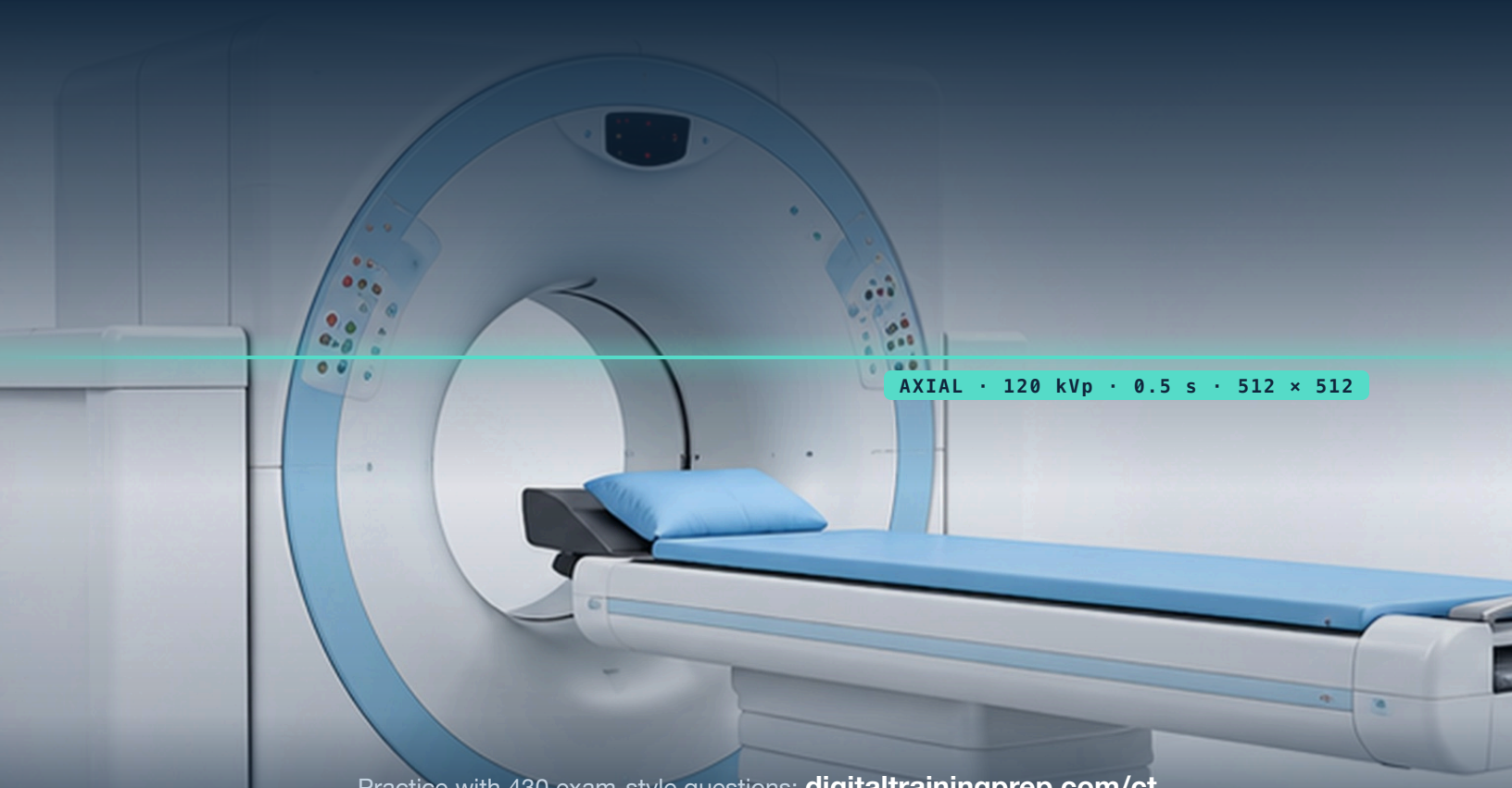
Digital Training Courses

ARRT® COMPUTED TOMOGRAPHY · 2026 CONTENT SPECIFICATIONS

CT Registry Study Guide

The short, essential review for the ARRT® CT exam: what to know, the numbers to memorize, and how to prepare.

165 scored items | Patient Care · Safety · Image Production · Procedures | Formulas & numbers | 20-question quiz | Abbreviations



Practice with 430 exam-style questions: **digitaltrainingprep.com/ct**

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Version 1.1

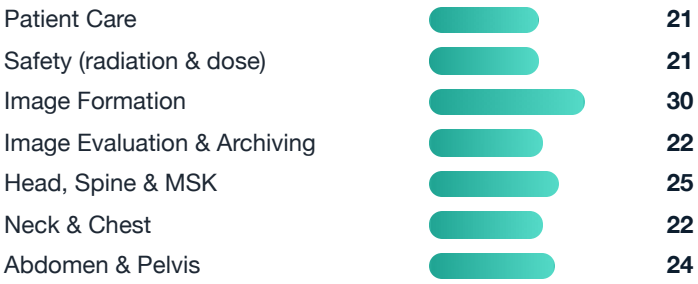
1. The exam and how to prepare

Spend your hours where the points are. Procedures and Image Production make up three quarters of the score.

Exam at a glance

- **195 items**: 165 scored + 30 unscored pilot items. You cannot tell them apart, so treat every item as scored.
- Computer-based at a Pearson VUE center; 195 minutes of test time; the appointment is 3 h 35 min with tutorial and survey.
- Three attempts, within three years of your first exam window.
- Scaled score from 1 to 99; **75 is passing**. A 75 is not 75% correct.
- A new passing standard applies from September 1, 2026; the scale and the 75 cut score are unchanged.
- No penalty for guessing: answer every item and flag the hard ones for review.
- Dose questions use **SI units**: mGy, mGy·cm, mSv.

Scored items by section



Source: ARRT Examination Content Specifications, Computed Tomography (board approved July 2025).

Eligibility (postprimary pathway)

- Hold a current ARRT credential in a supporting discipline (most often R.T.(R)); R.T.(T), R.T.(N) and NMTCB holders also qualify.
- **Structured education:** 16 credits, with at least one in each content category, completed within 24 months before you apply.
- **Clinical experience:** pick at least **25 different procedures** from the list of 67; perform each **3 to 5 times**, for at least **125 repetitions**.
- At least **30 repetitions with iodinated IV contrast**.
- One procedure per patient per day; up to 9 entries per day.
- A certified technologist or interpreting physician verifies each entry.
- Scans for PET/SPECT attenuation correction or radiation therapy planning do not count, and neither does remote scanning.

Check the current ARRT Clinical Experience Requirements, Structured Education Requirements and Postprimary Handbook at arrt.org before you apply.

An 8-week plan (about 8–10 hours a week)

Week	Focus	Do this
1	Baseline	Take a 50-question mixed test cold. Note your two weakest sections. Read sections 1–2 of this guide.
2	Patient Care	Lab values, contrast, injection and reactions. 40 questions a day, then reread every explanation.
3	Safety	Dose indices, formulas, dose reduction. Write the formula page from memory twice.
4	Image Formation	Parameters, acquisition, reconstruction, post-processing.
5	Image Evaluation	Windows, HU, resolution, QC, artifacts, informatics.
6	Head, Spine, MSK	Protocols, landmarks, pathology; scroll real cases in all three planes.
7	Neck, Chest, Abd/Pelvis	Phase timing, CTA, cardiac, multiphase organs.
8	Exam mode	Two full timed mocks (165 items each). Review every miss and drill the weak topics. Use the final-week checklist.

Rule of thumb: you are ready when you score 80% or higher on two fresh, timed, mixed mocks in a row.

2. Patient Care

21 items

Screening, labs, contrast, injection technique, reactions and aftercare.

Before the scan

- Use **two identifiers**: full name plus date of birth or record number.
- Do a **time-out** before every invasive procedure: right patient, procedure and site.
- **Informed consent** is obtained by the physician performing the procedure. The technologist may witness it. Implied consent applies in emergencies.
- Screen for allergies, prior contrast reactions, renal disease, metformin, pregnancy, breastfeeding, thyroid disease and planned radioiodine.
- Remove radiopaque objects from the scan range. Check implanted devices (pacemaker, insulin pump, neurostimulator) and avoid scanning over a pump where possible.
- Use positioning aids (straps, sponges) for comfort and immobilization, sliding boards for transfers, and good body mechanics.
- Infection control: hand hygiene and Standard Precautions; clean the table and wedges between patients.

Lab values

Test	Typical adult range	Why it matters
eGFR	> 60 mL/min/1.73 m²	Contrast risk mainly at < 30 or with AKI
Creatinine	0.6–1.2 mg/dL	Used to calculate eGFR
BUN	7–20 mg/dL	Supporting renal marker
PT / INR	11–13 s / 0.8–1.1	Biopsy, drainage; warfarin
PTT	25–35 s	Heparin
Platelets	150–400 k/µL	Procedures: > 50 k high bleeding risk, > 20 k low risk (SIR)
D-dimer	Negative	Rules out PE/DVT at low pretest probability
hCG	Negative	Pregnancy status
WBC	4.5–11 k/µL	Infection, abscess
Hgb	12–17 g/dL	Bleeding, anemia
LFTs (AST/ALT)	About 10–40 U/L	Liver disease

Monitoring

- Normal adult vital signs: pulse 60–100, respirations 12–20, BP below about 120/80, SpO_2 95–100%, temperature 36.5–37.5 °C.
- Oxygen flow: nasal cannula 1–6 L/min, simple mask 5–10 L/min, non-rebreather 10–15 L/min.
- ECG: know normal sinus rhythm, PVCs, atrial fibrillation (an irregular rhythm is a problem for gating), ventricular tachycardia and ventricular fibrillation.
- Keep chest tube drainage below chest level and never clamp it routinely. Keep Foley bags below bladder level. Never stop or disconnect lines you did not place.

Contrast media

- Use nonionic agents: low-osmolar (about 600–800 mOsm/kg) or iso-osmolar (iodixanol, about 290). Both cause fewer reactions than ionic high-osmolar agents.
- Warming to 37 °C lowers viscosity and injection pressure. ACR (2026): not needed routinely for lower-viscosity agents (300 mgI/mL); may reduce extravasation with high-viscosity agents (350–370).
- **Suspected perforation or leak:** use water-soluble oral contrast, not barium. Use negative or neutral oral contrast (water) for enterography and CTA.
- **Metformin:** if eGFR < 30 or AKI, hold it for 48 hours and restart after renal function is rechecked.
- **Pregnancy:** give contrast only if essential. **Breastfeeding** can continue. **Dialysis:** do not change the dialysis schedule because of contrast; a dialysis patient who still makes urine is treated as high risk. Iodine blocks radioiodine uptake for weeks.
- **Intrathecal:** only agents labeled for intrathecal use. An ionic agent given intrathecally can be fatal.

IV access and injection

Catheter	Typical maximum flow
18 G	5 mL/s and more (CTA, trauma)
20 G	About 5 mL/s (standard for CTA)
22 G	Best ≤ 3 mL/s (ACR: use 20 G or larger for ≥ 3 mL/s)
Power-injectable PICC/port	Only within the device label (often 5 mL/s, 300 psi)
Standard PICC/central line	Not for power injection

- Preferred site: antecubital vein. Avoid the side of a mastectomy, a fistula or an infiltrated site.
- Before injecting, check blood return and do a **saline test injection**.
- **Document** site, gauge, contrast agent and concentration, volume, flow rate, number of attempts and any complications.
- Power injectors come as single-head, dual-head (contrast plus saline chaser) or syringeless. Remove air, lock the syringe and check the pressure limit.
- Single-phase, biphasic and split-bolus injections. A saline chaser tightens the bolus and reduces streak artifact.
- **Timing:** fixed delay, **test (timing) bolus** with a small injection and a time-to-peak curve, or **bolus tracking** (ROI in the target vessel, trigger at about 100–150 HU).
- Typical adult dose is about 1–1.5 mL/kg (300–370 mgI/mL). Children: about 1.5–2 mL/kg.

Contrast reactions (ACR approach)

Type	Signs	Response
Mild physiologic	Warmth, metallic taste, limited nausea	Reassure and observe
Mild	Limited hives, itching, sneezing, nasal congestion	Observe; diphenhydramine if ordered
Moderate	Diffuse hives, bronchospasm without hypoxia, facial edema	O_2, albuterol, IM epinephrine as indicated
Severe	Laryngeal edema, hypoxic bronchospasm, anaphylactic shock, seizure, arrhythmia	Call a code, IM epinephrine 0.3 mg of 1 mg/mL (adult; repeat every 5–15 min up to 1 mg), O_2, IV fluids, CPR if pulseless
Vasovagal	Hypotension with bradycardia	Legs up, O_2, IV fluids; atropine 0.6–1 mg IV if needed
Hypotension with tachycardia	Possible anaphylaxis	Legs up, fluids, epinephrine

- **First responder:** stop the injection, stay with the patient, call for help, check ABCs and get the crash cart.
- **Elective premedication** (ACR 13-7-1): prednisone 50 mg PO at 13, 7 and 1 hour before, plus diphenhydramine 50 mg 1 hour before. The patient needs a driver. Alternative: methylprednisolone 32 mg PO at 12 and 2 hours before.
- **Delayed reactions** (rash hours to days later) are usually mild.
- **Extravasation:** stop the injection, elevate the limb, apply a cold or warm compress per policy, notify the radiologist and document. Seek a surgical consult if swelling increases, perfusion changes, sensation changes or blisters form.
- **Non-contrast drugs in CT:** nitroglycerin and metoprolol (cardiac CTA), lidocaine (biopsy), glucagon (bowel), tPA (stroke and catheter clearance).

Exam trap: a patient who reacted before with a moderate or severe reaction should be considered for a different agent and premedication, but premedication does not guarantee there will be no reaction. A shellfish allergy is not a specific contraindication.

3. Radiation Safety and Dose

21 items

Physics basics, dose indices and every knob that lowers dose.

Physics in one column

- **X-ray production:** electrons from the cathode filament hit the anode target. About 99% of the energy becomes heat and about 1% becomes x-rays.
- **Bremsstrahlung** gives a continuous spectrum and makes up most of the beam. **Characteristic** radiation (tungsten K-shell, about 69 keV) appears as discrete lines.
- **kVp** controls beam quality (energy and penetration). **mAs** controls quantity (number of photons). Filtration raises the average energy ("hardens" the beam).
- **Photoelectric absorption** $\propto Z^3/E^3$ and gives contrast. **Compton** scatter dominates in soft tissue and causes most occupational dose. **Coherent** scatter is minor.
- **Inverse square law:** doubling the distance gives ¼ the exposure; tripling it gives 1/9.
- Attenuation rises with density, atomic number and thickness, and falls as beam energy rises.

Dose indices

$CTDI_w = \frac{1}{3}$ center + $\frac{2}{3}$ periphery

$CTDI_{vol} = CTDI_w \div$ pitch [mGy]

$DLP = CTDI_{vol} \times$ scan length [mGy·cm]

$E \approx DLP \times k$ [mSv]

Region	k (mSv per mGy·cm, adult)
Head	0.0021
Neck	0.0059
Chest	0.014
Abdomen / pelvis	0.015

- $CTDI_{vol}$ describes **scanner output** in a phantom (16 cm head, 32 cm body). It is not the patient's dose.
- **SSDE** (size-specific dose estimate) corrects for patient size. It is higher than $CTDI_{vol}$ in small patients and children.

Dose reduction: what each factor does

Factor	Effect on dose	Trade-off
mAs ↓	Dose falls in proportion	Noise rises ($\propto 1/\sqrt{mAs}$)
kVp ↓	Dose $\propto$ about kVp^2	Iodine looks brighter; more noise in large patients
Pitch ↑	Dose falls (if mA is fixed)	Many scanners raise mA to hold image quality
Scan length ↓	DLP falls	Check coverage of anatomy
Fewer phases	Each phase adds a full dose	Diagnostic need
Tube current modulation	Adapts mA to size and angle (x-y and z)	Center the patient in the gantry
Iterative / deep-learning reconstruction	Allows lower mAs	"Plastic" texture at strong settings
Over-ranging / over-beaming	Extra dose at the ends and with narrow beams	Adaptive collimation reduces it

- **Centering matters:** a patient placed too low or too high gets wrong modulation and more noise or dose.
- **Children:** use size- or weight-based protocols, lower kVp, one phase and tight coverage (Image Gently).
- **Pregnancy:** confirm the indication with the radiologist and minimize coverage. A fetal dose below 50 mGy is not linked to malformations.
- **Shielding:** routine gonadal and fetal shielding is not recommended (AAPM 2019, reaffirmed through 2030). A shield in the scan range interferes with modulation.
- **Dose check:** a **notification value** warns before a series. An **alert value** (for example, 1000 mGy cumulative $CTDI_{vol}$) requires a reason and is documented.
- **DRL** (diagnostic reference level) is the 75th percentile of typical doses. It is a benchmark, not a patient limit.
- ACR $CTDI_{vol}$ reference / pass-fail: adult head 75 / 80 mGy, adult abdomen 25 / 30 mGy, pediatric abdomen 15 / 20 mGy. Lung screening ≤ 3 mGy.
- **Adverse events** (wrong patient, wrong exam, dose far above expected) are reported per policy. Device faults go to FDA MedWatch.
- **Staff:** occupational limit 50 mSv/year, cumulative 10 mSv × age; public 1 mSv/year; embryo/fetus 0.5 mSv/month. Stay outside the room during scanning; wear lead during CT fluoroscopy.

4. Image Formation

30 items

The largest single subsection: hardware, parameters, acquisition, reconstruction and post-processing.

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Pitch = table travel per rotation ÷ total beam width
```

```
Beam width = detector rows × row width
```

```
Pixel size = DFOV ÷ matrix
```

```
Voxel = pixel² × slice thickness
```

$$HU = 1000 \times (\mu_{tissue} - \mu_{water}) \div \mu_{water}$$

```
Scan time = (length ÷ (beam width × pitch)) × rotation time
```

Components

- **Gantry:** x-ray tube (cathode filament, rotating anode), high-frequency generator, filters, collimators, detectors, DAS and slip rings.
- **Slip rings** carry power and data with no cables, which allows continuous rotation (helical CT).
- **Detectors:** solid-state scintillators (ceramic, high efficiency) are standard. Gas (xenon) detectors are historical. Photon-counting detectors count individual photons and sort them by energy.
- **MDCT:** many rows along z. Rows can be combined, but the thinnest image equals the acquired row width.
- **Pre-patient collimation** sets beam width and dose. Post-patient collimation or grids reduce scatter.
- **DAS** (data acquisition system) amplifies the signal, converts it from analog to digital and sends it to the computer.
- **Array processor** performs reconstruction; the host computer runs the system.
- **External equipment:** check cables, IV lines and straps before the table moves. Observe the table weight limit.

Parameters

- **kVp** (80–140): use lower values for CTA and children, higher for large patients and metal.
- **mAs** sets noise. **Rotation time** of 0.25–0.5 s improves temporal resolution.
- **Pitch**: below 1 means overlap (better quality, more dose); above 1 means gaps (faster, less dose); cardiac uses a low pitch of about 0.2–0.3.
- **SFOV** (scan FOV) must include the whole body part. If anatomy falls outside it, you get truncation artifact. **DFOV** is set at reconstruction.

Acquisition modes

- **Sequential** (step-and-shoot): axial slices, the table stops between rotations. Used for HRCT and prospective cardiac.
- **Helical**: continuous rotation while the table moves; volume data that can be reconstructed at any position.
- **Volumetric** (wide detector, up to 16 cm): a whole organ in one rotation (heart, brain perfusion).
- **Shuttle / cine**: the table moves back and forth or stays still (perfusion, CT fluoroscopy).
- **Dual energy**: dual source, fast kVp switching, dual-layer detector, or photon counting. Outputs include virtual non-contrast, iodine maps, monoenergetic images, uric acid vs calcium stones and metal artifact reduction.

Reconstruction

- **Filtered backprojection (FBP)** is fast. A sharp kernel shows detail with more noise; a soft kernel smooths noise for soft tissue.
- **Iterative** and **deep-learning** reconstruction lower noise and allow lower dose.
- **Raw data** (projections) allow new kernels, slice thicknesses, intervals and DFOVs; this is retrospective reconstruction. **Image data** allow only reformats, windowing and zoom. Raw data are deleted after a while, so reconstruct early.
- **Interval** smaller than thickness (overlap, for example 1 mm at 0.5 mm) gives smoother MPR and 3D.
- **Interpolation** (180° or 360° linear) creates planar data from a helix.

Post-processing

Tool	Best for
MPR / curved MPR	Sagittal and coronal views, spine, vessels along their course
MIP	Vessels, lung nodules (brightest voxels)
MinIP	Airways, air trapping (darkest voxels)
SSD	Bone surfaces (threshold-based)
Volume rendering	3D using all voxels, surgical planning
Quantitative	Distance, diameter, volume, calcium score, ROI

5. Image Evaluation and Archiving

22 items

Display and HU

- The displayed range is **WL ± WW/2**. A narrow window gives high contrast; a wide window gives low contrast.
- Raising WL makes the image darker; lowering WL makes it brighter.
- Use a 512 × 512 matrix as standard. A smaller DFOV gives smaller pixels and better spatial resolution.
- **ROI** gives the mean HU and standard deviation. SD reflects noise.

Window	WW / WL
Brain	80 / 40
Subdural	150–200 / 50–80
Stroke	40 / 35
Soft tissue	350–400 / 40–50
Liver	150 / 80–100
Lung	1500 / –600
Bone	2000 / 400–500

Material	HU
Air	–1000
Lung	–850 to –600
Fat	–100 to –50
Water / simple cyst	0 (0–20)
CSF	0–15
White / gray matter	about 25 / 35–40
Acute blood	+50 to +90
Contrast-filled vessel (CTA)	+250 to +450
Cortical bone	+700 to +1000+

Image quality

- **Spatial resolution** (line pairs per cm) improves with small focal spot, thin slices, sharp kernel, small DFOV and larger matrix.
- **Contrast resolution** improves with less noise: more mAs, thicker slices, soft kernel and iterative reconstruction.
- **Temporal resolution** improves with faster rotation, half-scan reconstruction and dual source.
- **Noise** is the SD in a uniform ROI. **Uniformity** means the same HU from center to edge (within about 5 HU).
- **Linearity** means HU tracks density, checked with known materials.

QA / QC

- **Daily:** tube warm-up, air calibration, water phantom CT number (0 ± 7 HU per ACR, often tighter by vendor), noise and artifacts.
- **Periodic:** slice thickness, spatial resolution, low-contrast detectability, laser alignment, table increment and dose (by a physicist).
- Accreditation: ACR or IAC, using phantom images, clinical images and dose review.

Artifacts: cause → fix

Artifact	Cause	Fix
Beam hardening / cupping	Low-energy photons absorbed (posterior fossa, between shoulders)	Filtration, correction software, higher kVp, arms up
Partial volume	Thick slice averages tissues	Thinner slices
Motion	Breathing, peristalsis, heartbeat	Instructions, faster rotation, immobilize, gating, glucagon
Metal streaks	Photon starvation and beam hardening	MAR software, higher kVp, high-keV monoenergetic images, angle the gantry
Edge gradient	Sharp high-contrast edges	Thinner slices
Truncation (out-of-field)	Body outside the SFOV	Larger SFOV, centering, arms up
Ring	Bad or miscalibrated detector	Calibration, service
Tube arcing	Electrical discharge in the tube	Service; rescan
Cone beam / windmill	Wide beam, helical interpolation	Lower pitch, special reconstruction
Photon starvation	Too few photons through wide anatomy	Tube current modulation, higher mAs
Stair-step	Thick slices or big interval in 3D	Thin, overlapping reconstruction

Informatics

- **HIS / RIS / EMR / EHR** hold orders, schedules and records. **PACS** stores and displays images. **DICOM** is the image standard (modality worklist, MPPS, dose structured report). **HL7** carries text messages between systems.
- HIPAA: minimum necessary use, your own login, de-identify teaching files, and keep patient data off screens others can see.
- Downtime: use a paper log with verified identifiers, then reconcile with RIS and PACS when systems return.

6. Procedures: Head, Spine and MSK

25 items

Procedure questions ask about cross-sectional anatomy, pathology, landmarks, vessels, planes, protocol, patient factors, post-processing, contrast timing and add-ons (CTA/CTV, biopsy, drainage, trauma, surgical planning).

Study	Key protocol points	Must-know anatomy & pathology
Brain / head	Baseline at OML (or parallel to the skull base to spare the lenses); soft-tissue and bone kernels; non-contrast for trauma and acute stroke	Epidural: lens-shaped, does not cross sutures (middle meningeal artery). Subdural: crescent, crosses sutures (bridging veins). SAH: cisterns and sulci → CTA for aneurysm
Stroke	Non-contrast CT → CTA from aortic arch to vertex → perfusion	Core: low CBV and CBF. Penumbra: prolonged MTT/Tmax with preserved CBV. Hyperdense MCA sign. IV thrombolysis window about 4.5 h
Brain perfusion	Cine/shuttle mode, fast bolus (4–5 mL/s), about 40–60 s of repeated scans	CBF = CBV ÷ MTT
Temporal bones / IAC	Sub-mm slices, bone kernel, small DFOV per side, axial + coronal	Ossicles, cochlea, semicircular canals; cholesteatoma
Orbits	Thin slices, axial + coronal; contrast for infection or tumor	Blowout fracture of the orbital floor (inferior rectus entrapment); medial wall (lamina papyracea)
Sinuses	Low-dose non-contrast, coronal reformats for the ostiomeatal complex; image-guided surgery protocols	Air-fluid levels, mucosal disease
Maxillofacial / mandible / TMJ	Thin slices, bone kernel, 3D for surgical planning; TMJ open and closed mouth	All Le Fort fractures involve the pterygoid plates; mandible fractures are often bilateral
Cervical spine	Skull base through T1, thin slices, sagittal + coronal reformats; pull the shoulders down	Jefferson (C1 burst), hangman's (C2 pars), odontoid fractures; dens and C1 lateral masses
Thoracic / lumbosacral	Reformats from the trauma chest/abdomen data are often enough	Chance fracture (flexion-distraction) at T11–L2; conus ends at L1–L2
Post-myelogram	Scan promptly, usually within about 1–4 h (lumbar contrast is densest at about 1 h); roll the patient to mix it	Nerve root compression, CSF leak
Upper extremity	Wrist: prone "superman" position with the arm over the head (away from the body); elbow similar	Scaphoid fractures, comminuted distal radius
Shoulder	Affected arm at the side, palm up (external rotation); other arm up if possible	Glenoid, humeral head (Hill-Sachs), post-arthrogram labrum
Pelvis / hip	Feet internally rotated about 15°; include the whole pelvis for trauma	Acetabular and sacral fractures, SI joints
Lower extremity / knee / ankle	Feet first, the unaffected limb out of the field; 3D for tibial plateau and calcaneus	Tibial plateau, calcaneus, Lisfranc
Post-arthrogram	Scan soon after the intra-articular injection (diluted iodinated contrast)	Labral and cartilage tears
Runoff CTA	Bolus tracking in the abdominal aorta, diaphragm to toes, do not outrun the bolus (lower table speed or add a delay)	Occlusions, stenosis, bypass grafts

7. Procedures: Neck and Chest

22 items

Study	Key protocol points	Must-know anatomy & pathology
Soft tissue neck	IV contrast with a delay of about 60–90 s (or split bolus); skull base to aortic arch; quiet breathing, no swallowing	Abscess, lymph nodes, masses; cricoid at C6; hyoid at C3
Larynx / airway	Thin slices, non-contrast or with contrast for tumor; phonation ("eee") to show vocal cord motion	Vocal cords, epiglottis, subglottic stenosis
Carotid / neck CTA	Inject from the right arm to avoid streak from the left brachiocephalic vein; arch to vertex; bolus tracking	Stenosis at the carotid bifurcation (about C3–C4), dissection
Routine chest	Apices through adrenals, deep inspiration, arms up; contrast delay about 35–60 s	Mediastinal lymph nodes, masses, effusions
CTPA (PE study)	Bolus tracking with an ROI in the pulmonary trunk; gentle breath-hold (avoid Valsalva, which brings in unopacified blood from the IVC)	Filling defects in pulmonary arteries, RV strain
Aorta / dissection	Non-contrast first (intramural hematoma), then gated or high-pitch CTA; delayed phase after EVAR (endoleak)	Stanford A involves the ascending aorta (surgical); Stanford B does not
Cardiac CTA	HR ideally ≤ 60–65 bpm (beta-blocker), sublingual nitroglycerin; prospective triggering in mid-diastole, about 70–80% of the R-R interval (low dose); retrospective gating gives function at higher dose	Coronary arteries: LM, LAD, LCx, RCA; arrhythmia degrades images
Calcium scoring	Non-contrast, prospectively gated, 3 mm slices; threshold 130 HU (Agatston)	Score 0 = no detectable calcified plaque
TAVR planning	Gated aortic-root CTA, then non-gated CTA of the aorta and iliofemoral arteries to the femoral heads	Annulus size, access vessel diameter
HRCT	Thin (≤ 1.25 mm) slices, sharp kernel, no contrast; prone images (posterior lungs) and expiratory images (air trapping)	ILD, fibrosis, honeycombing, bronchiectasis
Lung screening (LDCT)	Non-contrast, $CTDI_{vol}$ ≤ 3 mGy for a standard-size patient; USPSTF 2021: ages 50–80, ≥ 20 pack-years, current smoker or quit within 15 years; Lung-RADS®	Nodule size and type; incidental nodules follow Fleischner guidelines
Esophagram (CT)	Oral water-soluble contrast just before or during the scan	Perforation and leak (water-soluble, not barium)
Chest wall / airway	3D and MinIP for airways; virtual bronchoscopy	Tracheal stenosis, pectus

Remember the chest landmarks: sternal angle and carina at about T4–T5; aortic arch at the level of T4; the left brachiocephalic vein crosses in front of the arch branches; the azygos vein arches over the right main bronchus.

8. Procedures: Abdomen and Pelvis

24 items

Contrast phases

Phase	Delay	Use
Early arterial (CTA)	About 20–25 s / tracking	Vessels, bleeding
Late arterial / pancreatic	35–45 s	HCC, hypervascular metastases, pancreas
Enteric	45–50 s	Enterography (bowel wall)
Portal venous	60–80 s	Routine abdomen, hypovascular metastases
Nephrographic	90–120 s	Renal masses
Excretory	5–15 min	Urography, collecting system injury
Adrenal delay	15 min	Washout

```
Absolute washout = (E − D) ÷ (E − U) × 100; ≥ 60% → adenoma
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Relative washout = (E − D) ÷ E × 100; ≥ 40% → adenoma
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E = enhanced (60–75 s), D = delayed (15 min), U = unenhanced HU.

- An adrenal nodule ≤ 10 HU unenhanced is a lipid-rich adenoma.
- A renal lesion that enhances by more than 20 HU is solid (suspicious); 10–20 HU is indeterminate.
- Multiphase liver: non-contrast, late arterial and portal venous phases, plus delayed if needed. Pancreas: pancreatic phase and portal venous phase, thin slices.
- Spleen: arterial phase heterogeneity is normal; use the portal venous phase to judge injury.

Key studies

- **Renal stone:** low-dose non-contrast, kidneys to bladder. Scan prone to tell a stone stuck at the UVJ from one that has passed into the bladder. Dual energy separates uric acid from calcium stones.
- **CT urogram / IVU:** non-contrast, nephrographic and excretory phases. A split bolus combines them into fewer acquisitions (hematuria workup). Hydration helps distend the collecting system.
- **Appendicitis:** IV contrast, oral contrast optional. Watch for a dilated appendix (over 6 mm) and fat stranding.
- **Enterography:** large volume of neutral oral contrast (about 1.5 L over 45–60 min), enteric phase. Crohn disease.
- **Retrograde cystogram:** 300–400 mL of dilute contrast by gravity through a Foley catheter. Intraperitoneal rupture outlines bowel loops; extraperitoneal rupture shows the "molar tooth" sign.
- **Dedicated delayed bladder:** delayed images with an opacified, full bladder.
- **Colorectal (rectal contrast):** for fistulas, leaks and anastomoses.
- **CT colonography:** bowel prep with fecal tagging, CO_2 insufflation through a rectal tube, supine and prone scans, low dose. Do not perform with acute diverticulitis, recent polypectomy or suspected perforation.
- **Reproductive organs:** CT is not first-line for gynecologic or scrotal disease (ultrasound or MRI is). Know ovarian torsion, abscess and staging.

Abdominal landmarks

Level	Structure
T12	Celiac trunk
L1	SMA, transpyloric plane, renal hila
L1–L2	Renal arteries, conus medullaris
L3	IMA
L4	Aortic bifurcation, iliac crests
L5	IVC formation

9. Additional procedures and special patients

CTA and CTV

- **Arterial CTA:** fast injection (4–5 mL/s), saline chaser, bolus tracking, thin slices, MIP/VR/curved MPR.
- **CT venography:** longer delay (about 90–120 s for systemic veins; or 3–4 min for the legs after a CTPA in a combined PE/DVT study).
- **Dissection:** image from thoracic inlet to the femoral heads; true and false lumens.
- Use a **low kVp** (80–100) when possible: iodine looks brighter, so you can use less contrast.

Interventional CT

- **Biopsy, drainage, aspiration:** check coagulation (INR, platelets) and anticoagulants, get consent, do a time-out, and use sterile technique.
- Localizing scans with a grid or skin marker; limited-range low-dose scans; CT fluoroscopy uses intermittent short exposures. Staff wear lead and keep their hands out of the beam.
- **After a lung biopsy**, scan for pneumothorax. After any biopsy, monitor for bleeding and document specimens.
- **Drainage:** record the fluid's appearance and volume and send samples as ordered.

Surgical planning

- Thin-slice, isotropic data allow 3D, VR and printing. Use navigation protocols for sinus and orthopedic surgery and TAVR sizing.

Trauma

- Head and C-spine non-contrast first. For chest, abdomen and pelvis, use a portal venous phase, or a split bolus to combine arterial and venous phases.
- Keep spine precautions with log rolling; arms up for the torso if it is safe.
- Delayed images are used for active bleeding (contrast blush grows), urinary tract injury and bladder injury.

Infant and young child

- Child-sized protocols with lower kVp and mAs, a single phase and tight coverage. Ask: is ultrasound or MRI an option?
- Immobilization, feed-and-wrap for infants, a parent in the room with a lead apron, sedation per policy.
- Contrast about 1.5–2 mL/kg; small catheters (22–24 G) and slower rates; hand injection is often used.

Geriatric and bariatric

- Geriatric patients: hearing and vision loss, fall risk, fragile veins and skin, renal function.
- Bariatric patients: table weight limit, gantry aperture, SFOV (truncation), higher kVp and mAs, longer needle and catheter.

> **Exam trap:** post-processing and timing questions often hide inside procedure items. For example: "Which reconstruction best shows the course of a tortuous vessel?" (curved MPR) or "Where do you place the ROI for a PE study?" (the pulmonary trunk).

10. Numbers to know: one-page review

Item	Number
eGFR contrast risk	< 30 or AKI
Metformin hold	48 h if eGFR < 30 / AKI
Premedication	Prednisone 50 mg at 13, 7, 1 h + diphenhydramine 50 mg
Epinephrine IM (adult)	0.3 mg of 1 mg/mL; repeat up to 1 mg
Atropine (vasovagal)	0.6–1 mg IV
20 G max flow	About 5 mL/s
Bolus-tracking trigger	About 100–150 HU
Adult IV contrast	About 1–1.5 mL/kg
Child IV contrast	About 1.5–2 mL/kg
Contrast osmolality	LOCM 600–800; IOCM about 290 mOsm/kg
Cardiac HR goal	≤ 60–65 bpm
Prospective gating window	About 70–80% R-R
Calcium score threshold	130 HU, 3 mm
Lung screening	50–80 y, ≥ 20 pack-years, quit ≤ 15 y; ≤ 3 mGy
Phantoms	16 cm head, 32 cm body
ACR head $CTDI_{vol}$	75 reference / 80 pass-fail
ACR adult abdomen	25 / 30 mGy
ACR pediatric head / abdomen	35 / 40; 15 / 20 mGy
Dose alert value	1000 mGy cumulative $CTDI_{vol}$
DRL	75th percentile
Fetal dose without malformation risk	< 50 mGy
Occupational limit	50 mSv/y; 10 mSv × age

Item	Number
Public / embryo-fetus	1 mSv/y; 0.5 mSv/month
Water QC	0 ± 7 HU (ACR)
Uniformity	Within about 5 HU
Characteristic x-rays (tungsten K)	About 69 keV
Heat vs x-rays at the anode	About 99% / 1%
Portal venous delay	60–80 s
Nephrographic	90–120 s
Excretory	5–15 min
Adrenal delay / washout	15 min; 60% absolute, 40% relative
Adrenal adenoma (unenhanced)	≤ 10 HU
Renal mass enhancement	> 20 HU solid
Appendix diameter	> 6 mm abnormal
Retrograde cystogram	300–400 mL by gravity
Post-myelogram delay	Promptly, about 1–4 h
Stroke thrombolysis window	About 4.5 h
Cricoid / carina	C6 / T4–T5
Celiac / SMA / IMA	T12 / L1 / L3
Aortic bifurcation	L4
Conus medullaris	L1–L2
Clinical requirements	25 procedures, 125 reps, 30 with IV contrast
Structured education	16 credits

Clinical numbers follow ACR, AAPM, NCRP and USPSTF guidance as of 2026. Your department's protocols and the radiologist's orders always come first.

11. Practice quiz: 20 questions

Questions from the CT Tech Prep bank, spread across all sections like the real exam. Give yourself 20 minutes. Answers and explanations are on the next page.

PATIENT CARE

1. An outpatient scheduled for a contrast-enhanced abdomen CT has an eGFR of 52 mL/min/1.73 m² and no acute kidney injury. What is the appropriate plan for IV iodinated contrast?

A. Give half the usual contrast dose so the kidneys handle a smaller iodine load during excretion
B. Book a dialysis session right after the scan so the contrast is cleared from the blood quickly
C. Cancel the IV contrast and convert the order to a non-contrast study
D. Proceed with the usual weight-based dose; this eGFR needs no special renal precautions

PATIENT CARE

2. The label on a patient's PICC lists 'power injectable, max 5 mL/s, 300 psi.' The radiologist's protocol asks for 6 mL/s. What is the correct course?

A. Raise the injector pressure limit so 6 mL/s can be reached
B. Stay within the label; consult the radiologist
C. Run 6 mL/s, because a 1 mL/s difference is negligible
D. Inject at 6 mL/s but warm the contrast first so the line is protected from pressure

PATIENT CARE

3. Soon after contrast, a patient has widespread hives and mild wheezing with normal blood pressure and oxygen saturation. How does the ACR grade this reaction?

A. Moderate
B. Severe reaction
C. Mild physiologic reaction to contrast osmolality
D. Delayed reaction

SAFETY

4. Which statement about CTDIvol is correct?

A. The patient's effective dose, expressed in millisieverts
B. A phantom-based index of scanner output, not this patient's dose
C. A value measured in milligray-centimeters for the whole scan length
D. A value that already includes the scan length, so it describes the whole exam

SAFETY

5. Which approach best reflects Image Gently® principles for a pediatric abdomen CT?

A. The adult protocol, so image quality is consistent
B. An extended scan range so nothing is missed
C. Size-based technique, indicated area, one phase
D. Routine arterial and delayed phases so that the study is complete the first time

SAFETY

6. For an ACR-designated low-dose lung cancer screening CT on a standard-sized adult, the CTDIvol should generally be:

A. 3 mGy or less
B. About 25 mGy
C. About 75 mGy
D. Above 10 mGy

IMAGE FORMATION

7. A protocol's pitch is lowered from 1.4 to 0.7 and nothing else is changed. Which outcome is expected?

A. No change in CTDIvol or acquisition time
B. A shorter acquisition time for the same range
C. Gaps in the helical data and about half the dose for the same range
D. Overlap and about double the CTDIvol

IMAGE FORMATION

8. Why should raw data be retained after scanning when possible?

A. Raw data files are smaller than image files
B. New kernels, thicknesses, intervals or DFOVs can be reconstructed later
C. Raw data can be windowed directly by the radiologist at the workstation
D. Raw data must be stored in PACS for every exam

IMAGE FORMATION

9. For a DFOV of 500 mm and a 512 × 512 matrix, what is the pixel size?

A. About 0.98 mm
B. About 2.0 mm
C. About 0.5 mm
D. About 5.0 mm

IMAGE EVALUATION

10. A thin subdural hematoma is hard to see against the skull on the brain window. Which adjustment helps?

A. An intermediate (subdural) window, about WW 150–200 / WL 50–80
B. The lung window, about WW 1500 / WL –600, to separate blood from bone
C. Repeat the head scan at lower mAs so the thin collection is less obscured by bone
D. The bone window alone, about WW 2000 / WL 500

IMAGE EVALUATION

11. Stair-step artifacts on sagittal reformations are reduced by:

A. Thin, overlapping axial reconstructions
B. Lower pitch only for the localizer
C. Thicker, non-overlapping slices to reduce noise
D. A sharper display window on the reformats

IMAGE EVALUATION

12. In daily QC, the water ROI measures +11 HU. What is the appropriate response?

A. Out of the ±7 HU tolerance: recalibrate, and if it persists stop and call service
B. Adjust the window level by 11 HU to compensate for the offset in every image
C. Ignore it until the annual physicist survey
D. Accept the result, since any water value under 20 HU passes the daily acceptance check

HEAD, SPINE & MSK

13. A crescent-shaped collection along the convexity that crosses suture lines is typical of:

A. Subdural hematoma
B. Epidural hematoma
C. Hemorrhagic stroke in the basal ganglia
D. Arachnoid cyst

HEAD, SPINE & MSK

14. A hyperdense middle cerebral artery sign on non-contrast CT indicates:

A. Thrombus within the MCA
B. Subdural hematoma
C. Calcified aneurysm only
D. Normal finding

HEAD, SPINE & MSK

15. For cervical spine trauma CT, which reformats are standard?

A. Coronal soft-tissue reformats only
B. Sagittal and coronal bone reformats plus axial images
C. 3D volume renderings only
D. Axial images only, reviewed in a bone window at 3 mm

NECK & CHEST

16. A filling defect in a segmental pulmonary artery on CTPA represents:

A. Atelectasis
B. Normal mixing of contrast in the aorta
C. Pulmonary embolus
D. Calcified lymph node

NECK & CHEST

17. Which heart rate is generally preferred for prospectively triggered coronary CTA on many single-source scanners?

A. About 100 bpm, and regular
B. An irregular rate above 90 bpm
C. About 120 bpm, and regular
D. About 65 bpm or lower, and regular

NECK & CHEST

18. According to USPSTF (2021), who is eligible for annual low-dose CT lung cancer screening?

A. Ages 50–80, ≥20 pack-years, smoking now or quit within 15 years
B. Nonsmokers aged 30 to 50
C. Only patients with a persistent cough
D. All adults over 40 years old, regardless of smoking history

ABDOMEN & PELVIS

19. What is the approximate scan delay for a routine portal venous phase abdomen CT?

A. About 15 seconds
B. About 60–80 seconds
C. About 20 minutes
D. About 5 minutes

ABDOMEN & PELVIS

20. Which protocol is standard for suspected urolithiasis (renal colic)?

A. CT colonography
B. Contrast-enhanced chest CT
C. Low-dose non-contrast CT
D. Arterial-phase CT angiography of the renal arteries

Answer key

1. D Current ACR guidance treats an eGFR of 30 or more, with no acute kidney injury, as low risk for contrast-associated AKI, so the usual weight-based dose is given. Cancelling the contrast, halving the dose or booking dialysis are not supported at this level and would only compromise the study.

2. B A catheter's labeled flow-rate and pressure limits are never exceeded, because the line can rupture. The radiologist decides how to adjust the injection (rate, concentration) or whether different access is needed. Warming contrast does not raise the label limit.

3. A Under the ACR classification, diffuse hives or bronchospasm without hypoxia or hypotension is a moderate allergic-like reaction that needs treatment and monitoring. Mild reactions are limited hives, itching or nasal congestion; severe ones involve airway, circulation or seizures.

4. B CTDIvol is a standardized index of scanner output measured in a 16 cm or 32 cm acrylic phantom, in mGy. It is not the dose to the individual patient; SSDE adjusts for size and effective dose (mSv) estimates risk.

5. C Image Gently® principles: size the technique to the child (lower kVp and mAs), scan only the indicated area, use a single phase when possible, and consider ultrasound or MRI. Children are more radiosensitive and have more years of life ahead.

6. A ACR technical specifications for low-dose lung cancer screening call for a CTDIvol of 3 mGy or less in a standard-sized patient, with no contrast and thin sections.

7. D Halving pitch from 1.4 to 0.7 makes the helical turns overlap, roughly doubles CTDIvol (CTDIvol = CTDIw ÷ pitch) and slows coverage. Low pitch is used, for example, in retrospective cardiac gating.

8. B With raw (projection) data, new images can be reconstructed later with a different kernel, slice thickness, interval, DFOV or center. From image data you can only reformat, window and zoom. Raw data are kept on the scanner for a limited time.

9. A Pixel size = DFOV ÷ matrix = 500 mm ÷ 512 ≈ 0.98 mm. Halving the DFOV to 250 mm with the same matrix would give about 0.49 mm pixels.

10. A A thin subdural collection blends into the skull on a narrow brain window. An intermediate subdural window (about WW 150–200 / WL 50–80) separates acute blood from bone. This is a display change, not a rescan.

11. A Stair-step artifacts appear on reformats made from thick, non-overlapping slices. Thin, overlapping reconstructions (or isotropic voxels) give smooth sagittal, coronal and 3D edges.

12. A Water should read about 0 HU, within the ACR tolerance of ±7 HU (some manufacturers use ±3–5). At +11 HU, run air calibration and repeat the test; if it is still out of tolerance, remove the scanner from clinical use, call service and document.

13. A A subdural hematoma is crescent-shaped, crosses suture lines (but not the falx) and comes from torn bridging veins. It is common in older and anticoagulated patients; acute blood is hyperdense, subacute may be isodense and chronic is hypodense.

14. A A hyperdense middle cerebral artery on non-contrast CT represents acute thrombus in the vessel. It is an early sign of large-vessel occlusion that CT angiography confirms.

15. B Cervical spine trauma CT requires thin axial images in bone and soft-tissue kernels plus sagittal and coronal bone reformats, from the skull base through T1–T2 including the cervicothoracic junction.

16. C A pulmonary embolus appears as an intraluminal filling defect in a contrast-filled pulmonary artery; in cross-section it can look like a polo mint. Signs of right heart strain (RV/LV ratio above 1) are also assessed.

17. D Prospective triggering on many single-source scanners works best at a regular heart rate of about 60–65 bpm or lower: diastole is longer and the coronaries move less, so a short low-dose window can be used. Beta-blockers help reach this rate.

18. A The USPSTF (2021) recommends annual low-dose CT for adults aged 50–80 with at least 20 pack-years who currently smoke or quit within the past 15 years. Screening is for people without symptoms.

19. B Abdominal phases: late arterial about 35–45 s, portal venous about 60–80 s (the routine abdomen), nephrographic about 90–120 s, excretory 5–15 min and adrenal washout delay about 15 min.

20. C Suspected renal colic is evaluated with low-dose non-contrast CT of the abdomen and pelvis from the top of the kidneys to the pubic symphysis. Nearly all stones are visible, and contrast in the collecting system would hide them.

12. Final week and test day

Final-week checklist

- [ ] Write the formula page (section 4) and the numbers page (section 10) from memory.
- [ ] Phase delays: arterial, pancreatic, enteric, portal venous, nephrographic, excretory, adrenal.
- [ ] Contrast reaction table and the first-responder steps.
- [ ] Window settings and the HU of common tissues.
- [ ] Artifact table: cause and fix for each.
- [ ] Cardiac: gating types, heart rate, calcium scoring.
- [ ] Dose: $CTDI_{vol}$, DLP, SSDE, effective dose, notification vs alert.
- [ ] One timed 165-question mock; review every missed item.
- [ ] Confirm your appointment, ID requirements and route to the Pearson VUE center.

On the day

- Bring the identification ARRT requires, with a name that matches your application. Arrive early.
- Use the tutorial to learn the calculator and the flag-for-review button.
- Pace yourself at about 1 minute per item. Leave a 15–20 minute buffer for flagged items.
- Read the last line of the question first: what exactly is being asked? Look for words like *first*, *best*, *most likely*, *except*.
- Eliminate two options, then choose between the remaining two. Change an answer only if you find a clear reason.
- Some items will look unfamiliar: these may be pilot items. Don't let one hard question shake you.
- You receive a preliminary result at the center; the official score follows from ARRT.

13. Abbreviations

Every abbreviation used in this guide, in alphabetical order. Units and standards (DICOM, PACS) are included.

AAPM	American Association of Physicists in Medicine
ABCs	Airway, Breathing, Circulation
ACR	American College of Radiology
AKI	Acute kidney injury
ALT / AST	Alanine / aspartate aminotransferase
ARRT®	American Registry of Radiologic Technologists
BP	Blood pressure
BUN	Blood urea nitrogen
C, T, L + number	Cervical, thoracic, lumbar vertebra (C6, T12, L4…)
CBF / CBV	Cerebral blood flow / volume
CPR	Cardiopulmonary resuscitation
CSF	Cerebrospinal fluid
CT	Computed tomography
CTA / CTV	CT angiography / venography
CTDI	CT dose index (vol = volume, w = weighted)
CTPA	CT pulmonary angiography
DAS	Data acquisition system
DFOV	Display field of view
DICOM	Digital Imaging and Communications in Medicine
DLP	Dose-length product
DRL	Diagnostic reference level
DVT	Deep vein thrombosis
ECG	Electrocardiogram
eGFR	Estimated glomerular filtration rate
EHR / EMR	Electronic health / medical record
EVAR	Endovascular aneurysm repair
FBP	Filtered backprojection
FDA	U.S. Food and Drug Administration
G	Gauge (catheter size)
HCC	Hepatocellular carcinoma
hCG	Human chorionic gonadotropin
HIPAA	Health Insurance Portability and Accountability Act
HIS / RIS	Hospital / radiology information system
HL7	Health Level Seven
HR	Heart rate
HRCT	High-resolution CT
HU	Hounsfield unit
IAC	Internal auditory canal
IAC (accreditation)	Intersocietal Accreditation Commission
ILD	Interstitial lung disease
IM / IV / PO	Intramuscular / intravenous / by mouth (per os)
IMA / SMA	Inferior / superior mesenteric artery
INR	International normalized ratio
IVC / SVC	Inferior / superior vena cava
IVU	Intravenous urography
keV	Kiloelectronvolt
kVp	Kilovolt peak
LAD / LCx / LM / RCA	Left anterior descending / left circumflex / left main / right coronary artery
LDCT	Low-dose CT
LFTs	Liver function tests
LOCM / IOCM	Low-osmolar / iso-osmolar contrast media
Lung-RADS®	Lung Imaging Reporting and Data System
mA / mAs	Milliampere / milliampere-second
MAR	Metal artifact reduction
MCA	Middle cerebral artery
MDCT	Multidetector CT
mGy / mSv	Milligray / millisievert
mgI/mL	Milligrams of iodine per milliliter
MIP / MinIP	Maximum / minimum intensity projection
mOsm/kg	Milliosmoles per kilogram
MPPS	Modality Performed Procedure Step
MPR	Multiplanar reformation
MRI	Magnetic resonance imaging
MSK	Musculoskeletal
MTT / Tmax	Mean transit time / time to maximum
NCRP	National Council on Radiation Protection and Measurements
NMTCB	Nuclear Medicine Technology Certification Board
OML	Orbitomeatal line
PACS	Picture archiving and communication system
PE	Pulmonary embolism
PET / SPECT	Positron emission tomography / single-photon emission CT
PICC	Peripherally inserted central catheter
psi	Pounds per square inch
PT / PTT	Prothrombin time / partial thromboplastin time
PVC	Premature ventricular contraction
QA / QC	Quality assurance / quality control
ROI	Region of interest
R-R	Interval between two R waves on the ECG
R.T.(R) / (T) / (N)	Registered Technologist in Radiography / Radiation Therapy / Nuclear Medicine
RV	Right ventricle
SAH	Subarachnoid hemorrhage
SD	Standard deviation
SFOV	Scan field of view
SI	International System of Units
SIR	Society of Interventional Radiology
SPR	Society for Pediatric Radiology
SSD	Shaded surface display
SSDE	Size-specific dose estimate
TAVR	Transcatheter aortic valve replacement
TMJ	Temporomandibular joint
tPA	Tissue plasminogen activator (alteplase)
USPSTF	U.S. Preventive Services Task Force
UVJ	Ureterovesical junction
VR	Volume rendering
WBC	White blood cells
WL / WW	Window level / window width
Z	Atomic number

14. Next step, sources and legal information

NEXT STEP

Test yourself with CT Tech Prep

430 exam-style questions with every answer explained, timed mock exams that follow the 2026 ARRT® blueprint, and score tracking by section. Works in your browser on any device.

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