



Computed Tomography

The purpose of the examination requirement is to assess whether individuals have obtained the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required in computed tomography (CT) for practice at entry level.

ARRT determined the tasks that entry-level CT technologists typically perform by administering a comprehensive practice analysis survey to a nationwide sample of CT technologists.¹ The *Task Inventory for Computed Tomography* is on ARRT's website (www.arrt.org).

The *Examination Content Specifications for Computed Tomography* and attached content outline identify the knowledge areas underlying performance of the tasks on the *Task Inventory for Computed Tomography*. Every content category links to one or more tasks on the [task inventory](#).

This document is not intended to serve as a curriculum guide. Although ARRT programs for certification and registration and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address the subject matter that is included in the content outline, but do not limit themselves to only this content.

The table below presents the major content categories and subcategories that the examination covers. The table lists the number of test questions in each category in bold and number of test questions in each subcategory in parentheses. The content outline, which makes up the remaining pages of this document, addresses specific topics within each category.

Content Category	Number of Scored Questions ²
Patient Care	21
<i>Patient Interactions and Management (21)</i>	
Safety ³	21
<i>Radiation Safety and Dose (21)</i>	
Image Production	52
<i>Image Formation (30)</i>	
<i>Image Evaluation and Archiving (22)</i>	
Procedures	71
<i>Head, Spine, and Musculoskeletal (25)</i>	
<i>Neck and Chest (22)</i>	
<i>Abdomen and Pelvis (24)</i>	
Total	165

¹. A special debt of gratitude is due to the hundreds of professionals participating in this project as committee members, survey respondents, and reviewers.

². The examination includes an additional 30 unscored (pilot) questions.

³. SI units are the primary (principal) units of radiation measurement used on the CT examination.



Patient Care

1. Patient Interactions and Management

- A. Patient Assessment and Preparation
 - 1. scheduling and screening
 - 2. patient history
 - 3. interpersonal communication (e.g., * patient care team, provider)
 - 4. lab values
 - a. renal function (e.g., eGFR, creatinine)
 - b. other (e.g., D-dimer, LFT, INR, PT, PTT, WBC, hCG, Hgb)
 - 5. patient education
 - 6. consent (e.g., informed, oral, implied)
 - 7. ergonomics and safe patient transfer techniques/devices
 - 8. remove radiopaque materials and radiosensitive devices
 - 9. positioning aids (e.g., Velcro® straps, padding)
 - 10. time-out
 - 11. patient monitoring
 - a. level of consciousness
 - b. fall prevention
 - c. vital signs
 - d. ECG pattern
 - e. oximetry
 - f. medical emergency
 - 12. management of accessory medical devices
 - a. oxygen delivery systems
 - b. chest tubes
 - c. indwelling catheters
 - 13. medications and dosage
 - a. current
 - b. preprocedure medications (e.g., steroid, anti-anxiety)
 - c. postprocedure instructions (e.g., diabetic patient, ACR/FDA guidelines)
 - 14. infection control (e.g., clean, disinfect, sterilize equipment)

B. Contrast and Medication

- 1. contrast media types and properties
 - a. nonionic
 - b. osmolality
 - c. barium sulfate
 - d. water soluble (iodinated)
 - e. air
 - f. water
 - g. other
- 2. special contrast considerations
 - a. contraindications (e.g., iodinated contrast allergy)
 - b. indications
 - c. pregnancy
 - d. lactation
 - e. dialysis patients
- 3. noncontrast medications (e.g., lidocaine, nitroglycerin, metoprolol, tPA)
- 4. administration routes and dose calculations
 - a. IV
 - b. oral
 - c. rectal
 - d. intrathecal
 - e. catheters (e.g., central line, PICC line, Foley)
 - f. other (e.g., stoma, intra-articular)
- 5. venipuncture
 - a. site selection
 - b. aseptic and sterile technique
 - c. documentation (e.g., site, amount, gauge, concentration, flow rate limitations, number of attempts)

*"e.g." indicates examples of the topics covered, but is not a complete list



Patient Care (continued)

6. injection techniques
 - a. safety
 - b. manual
 - c. power injector types
 1. single head
 2. dual head
 3. syringeless
 - d. power injection options
 1. single phase
 2. multiphase
 3. flow rate
7. scanning techniques
 - a. timing bolus
 - b. bolus tracking
 - c. scan delay
8. reactions
 - a. recognition and assessment
(e.g., call a code, retrieve crash cart, initiate CPR, side effects)
 - b. allergy type
 1. mild
 2. moderate
 3. severe
 - c. complications
 1. nephrotoxicity
 2. physiological responses
(e.g., airway, hemodynamic, CNS)
 - d. treatment
 1. types (e.g., steroids, antihistamines, epinephrine)
 2. indications and contraindications
9. postprocedure care
 - a. complications
(e.g., extravasation/infiltration)
 - b. documentation



Safety

1. Radiation Safety and Dose

A. Radiation Physics

1. x-ray production
2. target interactions
 - a. bremsstrahlung
 - b. characteristic
3. x-ray beam
 - a. frequency and wavelength
 - b. beam characteristics
 1. quality
 2. quantity
 3. primary versus remnant (exit)
 - c. inverse square law
 - d. fundamental properties of x ray
 - e. acquisition (geometry)
4. photon interactions with matter
 - a. photoelectric
 - b. Compton
 - c. coherent (classical)
 - d. attenuation by various tissues

B. Radiation Protection

1. minimizing patient exposure
 - a. kVp
 - b. mAs
 - c. pitch
 - d. collimation / beam width
 - e. filtration
 - f. gating
 - g. image reconstruction
(e.g., iterative, retrospective,
artifact suppression software)
 - h. detector efficiency
 - i. over-ranging
 - j. dose modulation techniques
(e.g., SMART mA, auto mA,
CARE dose, SURE Exposure)
2. shielding (e.g., lead apron)
3. patient considerations
 - a. positioning
 - b. communication
(e.g., breathing instructions)
 - c. pediatric
 - d. adult (e.g., BMI)
 - e. pregnancy
4. dose measurements
 - a. absorbed dose (mGy)
 - b. effective dose (mSv)
 - c. CT dose index
(CTDI) (mGy)
 - d. dose-length product
(DLP) (mGy*cm)
 - e. dose notification/alert
 - f. adverse event reporting
(e.g., scanning errors)
 - g. documentation
5. personnel protection
 - a. controlled access
 - b. education



Image Production

1. Image Formation

- A. Components of a CT Unit
 - 1. gantry
 - a. x-ray tube (e.g., cathode, anode)
 - b. generator
 - c. detectors (e.g., MDCT)
 - 1. configuration
 - 2. collimation
 - d. data acquisition system (DAS)
 - e. slip rings
 - 2. array processor and host computer
 - 3. external equipment (e.g., cables, cords, table, accessories, straps)
- B. Imaging Parameters
 - 1. kVp
 - 2. mAs
 - 3. pitch
 - 4. collimation / beam width
 - 5. acquisition slice thickness
 - 6. x, y, z planes
 - 7. scan field of view (SFOV)
- C. Methods of Data Acquisition
 - 1. sequential (e.g., step-and-shoot)
 - 2. helical
 - 3. volumetric
 - 4. shuttle/continuous/cine
 - 5. dual energy / dual source
- D. Image Reconstruction
 - 1. filtered backprojection
 - 2. iterative
 - 3. prospective/retrospective
 - 4. raw data versus image data
 - 5. reconstruction algorithm
 - 6. reconstruction slice thickness
 - 7. reconstruction interval
 - 8. interpolation
- E. Postprocessing
 - 1. multiplanar reformation (MPR)
 - 2. 3D rendering (e.g., MIP, SSD, volume rendering)
 - 3. quantitative analysis (e.g., distance, diameter, calcium scoring)

2. Image Evaluation and Archiving

- A. Image Display
 - 1. pixel, voxel
 - 2. matrix
 - 3. magnification (e.g., pan/zoom)
 - 4. display field of view (DFOV)
 - 5. window level (W/L), window width (W/W)
 - 6. cine loop / matrix
 - 7. distance measurement or region of interest (ROI) (e.g., mean, standard deviation [SD])
- B. Image Quality
 - 1. spatial resolution
 - 2. contrast resolution
 - 3. temporal resolution
 - 4. noise and uniformity
 - 5. quality assurance tests (QA/QC)
 - 6. accreditation
 - 7. CT number (Hounsfield units [HU])
 - 8. linearity
 - 9. x-ray tube warm-up procedures
- C. Artifact Recognition and Reduction
 - 1. beam hardening or cupping
 - 2. partial volume averaging
 - 3. motion
 - 4. metallic
 - 5. edge gradient
 - 6. patient positioning (out-of-field)
 - 7. equipment artifacts
 - a. rings
 - b. streaks
 - c. tube arcing
 - d. cone beam
- D. Informatics
 - 1. information systems (e.g., HIS, RIS, EMR, EHR)
 - 2. hard/electronic copy (e.g., CD)
 - 3. networking
 - a. PACS/MIMPS
 - b. DICOM
 - c. security and confidentiality
 - d. teleradiology (e.g., third-party coverage)
 - 4. downtime procedures



Procedures

TYPE OF STUDY

1. Head, Spine, and Musculoskeletal

A. Head

1. brain/cranium
2. brain perfusion
3. temporal bones /
internal auditory canal (IAC)
4. orbits
5. sinuses
6. maxillofacial bones
7. dedicated mandible
8. temporomandibular joints (TMJs)

B. Spine

1. cervical
2. thoracic
3. lumbosacral
4. postmyelogram

C. Musculoskeletal

1. upper extremity
2. lower extremity
3. postarthrogram
4. shoulder
5. bony pelvis
6. hip

FOCUS OF QUESTIONS

Questions about each of the studies listed on the left may focus on any of the following:

Anatomy and Physiology

- cross sectional anatomy
- pathological considerations/recognition
- landmarks
- vasculature

Factors

- imaging planes
- protocol considerations
- patient considerations
(e.g., infant, young child, geriatric,
bariatric)
- postprocessing presentations

Contrast Media

- indications
- scan/prep delay
- effect on images

Additional Procedures

- vascular (CTA, CTV) (e.g., runoff)
- biopsy
- drainage
- aspiration
- trauma
- surgical planning



Procedures (continued)

TYPE OF STUDY

2. Neck and Chest

- A. Neck
 - 1. larynx/airway
 - 2. soft tissue neck
- B. Chest
 - 1. cardiac
 - a. coronary artery angiogram
 - b. coronary artery calcium scoring
 - c. prospective gating
 - d. retrospective gating
 - e. TAVR
 - 2. mediastinum
 - 3. lungs (e.g., HRCT, ILD, nodule)
 - 4. airway
 - 5. chest wall
 - 6. low-dose lung screening
 - 7. esophagram

3. Abdomen and Pelvis

- A. Abdomen
 - 1. spleen
 - 2. multiphase liver
 - 3. multiphase pancreas
 - 4. multiphase adrenals
 - 5. multiphase kidneys
 - 6. urogram/IVU
 - 7. renal stone
 - 8. GI tract
(e.g., enterography, appendicitis)
- B. Pelvis
 - 1. dedicated delay bladder
 - 2. retrograde cystogram
 - 3. colorectal (rectal contrast)
 - 4. colonography ("virtual")
 - 5. reproductive organs

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Factors

- imaging planes
- protocol considerations
- patient considerations
(e.g., infant, young child, geriatric, bariatric)
- postprocessing presentations

Contrast Media

- indications
- scan/prep delay
- effect on images

Additional Procedures

- vascular (CTA, CTV)
(e.g., PE, dissection, runoff, DVT)
- biopsy
- drainage
- aspiration
- trauma
- surgical planning