

---

## CONTENT SPECIFICATIONS FOR THE EXAMINATION IN RADIOGRAPHY



Publication Date: August 2007

Implementation Date: January 2008

---

The purpose of the ARRT Examination in Radiography is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of the staff technologist at entry into the profession. To identify the knowledge and skills covered by the examination, the ARRT periodically conducts practice analysis studies involving a nationwide sample of staff technologists<sup>1</sup>. The results of the most recent practice analysis are reflected in this document. The complete task inventory, which serves as the basis for these content specifications, is available from our website [www.arrt.org](http://www.arrt.org).

The table below presents the five major content categories, along with the number and percentage of test questions appearing in each category. The remaining pages provide a detailed listing of topics addressed within each major content category.

This document is not intended to serve as a curriculum guide. Although certification programs and educational programs may have related purposes, their functions are clearly different. Educational programs are generally broader in scope and address subject matter not included in these content specifications.

---

CONTENT CATEGORY	PERCENT OF TEST	NUMBER OF QUESTIONS <sup>2</sup>
A. Radiation Protection	20%	40
B. Equipment Operation and Quality Control	12%	24
C. Image Production and Evaluation	25%	50
D. Radiographic Procedures	30%	60
E. Patient Care and Education	<u>13%</u>	<u>26</u>
	100%	200

---

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 up to 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.

*(continued on next page)*

## A. RADIATION PROTECTION (40)

### I. Biological Aspects of Radiation (10)

- A. Radiosensitivity
  - 1. dose-response relationships
  - 2. relative tissue radio sensitivities (e.g., LET, RBE)
  - 3. cell survival and recovery ( $LD_{50}$ )
- B. Somatic Effects
  - 1. short-term versus long-term effects
  - 2. acute versus chronic effects
  - 3. carcinogenesis
  - 4. eye/thyroid
  - 5. reproductive (sterility)
- C. Systemic Responses
  - 1. CNS
  - 2. hemopoietic
  - 3. skin
  - 4. GI
- D. Embryonic and Fetal Risks
- E. Genetic Impact
  - 1. genetic significant dose
  - 2. goals of gonadal shielding

### II. Minimizing Patient Exposure (12)

- A. Exposure Factors
  - 1. kVp
  - 2. mAs
- B. Shielding
  - 1. rationale for use
  - 2. types
  - 3. placement
- C. Beam Restriction
  - 1. purpose of primary beam restriction
  - 2. types (e.g. collimators)
- D. Filtration
  - 1. effect on skin and organ exposure
  - 2. effect on average beam energy
  - 3. NCRP recommendations (NCRP #102, minimum filtration in useful beam)
- E. Exposure Reduction
  - 1. patient positioning
  - 2. automatic exposure control (AEC)
  - 3. patient communication
- F. Image Receptors (e.g., types, relative speed, digital vs. film)
- G. Grids
- H. Fluoroscopy
  - 1. pulsed
  - 2. exposure factors
  - 3. grids
  - 4. positioning
  - 5. fluoroscopy time

(Section A continues on the following page)

## A. RADIATION PROTECTION (cont.)

### III. Personnel Protection (9)

- A. Sources of Radiation Exposure
  - 1. primary x-ray beam
  - 2. secondary radiation
    - a. scatter
    - b. leakage
  - 3. patient as source
- B. Basic Methods of Protection
  - 1. time
  - 2. distance
  - 3. shielding
- C. Protective Devices
  - 1. types
  - 2. attenuation properties
  - 3. minimum lead equivalent (NCRP #102)
- D. Special Considerations
  - 1. portable (mobile) units
  - 2. fluoroscopy
    - a. protective drapes
    - b. protective Bucky slot cover
    - c. cumulative timer
  - 3. guidelines for fluoroscopy and portable units (NCRP #102, CFR-21)
    - a. fluoroscopy exposure rates
    - b. exposure switch guidelines

### IV. Radiation Exposure and Monitoring (9)

- A. Units of Measurement\*
  - 1. absorbed dose (rad)
  - 2. dose equivalent (rem)
  - 3. exposure (Roentgen)
- B. Dosimeters
  - 1. types
  - 2. proper use
- C. NCRP Recommendations for Personnel Monitoring (NCRP #116)
  - 1. occupational exposure
  - 2. public exposure
  - 3. embryo/fetus exposure
  - 4. ALARA and dose equivalent limits
  - 5. evaluation and maintenance of personnel dosimetry records

---

\*Conventional units are generally used. However, questions referenced to specific reports (e.g., NCRP) will use SI units to be consistent with such reports.

(continued on next page)

## B. EQUIPMENT OPERATION AND QUALITY CONTROL (24)

### I. Principles of Radiation Physics (10)

- A. X-Ray Production
  - 1. source of free electrons (e.g., thermionic emission)
  - 2. acceleration of electrons
  - 3. focusing of electrons
  - 4. deceleration of electrons
- B. Target Interactions
  - 1. bremsstrahlung
  - 2. characteristic
- C. X-Ray Beam
  - 1. frequency and wavelength
  - 2. beam characteristics
    - a. quality
    - b. quantity
    - c. primary vs. remnant (exit)
  - 3. inverse square law
  - 4. fundamental properties (e.g., travel in straight lines, ionize matter)
- D. Photon Interactions with Matter
  - 1. Compton effect
  - 2. photoelectric absorption
  - 3. coherent (classical) scatter
  - 4. attenuation by various tissues
    - a. thickness of body part (density)
    - b. type of tissue (atomic number)

### II. Radiographic Equipment (10)

- A. Components of Basic Radiographic Unit
  - 1. operating console
  - 2. x-ray tube construction
    - a. electron sources
    - b. target materials
    - c. induction motor
  - 3. automatic exposure control (AEC)
    - a. radiation detectors
    - b. back-up timer
    - c. density adjustment (e.g. +1 or -1)
  - 4. manual exposure controls
  - 5. beam restriction devices
- B. X-Ray Generator, Transformers, and Rectification System
  - 1. basic principles
  - 2. phase, pulse, and frequency
- C. Fluoroscopic Unit
  - 1. image intensifier
  - 2. viewing systems
  - 3. recording systems
  - 4. automatic brightness control (ABC)
- D. Image Display
  - 1. viewing conditions (i.e., luminance, ambient lighting)
  - 2. spatial resolution
  - 3. contrast resolution/dynamic range
  - 4. DICOM gray scale function
  - 5. window level and width function
- E. Image Acquisition and Readout
  - 1. PSP (photo-stimulable phosphor)
  - 2. flat panel detectors (direct and indirect)

(Section B continues on the following page)