



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 performed were determined~~ by administering a comprehensive practice analysis survey to a nationwide sample of ~~computed tomography~~CT technologists.¹ The *Task Inventory for Computed Tomography* ~~may be found~~ is on the 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 can be linked to one or more activities 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 these content outline, but do not limit themselves to only this content.

The table below presents the major content categories ~~and subcategories covered on the examination covers~~. The ~~table lists the~~ number of test questions in each category ~~are listed in bold~~ and number of test questions in each subcategory in parentheses. ~~The content outline, Specific topics within each category are addressed in 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	22
<i>Patient Interactions and Management (22)</i>	
Safety ³	22
<i>Radiation Safety and Dose (22)</i>	
Image Production	50
<i>Image Formation (28)</i>	
<i>Image Evaluation and Archiving (22)</i>	
Procedures	71
<i>Head, Spine, and Musculoskeletal (25)</i>	
<i>Neck and Chest (21)</i>	
<i>Abdomen and Pelvis (25)</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 exam includes an additional 30 unscored (pilot) questions.

3. SI units are the primary (principal) units of radiation measurement used on the ~~computed tomography~~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,
~~physician~~provider)
4. lab values
 - a. renal function (*e.g., eGFR,
creatinine, ~~BUN~~)
 - b. other (e.g., ~~Dd~~-dimer, LFT, INR,
PT, PTT, hCG)
5. patient education
6. consent (e.g., informed, oral, implied)
7. ergonomics and **safe** patient transfer
techniques/**devices**
8. removal ~~of~~ radiopaque materials and
radiosensitive devices
9. positioning aids ~~to eliminate motion~~
~~artifacts and for patient safety~~
(e.g., ~~V~~elcro® straps, padding)
10. **time-out**
11. patient monitoring
 - a. level of consciousness
 - b. fall prevention
 - c. vital signs
 - d. ~~heart rhythm and cardiac~~
~~cycle~~**ECG pattern**
 - e. oximetry
 - f. medical emergency
12. management of accessory
medical devices
 - a. oxygen delivery systems
 - b. chest tubes
 - c. in-dwelling catheters
13. medications and dosage
 - a. current
 - b. pre-procedure medications
(e.g., steroid, anti-anxiety, **TPA**)
 - c. post-procedure 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. ~~ionic~~, nonionic
 - b. osmolarity
 - c. barium sulfate
 - d. water soluble (iodinated)
 - e. air
 - f. water
 - g. other

2. special contrast considerations
 - a. contraindications
 - b. indications
 - c. pregnancy
 - d. lactation
 - e. dialysis patients
3. noncontrast medications
(e.g., lidocaine, nitroglycerin,
metoprolol)
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. ~~medical~~ aseptic and sterile
technique
 - c. documentation (e.g., site, amount,
gauge, concentration, **flow** rate,
~~and~~ number of attempts)
6. injection techniques
 - a. safety
 - b. manual
 - c. power injector options
 1. single **head**
 2. ~~or~~ dual head
 3. **syringeless**
 4. single phase
 5. multi-phase
 6. flow rate
7. **scanning techniques**
 - a. **timing bolus**
 - b. **bolus tracking**
 - c. **scan delay**
8. post-procedure care
 - a. complications
(e.g., extravasation/infiltration)
 - b. documentation
9. adverse reactions
 - a. recognition and assessment (e.g.,
call a code, retrieve crash cart)
 - b. treatment (e.g., **initiate CPR**),
 - c. documentation

*The abbreviation "e.g.," is used to indicate that examples are listed in parenthesis, but that it is not a complete list of all possibilities.

*e.g., is used to indicate examples of the topics covered, but not a complete list

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. overranging
 - 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/dose 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. tube (e.g., cathode, anode)
~~1. x-ray production~~
 - b. generator
 - c. detectors
 - 1. ~~detector~~ configuration
 - 2. ~~detector~~ 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. axial/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 ~~reconstruction~~
 - 2. iterative ~~reconstruction~~
 - 3. prospective/retrospective ~~reconstruction~~
 - 4. raw data versus image data
 - 5. reconstruction algorithm
 - 6. reconstruction slice thickness
 - 7. reconstruction interval
 - 8. interpolation
- E. Post-Processing
 - 1. multi-planar reformation (MPR)
 - 2. 3D rendering (e.g., MIP, SSD, VR)
 - 3. quantitative analysis (e.g., distance, diameter, calcium scoring, ejection fraction)

2. Image Evaluation and Archiving

- A. Image Display
 - 1. pixel, voxel
 - 2. matrix
 - 3. ~~image~~ magnification
 - 4. display field of view (DFOV)
 - 5. window level (W/L), window width (W/W)
 - 6. cine loop/matrix
 - 7. ~~geometric~~ 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. ~~and~~ accreditation
 - 7. CT number (Hounsfield units [HU])
 - 8. linearity
 - 9. 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. ~~hard/electronic copy~~ (e.g., DICOM file format)
 - 2. ~~archive~~
 - 3. ~~electronic medical record (EMR)~~
 - 4. ~~networking~~
- 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
 - ~~a.~~d. teleradiology (e.g., third party coverage)
 - 4.4. 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 (IACs)
4. orbits
5. sinuses
6. maxillofacial bones
7. ~~and/or~~ dedicated mandible
8. temporomandibular joints (TMJs)

B. Spine

1. cervical
2. thoracic
3. lumbosacral
4. ~~sacrum/coccyx~~
4. post-myelography

C. Musculoskeletal

1. upper extremity
2. lower extremity
3. arthrography
4. shoulder ~~and/or~~ scapula
5. bony pelvis ~~and/or~~
6. hips

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., pediatric, geriatric, bariatric)
- post-processing presentations

Contrast Media

- indications
- scan/prep delay
- effect on images

Additional Procedures/Examinations

- vascular (CTA, CTV)
(e.g., ~~PE, dissection, runoff, venogram~~)
- biopsies
- drainages
- aspirations
- trauma
- surgical planning

(Procedures continue on the following page.)

Procedures (continued)

TYPE OF STUDY

2. Neck and Chest

- A. Neck
 - 1. larynx/airway
 - 2. soft tissue neck
- B. Chest
 - 1. **heart**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. **biliary**
 - 2. spleen
 - 3. multiphase liver
 - 4. multiphase pancreas
 - 5. multiphase adrenals
 - 6. multiphase kidneys **and/or ureters**
 - 7. urogram/IVU
 - 8. renal stone
 - 9. 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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