



# CT ARRT

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## Practice Questions

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### 1. Which lobe of the brain is located in the most anterior portion of the cranium?

- A. Frontal lobe
- B. Parietal lobe
- C. Occipital lobe
- D. Temporal lobe

### 2. What is the primary purpose of iodinated contrast media in CT imaging?

- A. To increase the attenuation of vascular and soft-tissue structures
- B. To decrease radiation dose to the patient
- C. To improve spatial resolution of the image
- D. To reduce image noise

### 3. Which of the following contrast agents is classified as a non-ionic iso-osmolar dimer?

- A. Diatrizoate
- B. Ioxaglate
- C. Iohexol
- D. Iodixanol

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### 4. What does the term 'pitch' refer to in helical CT scanning?

- A. The angle of the X-ray tube relative to the isocenter
- B. The distance the table travels per gantry rotation divided by beam width
- C. The number of detector rows activated during a scan
- D. The rate at which image reconstruction occurs



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**5. Which component of a CT scanner converts X-ray photons into an electrical signal?**

- A. Detector
- B. X-ray tube
- C. Collimator
- D. Gantry

**6. Before performing a CT scan, which TWO identifiers should be used to confirm patient identity per Joint Commission standards?**

- A. Patient name and date of birth
- B. Patient name and room number
- C. Room number and date of birth
- D. Insurance ID and room number

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**7. What is the primary interaction responsible for producing the continuous X-ray spectrum (Bremsstrahlung)?**

- A. Characteristic emission from inner-shell electrons
- B. Photoelectric absorption of photons in the target
- C. Deceleration of electrons in the Coulomb field of the target nucleus
- D. Compton scattering of electrons within the anode

**8. Which landmark is used to position the gantry for a routine axial head CT?**

- A. Orbitomeatal line (OML)
- B. Infraorbitomeatal line (IOML)
- C. Glabellomeatal line
- D. Mentomeatal line

**9. Which unit is used to express the absorbed dose of ionizing radiation in SI units?**

- A. Roentgen (R)
- B. Gray (Gy)
- C. Rem (rem)
- D. Curie (Ci)

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**10. The primary visual cortex is located in which lobe of the cerebrum?**

- A. Frontal lobe
- B. Temporal lobe
- C. Occipital lobe
- D. Parietal lobe

**11. Which element is responsible for the X-ray attenuation properties of conventional CT contrast agents?**

- A. Barium
- B. Iodine
- C. Gadolinium
- D. Manganese

**12. What is the relationship between slice thickness and spatial resolution along the z-axis (longitudinal resolution) in CT?**

- A. Thicker slices provide better z-axis resolution
- B. Slice thickness has no effect on z-axis resolution
- C. Z-axis resolution depends only on detector size, not slice thickness
- D. Thinner slices provide better z-axis resolution

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**13. What is the primary function of the pre-patient collimator in a CT scanner?**

- A. Amplify the X-ray beam
- B. Convert X-rays to visible light
- C. Define the width of the X-ray beam
- D. Filter scattered radiation after the patient

**14. A patient arrives without a wristband. The technologist should:**

- A. Proceed with the scan using verbal confirmation only
- B. Ask a family member to confirm the patient's identity
- C. Obtain a wristband from nursing before scanning
- D. Check the requisition and proceed immediately



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**15. Which target material property most directly determines the energy of characteristic X-rays produced in the CT tube?**

- A. Atomic mass of the target element
- B. Atomic number (Z) of the target element
- C. Melting point of the target material
- D. Thickness of the focal spot track

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**16. For a routine non-contrast head CT, the patient is typically positioned:**

- A. Prone with head extended
- B. Lateral decubitus
- C. Supine with chin tucked
- D. Prone with chin tucked

**17. Which SI unit is used to express effective dose, accounting for the biological effectiveness of different radiation types?**

- A. Gray (Gy)
- B. Becquerel (Bq)
- C. Sievert (Sv)
- D. Coulomb per kilogram (C/kg)

**18. The third ventricle communicates with the lateral ventricles through which structure?**

- A. Cerebral aqueduct
- B. Foramen of Monro
- C. Foramen of Luschka
- D. Foramen of Magendie

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**19. Ionic high-osmolality contrast media typically have an osmolality of approximately:**

- A. 290 mOsm/kg (isotonic)
- B. 500–600 mOsm/kg
- C. 1400–1800 mOsm/kg
- D. 2800–3200 mOsm/kg



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**20. What reconstruction algorithm is most commonly used in clinical CT to convert raw data into images?**

- A. Fourier slice theorem direct inversion
- B. Filtered back-projection (FBP)
- C. Maximum likelihood expectation maximization
- D. Compressed sensing reconstruction

**21. In a third-generation CT scanner, how do the X-ray tube and detector array move?**

- A. Tube rotates; detectors are stationary
- B. Tube and detectors both rotate together around the patient
- C. Detectors rotate; tube is stationary
- D. Both tube and detectors translate linearly

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**22. Informed consent for a contrast-enhanced CT study must include which element?**

- A. The patient's insurance coverage details
- B. A description of the risks, benefits, and alternatives to the procedure
- C. The radiologist's fee schedule
- D. The specific brand of contrast agent to be used

**23. Increasing the X-ray tube kilovoltage (kVp) primarily affects which beam property?**

- A. Maximum energy (penetrating power) of the beam
- B. Total number of photons produced without changing energy
- C. Filament temperature in the cathode
- D. Heel effect magnitude along the anode-cathode axis

**24. For CT of the lumbar spine, images are typically obtained:**

- A. Parallel to the long axis of the spine
- B. Parallel to the disc spaces (angled to each disc)
- C. Perpendicular to the lumbar lordosis
- D. In the prone position only

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**25. The traditional (non-SI) unit of absorbed dose is:**

- A. Rad
- B. Rem
- C. Roentgen
- D. Curie

**26. Which structure connects the third ventricle to the fourth ventricle?**

- A. Foramen of Monro
- B. Foramen of Luschka
- C. Foramen of Magendie
- D. Cerebral aqueduct of Sylvius

**27. Non-ionic contrast media have lower adverse-reaction rates than ionic agents primarily because they:**

- A. Do not dissociate into charged particles in solution
- B. Contain fewer iodine atoms per molecule
- C. Are administered at lower injection rates
- D. Are exclusively iso-osmolar

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**28. What is the primary advantage of iterative reconstruction (IR) algorithms over filtered back-projection (FBP) in CT?**

- A. Faster image reconstruction compared to FBP
- B. Ability to reduce image noise at the same dose level, allowing dose reduction
- C. Improved enhancement of bone detail compared to FBP
- D. Elimination of beam hardening artifacts without additional processing

**29. Which material is most commonly used as the anode target in modern CT X-ray tubes?**

- A. Copper
- B. Molybdenum
- C. Rhodium
- D. Tungsten



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**30. A patient states they do not understand what they are signing for contrast. The technologist should:**

- A. Have the patient sign anyway and document their confusion
- B. Obtain a translator device and proceed without further delay
- C. Skip the consent form since CT is non-invasive
- D. Explain the procedure and notify the radiologist if the patient still refuses



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## Answer Key & Explanations

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### 1. A — Frontal lobe

The frontal lobe occupies the anterior cranial fossa and is the most anteriorly positioned cerebral lobe, lying anterior to the central sulcus.

### 2. A — To increase the attenuation of vascular and soft-tissue structures

Iodinated contrast media contain iodine atoms that attenuate X-rays more strongly than surrounding tissue, increasing the Hounsfield unit values of enhanced structures and improving conspicuity. They do not alter dose, resolution, or noise in the traditional sense.

### 3. D — Iodixanol

Iodixanol is a non-ionic dimer with an osmolality of approximately 290 mOsm/kg, matching blood plasma (iso-osmolar). Iohexol is a non-ionic low-osmolality monomer; ioxaglate is an ionic low-osmolality dimer; diatrizoate is an ionic high-osmolality monomer.

### 4. B — The distance the table travels per gantry rotation divided by beam width

Pitch = table distance per rotation ÷ nominal beam width (or detector row width × number of rows). A pitch of 1.0 means the table advances exactly one beam width per rotation, while values >1 indicate gaps and values <1 indicate overlap.

### 5. A — Detector

Detectors (typically solid-state or gas-filled ionization chambers) absorb X-ray photons and convert them into electrical signals that are then digitized. The X-ray tube produces the beam; the collimator shapes it; the gantry is the rotating housing.

### 6. A — Patient name and date of birth

The Joint Commission requires at least two patient identifiers before any procedure; acceptable identifiers include name, date of birth, and medical record number — but NOT room or bed number.

### 7. C — Deceleration of electrons in the Coulomb field of the target nucleus

Bremsstrahlung ('braking radiation') occurs when a high-speed electron decelerates as it passes near a target nucleus; kinetic energy is converted directly into X-ray photons. Characteristic radiation arises from inner-shell transitions, not the continuous spectrum.

### 8. A — Orbitomeatal line (OML)

The orbitomeatal line (OML), extending from the outer canthus of the eye to the EAM, is the standard baseline for routine axial head CT positioning to maintain reproducibility.

### 9. B — Gray (Gy)

The Gray (Gy) is the SI unit of absorbed dose, equal to 1 joule of energy deposited per kilogram of tissue. The Roentgen measures exposure in air, and the rem/sievert measure effective dose.



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**10. C — Occipital lobe**

The primary visual cortex (V1) resides in the occipital lobe, specifically along the calcarine sulcus, and processes visual input from the retinas.

**11. B — Iodine**

Iodine (atomic number 53) has a K-edge at 33.2 keV that falls within the diagnostic X-ray spectrum, making iodinated compounds highly effective attenuators. Gadolinium is used for MRI; barium is used for GI fluoroscopy.

**12. D — Thinner slices provide better z-axis resolution**

Thinner slices sample the patient more finely along the z-axis, improving longitudinal (z-axis) spatial resolution and enabling higher-quality multiplanar reformations. Thicker slices improve noise and dose efficiency but sacrifice z-resolution.

**13. C — Define the width of the X-ray beam**

The pre-patient collimator shapes and restricts the X-ray beam to the desired slice thickness or width before it reaches the patient, reducing patient dose and controlling the irradiated volume.

**14. C — Obtain a wristband from nursing before scanning**

A wristband is the standard physical identifier for inpatients; the technologist must obtain one before scanning to comply with patient safety protocols and prevent wrong-patient errors.

**15. B — Atomic number (Z) of the target element**

Characteristic X-ray energies are determined by the binding energies of electron shells, which are fixed by the atomic number Z of the element. Tungsten (Z=74) is the standard CT anode material, producing K-characteristic photons at ~59 keV and ~67 keV.

**16. C — Supine with chin tucked**

The supine position with slight chin tuck aligns the orbitomeatal line perpendicular to the table, reducing radiation dose to the eyes and providing standard anatomic orientation.

**17. C — Sievert (Sv)**

The Sievert (Sv) is the SI unit of effective dose, which accounts for both absorbed dose and the radiation weighting factor. It replaces the older rem (1 Sv = 100 rem).

**18. B — Foramen of Monro**

The paired foramina of Monro (interventricular foramina) connect each lateral ventricle to the midline third ventricle, allowing CSF to flow between them.

**19. C — 1400–1800 mOsm/kg**

First-generation ionic monomers (e.g., diatrizoate) have osmolalities around 1400–1800 mOsm/kg — roughly five to seven times that of blood plasma. This high osmolality accounts for many of their adverse physiological effects.

**20. B — Filtered back-projection (FBP)**

Filtered back-projection is the traditional and most widely used clinical CT reconstruction algorithm. It applies a ramp filter to raw projection data and then back-projects filtered data to form the image.

**21. B — Tube and detectors both rotate together around the patient**

Third-generation (rotate-rotate) scanners have the tube and a curved detector array rigidly coupled and



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rotating together around the patient, which is the standard design in modern CT.

**22. B — A description of the risks, benefits, and alternatives to the procedure**

Informed consent requires that patients be told about the nature of the procedure, its benefits, its material risks (including contrast reactions), and available alternatives so they can make a voluntary, informed decision.

**23. A — Maximum energy (penetrating power) of the beam**

kVp sets the peak accelerating potential, which equals the maximum photon energy in keV. Higher kVp shifts the spectrum to higher energies and increases beam penetration. mA controls photon quantity; kVp controls maximum photon energy.

**24. B — Parallel to the disc spaces (angled to each disc)**

Angulating the scan plane parallel to each disc space ensures true axial cross-sections through the intervertebral disc and neural foramina, improving detection of disc herniations.

**25. A — Rad**

The rad (radiation absorbed dose) is the traditional unit of absorbed dose, equal to 0.01 Gy. The rem is the traditional effective dose unit, and the Roentgen measures exposure in air.

**26. D — Cerebral aqueduct of Sylvius**

The cerebral aqueduct (aqueduct of Sylvius) is a narrow channel through the midbrain that connects the third and fourth ventricles.

**27. A — Do not dissociate into charged particles in solution**

Non-ionic agents do not ionize in solution, so they do not carry electrical charge. This reduces interactions with plasma proteins, cell membranes, and enzymes, resulting in lower chemotoxicity and fewer adverse reactions. Osmolality is also lower but is a separate factor.

**28. B — Ability to reduce image noise at the same dose level, allowing dose reduction**

Iterative reconstruction algorithms compare estimated projections with measured data repeatedly, suppressing noise and artifacts more effectively than FBP. This allows dose reduction while maintaining acceptable image quality.

**29. D — Tungsten**

Tungsten is used because of its high atomic number (74), high melting point (~3422 °C), and excellent X-ray production efficiency, making it ideal for CT tube anodes that endure high heat loads.

**30. D — Explain the procedure and notify the radiologist if the patient still refuses**

Consent must be truly informed and voluntary; the technologist should provide a clear explanation, use interpreter services if needed, and escalate to the radiologist if the patient withholds or is unable to provide consent.



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