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# CONTENT SPECIFICATIONS FOR THE EXAMINATION IN COMPUTED TOMOGRAPHY



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The purpose of the ARRT Examination in Computed Tomography is to assess the knowledge and cognitive skills underlying the performance of the tasks typically required of staff technologists practicing in this specialized area. In order to identify the knowledge and skills covered by the examination, the ARRT conducted a practice analysis study involving a nationwide sample of CT technologists<sup>1</sup>. The results of the practice analysis are reflected in this document.

The table below presents the three major content categories covered on the examination, along with the number of test questions in each major category. The remaining pages of this document list the specific topics addressed within each major content category. The approximate number of test questions allocated to each content category appears in parentheses.

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

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<b>CONTENT CATEGORY</b>	<b>NUMBER OF QUESTIONS<sup>2</sup></b>
A. Patient Care	31
B. Imaging Procedures	76
C. Physics and Instrumentation	<u>58</u>
	165

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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. Each exam includes an additional 20 unscored (pilot) questions. On the pages that follow, the approximate number of test questions allocated to each content category appears in parentheses.

## A. PATIENT CARE (31)

### 1. Patient Preparation (2)

- a. Consent
- b. Scheduling and Screening
- c. Patient Education
- d. Immobilization

### 2. Patient Assessment (4)

- a. History
- b. Monitoring
  1. vital signs
  2. heart rhythm and cardiac cycle
  3. oximetry
- c. Lab Values
  1. renal function (e.g., BUN, creatinine clearance, GFR, creatinine)
  2. blood coagulation (e.g., PT, PTT, platelet, INR)
  3. other (e.g., D-dimer)
- d. Medications

### 3. IV Procedures (5)

- a. Venipuncture
  1. site selection
  2. aseptic and sterile technique
- b. Injection Techniques
  1. manual
  2. automatic
    - a. single phase
    - b. multi-phase
    - c. flow rate

### 4. Contrast Agents (10)

- a. Types
  1. ionic, non-ionic
  2. hyper-osmolar, iso-osmolar
  3. barium sulfate
  4. water soluble (iodinated)
  5. air
  6. water
- b. Administration Route and Dose Calculations
  1. IV
  2. oral
  3. rectal
  4. intrathecal
  5. catheters
  6. intra-articular
- c. Special Considerations
  1. allergy preparation
  2. pathologic processes
  3. contraindications
  4. indications
- d. Adverse Reactions
  1. recognition and assessment of symptoms
  2. treatment (e.g., compresses, medications)
  3. documentation

### 5. Radiation Safety and Dosimetry (10)

- a. Technical Factors Affecting Patient Dose
  1. kVp
  2. mAs
  3. pitch
  4. collimation
  5. mA modulation techniques
  6. multidetector configuration
  7. gating
- b. Radiation Protection
- c. Dose Measurement
  1. CT Dose Index (CTDI)
  2. Multiple Scan Average Dose (MSAD)
  3. Dose Length Product (DLP)
- d. Patient Dose Reduction
  1. pediatric
  2. adult

## B. IMAGING PROCEDURES (76)

<u>TYPE OF STUDY</u>	<u>APPROX. # QUESTIONS</u>	<u>FOCUS OF QUESTIONS</u>
<b>1. Head</b> a. cranial nerves b. internal auditory canal c. petrous pyramid d. pituitary e. orbit f. paranasal sinuses g. maxillofacial h. temporomandibular joint i. posterior fossa j. brain k. cranium l. vascular	(13)	<p><i>Questions about each of the studies listed on the left may focus on any of the following relevant factors:</i></p> <ol style="list-style-type: none"> <li>1. Sectional Anatomy               <ul style="list-style-type: none"> <li>• sagittal plane</li> <li>• transverse plane (axial)</li> <li>• coronal plane</li> <li>• off-axis (oblique)</li> <li>• landmarks</li> <li>• pathology recognition</li> </ul> </li> <li>2. Contrast Media               <ul style="list-style-type: none"> <li>• types of agents</li> <li>• indications</li> <li>• contraindications</li> <li>• dose calculation</li> <li>• administration route</li> <li>• scan/prep delay (e.g., bolus timing, text bolus)</li> </ul> </li> <li>3. Scanning Procedures               <ul style="list-style-type: none"> <li>• positioning</li> <li>• scout</li> <li>• acquisition methods (e.g., volumetric, axial or sequential)</li> <li>• parameter selection (e.g., slice thickness, mA, time, algorithm, pitch)</li> <li>• protocol modification for pathology or trauma</li> <li>• CT angiography</li> <li>• cardiac gating</li> </ul> </li> <li>4. Special Procedures               <ul style="list-style-type: none"> <li>• 3-D studies</li> <li>• biopsies</li> <li>• radiation therapy planning</li> <li>• drainage</li> <li>• post myelography</li> <li>• CT arthrography</li> <li>• hybrid imaging</li> </ul> </li> </ol>
<b>2. Neck</b> a. larynx b. soft tissue neck c. vascular	(7)	
<b>3. Chest</b> a. mediastinum b. lung c. heart d. airway e. vascular	(14)	
<b>4. Abdomen</b> a. liver b. biliary c. spleen d. pancreas e. adrenals f. kidneys/ureters g. peritoneum h. retroperitoneum i. GI tract j. vascular	(23)	
<b>5. Pelvis</b> a. bladder b. colorectal c. reproductive organs d. vascular	(6)	
<b>6. Musculoskeletal</b> a. upper extremity b. lower extremity c. spine d. pelvis; hips e. shoulder f. sternum g. vascular	(13)	

## C. PHYSICS AND INSTRUMENTATION (58)

### 1. CT System Principles, Operation and Components (17)

- a. Tube
  1. kVp
  2. mA
  3. warm-up procedures
- b. Generator and Transformers
- c. Detector Configuration
- d. Data Acquisition Systems (DAS)
- e. Collimation
- f. Computer and Array Processor
- g. Equipment Maintenance

### 2. Image Processing (10)

- a. Reconstruction
  1. filtered back projection reconstruction
  2. reconstruction filters (algorithms)
  3. raw data vs. image data
  4. prospective/retrospective reconstruction
  5. effective slice thickness
  6. reconstruction interval
- b. Post-Processing
  1. multiplanar reformation
  2. 3-D rendering (MIP, SSD, VR)
  3. quantitative analysis (e.g., distance, diameter, calcium scoring, ejection fraction)

### 3. Image Display (10)

- a. Pixel, Voxel
- b. Matrix
- c. Image Magnification
- d. Field of View (scan, reconstruction and display)
- e. Attenuation Coefficient
- f. Window Level, Window Width
- g. Plane Specification (x, y, z Coordinates)
- h. Cine
- i. ROI (single and multiple image)

### 4. Informatics (5)

- a. Hard/Soft Copy (e.g., DICOM file format)
- b. Storage/Archive
- c. PACS
- d. Security and Confidentiality
- e. Networking

### 5. Image Quality (10)

- a. Spatial Resolution
- b. Contrast Resolution
- c. Temporal Resolution
- d. Noise and Uniformity
- e. Quality Assurance
- f. CT Number
- g. Linearity

### 6. Artifact Recognition and Reduction (6)

- a. Beam Hardening
- b. Partial Volume Averaging
- c. Motion
- d. Metallic
- e. Edge Gradient
- f. Patient Positioning
- g. Equipment-Induced
  1. rings
  2. streaks
  3. tube arcing
  4. cone beam