cerebrospinal fluid spaces is hyperdense on CT.

Step 1 – read the CT: Hyperdense (white) blood filling the **basal cisterns and sulci** in a star-shaped pattern (**X**) is the classic sign of **subarachnoid haemorrhage**, most often from a ruptured berry aneurysm.

Step 2 – the next steps: If the CT is negative but suspicion remains, lumbar puncture shows xanthochromia; CT or catheter angiography then identifies the aneurysm for treatment.

Why the other options are wrong:

- A, extradural haematoma: is a biconvex clot that does not cross sutures.
- B, cerebral infarct: is a hypodense (dark) region, not hyperdense cisternal blood.
- D, subdural haematoma: is a crescentic collection along the convexity.

Final Answer: Subarachnoid haemorrhage ⇒ C

Answer: (C) Go Back to Q12

Q13.

Solution

Concept – scaphoid fracture: A fall on an outstretched hand with snuffbox tenderness suggests a scaphoid injury.

Step 1 – name the bone: Tenderness in the **anatomical snuffbox** points to a fracture of the **scaphoid**, the most commonly fractured carpal bone.

Step 2 – the avascular-necrosis risk: Its blood supply enters distally and runs **retrograde**, so a fracture at the waist or proximal pole may cut off supply to the proximal fragment, risking **avascular necrosis** and non-union. An initially normal X-ray does not exclude it; immobilise and re-image or use MRI.

Why the other options are wrong:

- A, distal radius: fractures cause dorsal wrist tenderness, not snuffbox tenderness.
- B, lunate: dislocation gives central wrist signs, not the classic snuffbox picture.
- D, fifth metacarpal: (boxer's) fractures follow a punch, with hand rather than snuffbox tenderness.

Final Answer: Scaphoid ⇒ C

Answer: (C) Go Back to Q13

Q14.

Solution

Concept – angiography and embolisation: Catheter angiography can both find and treat arterial bleeding.

Step 1 – name the technique: Digital subtraction angiography (DSA) removes overlying bone and soft tissue to display the vessels, localising active contrast extravasation at the bleeding point.

Step 2 – the treatment: Through the same catheter the operator performs **embolisation** (with coils, particles or glue) to occlude the culprit vessel and stop the haemorrhage, avoiding open surgery.

Why the other options are wrong:

- A, plain radiography: cannot localise or treat an arterial bleed.
- C, barium enema: is a luminal GI study, not a vascular intervention.
- D, PET scan: images metabolism, not acute bleeding.

Final Answer: DSA with embolisation $\Rightarrow$ B

Answer: (B) Go Back to Q14

Q15.

Solution

Concept – renal nuclear scans: Different tracers answer different renal questions.

Step 1 – choose the tracer: DMSA is taken up and retained by functioning proximal tubular cells, giving a static cortical map that best shows **cortical scarring** and differential (split) cortical function.

Step 2 – contrast the dynamic agents: DTPA and **MAG3** are dynamic tracers that assess **perfusion, drainage and obstruction** (for example a PUJ obstruction), not fine cortical scarring.

Why the other options are wrong:

- B, DTPA: is a dynamic drainage study, poor for detecting scars.
- C, MAG3: is dynamic; it gives split function and drainage, not the best scar detail.
- D, bone scan: images the skeleton, not renal cortical scarring.

Final Answer: DMSA static cortical scan $\Rightarrow$ A

Answer: (A) Go Back to Q15

Answer Key

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