



# Limited Scope of Practice in Radiography

The purpose of the *Limited Scope of Practice in Radiography Examination*, which is developed and administered by *The American Registry of Radiologic Technologists (ARRT)* on behalf of state licensing agencies, is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of operators of radiographic equipment used to radiograph selected anatomic regions (chest, extremities, etc.). ARRT administers the examination to state approved candidates under contractual arrangement with the state and provides the results directly to the state. This examination is not associated with any type of certification and registration by the ARRT.

The knowledge and skills covered by the examination were determined by administering a comprehensive practice analysis survey to a nationwide sample of radiographers and adopting a subset of the tasks developed for the radiography task inventory as the limited scope task inventory. The task inventory appears in *Attachment D* of this document. The content specifications for the limited scope examination identify the knowledge areas underlying performance of the tasks on the limited scope task inventory. Every content category can be linked to one or more activities on the task inventory.

It is the philosophy of the ARRT that an individual licensed in limited scope radiography possess the same knowledge and cognitive skill, in his or her specific area of radiography, as radiographers. The modules covered by the examination are outlined below. Subsequent pages describe in detail the topics covered within each module. All candidates take the CORE module of the examination and one or more PROCEDURE modules, depending on the type of license for which they have applied.

| <b>Core Module</b>                                     | <b>Number of Scored Questions<sup>1</sup></b> | <b>Testing Time</b> |
|--|---|---------------------|
| Patient Care   | 18  |                     |
| <i>Patient Interactions and Management (18)</i>        |   |                     |
| Safety <sup>2</sup>                                    | 40  |                     |
| <i>Radiation Physics and Radiobiology (12)</i>         |   |                     |
| <i>Radiation Protection (28)</i>                       |   |                     |
| Image Production                                       | 42  |                     |
| <i>Image Acquisition and Technical Evaluation (20)</i> |   |                     |
| <i>Equipment Operation and Quality Assurance (22)</i>  |   |                     |
| <b>Total for Core Module</b>                           | <b>100</b>                                    | <b>1 hr, 55 min</b> |
| <b>Procedure Modules</b>                               |   |                     |
| 1. Chest   | 20  | 25 min              |
| 2. Extremities   | 25  | 30 min              |
| 3. Skull/Sinuses                                       | 20  | 25 min              |
| 4. Spine   | 25  | 30 min              |
| 5. Podiatric   | 20  | 25 min              |

<sup>1</sup> The core module includes an additional 15 unscored (pilot) questions. Each of the procedure modules has five additional unscored questions.

<sup>2</sup> SI units will become the primary (principle) units of radiation measurement used on the limited scope of practice in radiography examination in 2018.



## Patient Care

### 1. Patient Interactions and Management

#### A. Ethical and Legal Aspects

1. patient's rights
  - a. informed consent (\*e.g., written, oral, implied)
  - b. confidentiality (HIPAA)
  - c. American Hospital Association (AHA) Patient Care Partnership (Patient's Bill of Rights)
    1. privacy
    2. extent of care (e.g., DNR)
    3. access to information
    4. living will, health care proxy, advanced directives
    5. research participation
2. legal issues
  - a. verification (e.g., patient identification, compare order to clinical indication)
  - b. common terminology (e.g., battery, negligence, malpractice, beneficence)
  - c. legal doctrines (e.g., respondeat superior, res ipsa loquitur)
  - d. restraints versus immobilization
  - e. manipulation of electronic data (e.g., exposure indicator, processing algorithm, brightness and contrast, cropping or masking off anatomy)

#### 3. Professional Ethics

#### B. Interpersonal Communication

1. modes of communication
  - a. verbal/written
  - b. nonverbal (e.g., eye contact, touching)
2. challenges in communication
  - a. interactions with others
    1. language barriers
    2. cultural and social factors
    3. physical or sensory impairments
    4. age
    5. emotional status, acceptance of condition
  - b. explanation of medical terms
  - c. strategies to improve understanding
3. patient education (e.g., explanation of current procedure purpose, exam length)

#### C. Physical Assistance and Monitoring

1. patient transfer and movement
  - a. body mechanics (e.g., balance, alignment, movement)
  - b. patient transfer techniques
2. assisting patients with medical equipment (e.g., oxygen delivery systems, urinary catheters)
3. routine monitoring
  - a. vital signs
  - b. physical signs and symptoms (e.g., motor control, severity of injury)
  - c. fall prevention
  - d. documentation

#### D. Medical Emergencies

1. allergic reactions (e.g., contrast media, latex)
2. cardiac or respiratory arrest (e.g., CPR)
3. physical injury or trauma
4. other medical disorders (e.g., seizures, diabetic reactions)

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

(Patient Care continues on the following page.)



## Patient Care (continued)

- E. Infection Control
    - 1. cycle of infection
      - a. pathogen
      - b. reservoir
      - c. portal of exit
      - d. mode of transmission
        - 1. direct
          - a. droplet
          - b. direct contact
        - 2. indirect
          - a. airborne
          - b. vehicle borne–fomite
          - c. vector borne–mechanical or biological
      - e. portal of entry
      - f. susceptible host
    - 2. asepsis
      - a. equipment disinfection
      - b. equipment sterilization
      - c. medical aseptic technique
      - d. sterile technique
  - 3. CDC Standard Precautions
    - a. hand hygiene
    - b. use of personal protective equipment (e.g., gloves, gowns, masks)
    - c. safe injection practices
    - d. safe handling of contaminated equipment/surfaces
    - e. disposal of contaminated materials
      - 1. linens
      - 2. needles
      - 3. patient supplies
      - 4. blood and body fluids
  - 4. transmission-based precautions
    - a. contact
    - b. droplet
    - c. airborne
  - 5. additional precautions
    - a. neutropenic precautions (reverse isolation)
    - b. healthcare associated (nosocomial) infections
- F. Handling and Disposal of Toxic or Hazardous Material
  - 1. chemicals
  - 2. safety data sheet (e.g., material safety data sheets)



## Safety

### 1. Radiation Physics and Radiobiology

#### A. Principles of Radiation Physics

1. x-ray production
  - a. source of free electrons (e.g., thermionic emission)
  - b. acceleration of electrons
  - c. focusing of electrons
  - d. deceleration of electrons
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 (e.g., travel in straight lines, ionize matter)
4. photon interactions with matter
  - a. Compton effect
  - b. photoelectric absorption
  - c. coherent (classical) scatter
  - d. attenuation by various tissues
    1. thickness of body part
    2. type of tissue (atomic number)

#### B. Biological Aspects of Radiation

1. SI units of measurement
  - a. absorbed dose
  - b. dose equivalent
  - c. exposure
  - d. effective dose
2. radiosensitivity
  - a. dose-response relationships
  - b. relative tissue radiosensitivities (e.g., LET, RBE)
  - c. cell survival and recovery (LD50)
  - d. oxygen effect
3. somatic effects
  - a. short-term versus long-term effects
  - b. acute versus chronic effects
  - c. carcinogenesis
  - d. organ and tissue response (e.g., eye, thyroid, breast, bone marrow, skin, gonadal)
4. acute radiation syndromes
  - a. hemopoietic
  - b. gastrointestinal (GI)
  - c. central nervous system (CNS)
5. embryonic and fetal risks
6. genetic impact
  - a. genetically significant dose
  - b. goals of gonadal shielding

(Safety continues on the following page.)



## Safety (continued)

### 2. Radiation Protection

#### A. Minimizing Patient Exposure

1. exposure factors
  - a. kVp
  - b. mAs
2. shielding
  - a. rationale for use
  - b. types
  - c. placement
3. beam restriction
  - a. purpose of primary beam restriction
  - b. types (e.g., collimators)
4. filtration
  - a. effect on skin and organ exposure
  - b. effect on average beam energy
  - c. NCRP recommendations (NCRP #102, minimum filtration in useful beam)
5. patient considerations
  - a. positioning
  - b. communication
  - c. pediatric
  - d. morbid obesity
6. radiographic dose documentation
7. image receptors
8. dose area product (DAP) meter

#### B. Personnel Protection (ALARA)\*

1. sources of radiation exposure
  - a. primary x-ray beam
  - b. secondary radiation
    1. scatter
    2. leakage
  - c. patient as source
2. basic methods of protection
  - a. time
  - b. distance
  - c. shielding
3. protective devices
  - a. types
  - b. attenuation properties
  - c. minimum lead equivalent (NCRP #102)
4. radiation exposure and monitoring
  - a. dosimeters
    1. types
    2. proper use
  - b. NCRP recommendations for personnel monitoring (NCRP #116)
    1. occupational exposure
    2. public exposure
    3. embryo/fetus exposure
    4. dose equivalent limits
    5. evaluation and maintenance of personnel dosimetry records

\* Note: Although it is the responsibility of the individual licensed in limited scope radiography to apply radiation protection principles to minimize bioeffects for both patients and personnel, the ALARA concept is specific to personnel protection and is listed only for that section.



## Image Production

### 1. Image Acquisition and Technical Evaluation

#### A. Selection of Technical Factors Affecting Radiographic Quality

Refer to *Attachment C* to clarify terms that may occur on the exam. (X indicates topics covered on the examination.)

|                                      | 1.<br>Receptor<br>Exposure | 2.<br>Contrast | 3.<br>Spatial<br>Resolution | 4.<br>Distortion |
|--------------------------------------|----------------------------|----------------|-----------------------------|------------------|
| a. mAs                               | X                          |                |                             |                  |
| b. kVp                               | X                          | X              |                             |                  |
| c. OID                               |                            | X (air gap)    | X                           | X                |
| d. SID                               | X                          |                | X                           | X                |
| e. focal spot size                   |                            |                | X                           |                  |
| f. tube filtration                   | X                          | X              |                             |                  |
| g. beam restriction                  | X                          | X              |                             |                  |
| h. motion                            |                            |                | X                           |                  |
| i. anode heel effect                 | X                          |                |                             |                  |
| j. patient factors (size, pathology) | X                          | X              | X                           | X                |
| k. angle (tube, part, or receptor)   |                            |                | X                           | X                |

#### B. Technique Charts

1. anatomically programmed technique
2. caliper measurement
3. fixed versus variable kVp
4. special considerations
  - a. pathologic factors
  - b. age (e.g., pediatric, geriatric)
  - c. body mass index (BMI)

#### C. Digital Imaging Characteristics

1. spatial resolution (equipment related)
  - a. pixel characteristics (e.g., size, pitch)
  - b. detector element (DEL) (e.g., size, pitch, fill factor)
  - c. matrix size
  - d. sampling frequency

#### 2. contrast resolution (equipment related)

- a. bit depth
- b. modulation transfer function (MTF)
- c. detective quantum efficiency (DQE)
3. image signal (exposure related)
  - a. dynamic range
  - b. quantum noise (quantum mottle)
  - c. signal to noise ratio (SNR)
  - d. contrast to noise ratio (CNR)

#### D. Image Identification

1. methods (e.g., radiographic, electronic)
2. legal considerations (e.g., patient data, examination data)

(Image Production continues on the following page.)



## Image Production (continued)

### 2. Equipment Operation and Quality Assurance

#### A. Imaging Equipment

1. components of radiographic unit (fixed or mobile)
  - a. operating console
  - b. x-ray tube construction
    1. electron source
    2. target materials
    3. induction motor
  - c. manual exposure controls
  - d. beam restriction
2. x-ray generator, transformers and rectification system
  - a. basic principles
  - b. tube loading
3. components of digital imaging
  - a. CR components
    1. plate (e.g., photo-stimulable phosphor [PSP])
    2. plate reader
  - b. DR image receptors
    1. flat panel
    2. charge coupled device (CCD)
    3. complementary metal oxide semiconductor (CMOS)

#### B. Image Processing and Display

1. raw data (pre-processing)
  - a. analog-to-digital converter (ADC)
  - b. quantization
  - c. corrections (e.g., rescaling, flat fielding, dead pixel correction)
  - d. histogram
2. corrected data for processing
  - a. grayscale
  - b. edge enhancement
  - c. equalization
  - d. smoothing
3. data for display
  - a. values of interest (VOI)
  - b. look-up table (LUT)
4. post-processing
  - a. brightness
  - b. contrast
  - c. region of interest (ROI)
  - d. electronic cropping or masking
  - e. stitching
5. display monitors
  - a. viewing conditions (e.g., viewing angle, ambient lighting)
  - b. spatial resolution (e.g., pixel size, pixel pitch)
  - c. brightness and contrast
6. imaging informatics
  - a. DICOM
  - b. PACS
  - c. RIS (modality work list)
  - d. HIS
  - e. EMR or EHR

(Image Production continues on the following page.)



## Image Production (continued)

### C. Criteria for Image Evaluation of Technical Factors

1. exposure indicator
2. quantum noise (quantum mottle)
3. gross exposure error (e.g., loss of contrast, saturation)
4. contrast
5. spatial resolution
6. distortion (e.g., size, shape)
7. identification markers (e.g., anatomical side, patient, date)
8. image artifacts
9. radiation fog

### D. Quality Control of Imaging Equipment and Accessories

1. beam restriction
  - a. light field to radiation field alignment
  - b. central ray alignment
2. recognition and reporting of malfunctions
3. digital imaging receptor systems
  - a. maintenance (e.g., detector calibration, plate reader calibration)
  - b. QC tests (e.g., erasure thoroughness, plate uniformity, spatial resolution)
  - c. display monitor quality assurance (e.g., grayscale standard display function, luminance)
4. shielding accessories (e.g., lead apron, glove testing)





## Procedures

The specific positions and projections within each anatomic region that may be covered on the examination are listed in *Attachment A*. A guide to positioning terminology appears in *Attachment B*.

| <b>PROCEDURE<br/>MODULE</b> <sup>1</sup>   | <b># QUESTIONS<br/>PER MODULE</b> <sup>2</sup> | <b>FOCUS OF QUESTIONS</b> <sup>3</sup>   |
|--|--|--|
| <b>1. Chest</b>  |  |  |
| A. Routine   | 16   | 1. <b>Positioning</b> (e.g., topographic landmarks, body positions, path of central ray, immobilization devices, respiration)                                      |
| B. Other   | <u>4</u>                                       |  |
| <b>TOTAL</b>   | <b>20</b>                                      | emphasis: high   |
| <b>2. Extremities</b>  |  |  |
| A. Lower (toes, foot, calcaneus, ankle, tibia/fibula, knee/ patella, and distal femur) | 11   | 2. <b>Anatomy</b> (including physiology, basic pathology, and related medical terminology)   |
| B. Upper (fingers, hand, wrist, forearm, elbow, and humerus)                           | 11   |  |
| C. Pectoral Girdle (shoulder, scapula, clavicle, and acromioclavicular joints)         | <u>3</u>                                       | emphasis: medium   |
| <b>TOTAL</b>   | <b>25</b>                                      | 3. <b>Evaluation of displayed anatomical structures</b> (e.g., patient positioning, tube-part-image receptor alignment)  |
| <b>3. Skull/Sinuses</b>  |  |  |
| A. Skull   | 8  | emphasis: medium   |
| B. Paranasal Sinuses   | 8  |  |
| C. Facial Bones (orbits, nasal bones)  | <u>4</u>                                       | 4. <b>Procedure adaptation</b> (e.g., body habitus, body mass index, trauma, pathology, age, limited mobility, casts, splints, soft tissue for foreign body, etc.) |
| <b>TOTAL</b>   | <b>20</b>                                      |  |
| <b>4. Spine</b>  |  |  |
| A. Cervical Spine  | 8  | emphasis: low  |
| B. Thoracic Spine  | 6  |  |
| C. Lumbar Spine  | 8  | 5. <b>Equipment and Accessories</b> (grids or Bucky, compensating filter, automatic exposure control [AEC], automatic collimation)                                 |
| D. Sacrum, Coccyx, and Sacroiliac Joints   | 2  |  |
| E. Scoliosis Series  | <u>1</u>                                       |  |
| <b>TOTAL</b>   | <b>25</b>                                      | emphasis: low  |
| <b>5. Podiatric</b>  |  |  |
| A. Foot and Toes   | 14   |  |
| B. Ankle   | 5  |  |
| C. Calcaneus (os calcis)   | <u>1</u>                                       |  |
| <b>TOTAL</b>   | <b>20</b>                                      |  |

### Notes:

- Examinees take one or more procedure modules, depending on the type of license they have applied for. Each procedure module has 20 or 25 scored test questions, depending on the module (see chart above). The number of questions within a module should be regarded as approximate values.
- Each of the procedure modules has five additional unscored questions.
- The procedure modules may include questions about the five areas listed under *FOCUS OF QUESTIONS* on the right side of the chart. The podiatric module does not include questions from the equipment and accessories section.



## Attachment A

### Radiographic Positions and Projections

- I. Chest**
  - A. Chest
    1. PA or AP upright
    2. lateral upright
    3. AP Lordotic
    4. AP supine
    5. lateral decubitus
    6. anterior and posterior obliques
- II. Extremities**
  - A. Toes
    1. AP, entire forefoot
    2. AP or AP axial toe
    3. oblique toe
    4. lateral toe
    5. sesamoids, tangential
  - B. Foot
    1. AP axial
    2. medial oblique
    3. lateral oblique
    4. lateral
    5. AP axial weight bearing
    6. lateral weight bearing
  - C. Calcaneus
    1. lateral
    2. plantodorsal, axial
    3. dorsoplantar, axial
  - D. Ankle
    1. AP
    2. mortise
    3. lateral
    4. medial oblique
    5. AP stress views
    6. AP weight bearing
    7. lateral weight bearing
  - E. Tibia/Fibula
    1. AP
    2. lateral
  - F. Knee/patella
    1. AP
    2. Lateral
    3. AP weight bearing
    4. lateral oblique
    5. medial oblique
    6. PA axial–intercondylar fossa (Holmblad)
    7. PA axial–intercondylar fossa (Camp Coventry)
    8. AP axial–intercondylar fossa (Béclère)
    9. PA patella
    10. Tangential (Merchant)
    11. tangential (Settegast)
    12. tangential (Hughston)
  - G. Femur (Distal)
    1. AP
    2. lateral
  - H. Fingers
    1. PA entire hand
    2. PA finger only
    3. lateral
    4. medial and/or lateral oblique
    5. AP thumb
    6. medial oblique thumb
    7. lateral thumb
  - I. Hand
    1. PA
    2. lateral
    3. lateral oblique
  - J. Wrist
    1. PA
    2. lateral oblique
    3. lateral
    4. PA–ulnar deviation
    5. PA axial (Stecher)
    6. tangential carpal canal (Gaynor-Hart)
  - K. Forearm
    1. AP
    2. lateral
  - L. Elbow
    1. AP
    2. lateral
    3. lateral oblique
    4. medial oblique
    5. AP partial flexion
    6. trauma axial laterals (Coyle)
  - M. Humerus
    1. AP
    2. lateral
    3. neutral
    4. transthoracic lateral
  - N. Shoulder
    1. AP internal and external rotation
    2. inferosuperior axial (Lawrence)
    3. posterior oblique (Grashey)
    4. AP neutral
    5. scapular Y
  - O. Scapula
    1. AP
    2. lateral
  - P. Clavicle
    1. AP
    2. AP axial
    3. PA axial
  - Q. Acromioclavicular Joints – AP Bilateral With and Without Weights
- III. Skull/Sinuses**
  - A. Skull
    1. AP axial (Towne)
    2. lateral
    3. PA axial (Caldwell)
    4. PA
    5. submentovertex (full basal)
  - B. Facial Bones
    1. lateral
    2. parietoacanthial (Waters)
    3. PA axial (Caldwell)
    4. modified parietoacanthial (modified Waters)
  - C. Nasal Bones
    1. parietoacanthial (Waters)
    2. lateral
    3. PA axial (Caldwell)
  - D. Orbits
    1. parietoacanthial (Waters)
    2. lateral
    3. PA axial (Caldwell)
    4. modified parietoacanthial (modified Waters)
  - E. Paranasal Sinuses
    1. lateral, horizontal beam
    2. PA axial (Caldwell), horizontal beam
    3. parietoacanthial (Waters), horizontal beam
    4. submentovertex (full basal), horizontal beam
- IV. Spine**
  - A. Cervical Spine
    1. AP axial
    2. AP open mouth
    3. lateral
    4. PA axial obliques
    5. AP axial obliques
    6. lateral swimmers
    7. lateral flexion and extension
  - B. Thoracic Spine
    1. AP
    2. lateral, breathing
    3. lateral, expiration
  - C. Lumbar Spine
    1. AP
    2. PA
    3. lateral
    4. L5-S1 lateral spot
    5. posterior oblique
    6. anterior oblique
    7. AP axial L5-S1
    8. AP right and left bending
    9. lateral flexion and extension
  - D. Sacrum and Coccyx
    1. AP axial sacrum
    2. AP axial coccyx
    3. lateral sacrum and coccyx, combined
    4. lateral sacrum or coccyx, separate
  - E. Sacroiliac Joints
    1. AP
    2. posterior oblique
    3. anterior oblique
  - F. Scoliosis Series
    1. AP or PA
    2. lateral
- V. Podiatric**
  - A. Foot and Toes
    1. dorsal plantar (DP)\*
    2. medial oblique
    3. lateral oblique
    4. lateral\*
    5. sesamoidal axial\*
  - B. Ankle\*
    1. AP\*
    2. mortise\*
    3. AP medial oblique\*
    4. AP lateral oblique\*
    5. lateral\*
  - C. Calcaneus
    1. axial calcaneal\*
    2. Harris and Beath (ski-jump)\*

\*weightbearing



## Attachment B Standard Terminology for Positioning and Projection

**Radiographic View:** Describes the body part as seen by the image receptor or other recording medium, such as a fluoroscopic screen. Restricted to the discussion of a *radiograph* or *image*.

**Radiographic Position:** Refers to a specific body position, such as supine, prone, recumbent, erect or Trendelenburg. Restricted to the discussion of the *patient's physical position*.

**Radiographic Projection:** Restricted to the discussion of the *path of the central ray*.

### POSITIONING TERMINOLOGY

#### A. Lying Down

1. *supine* – lying on the back
2. *prone* – lying face downward
3. *decubitus* – lying down with a horizontal x-ray beam
4. *recumbent* – lying down in any position

#### B. Erect or Upright

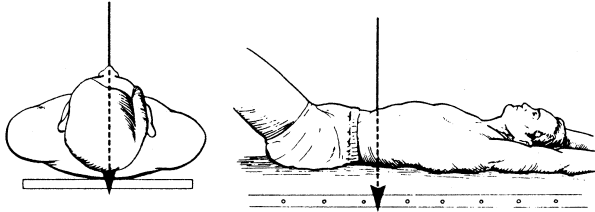
1. *anterior position* – facing the image receptor
2. *posterior position* – facing the radiographic tube

#### C. Either Upright or Recumbent

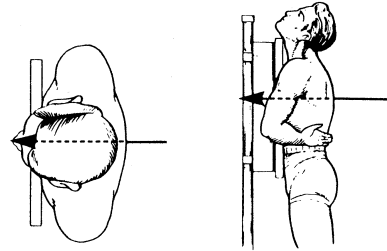
1. oblique torso positions
  - a. anterior oblique (facing the image receptor)
    - i. *left anterior oblique (LAO)* body rotated with the left anterior portion closest to the image receptor
    - ii. *right anterior oblique (RAO)* body rotated with the right anterior portion closest to the image receptor
  - b. posterior oblique (facing the radiographic tube)
    - i. *left posterior oblique (LPO)* body rotated with the left posterior portion closest to the image receptor
    - ii. *right posterior oblique (RPO)* body rotated with the right posterior portion closest to the image receptor
2. oblique extremity positions
  - a. lateral (external) rotation from either prone or supine, outward rotation of the extremity
  - b. medial (internal) rotation from either prone or supine, inward rotation of the extremity



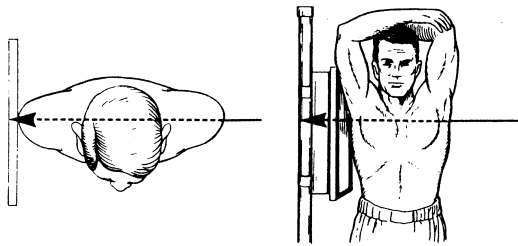
Anteroposterior Projection



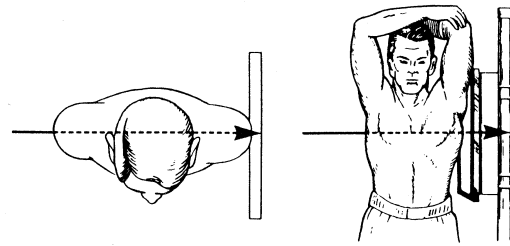
Posteroanterior Projection



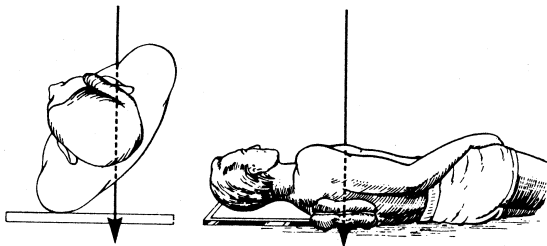
Right Lateral Position



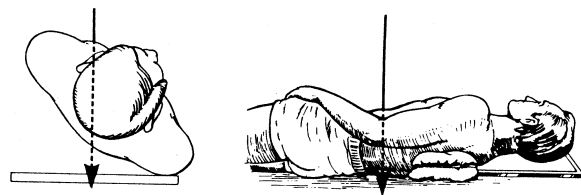
Left Lateral Position



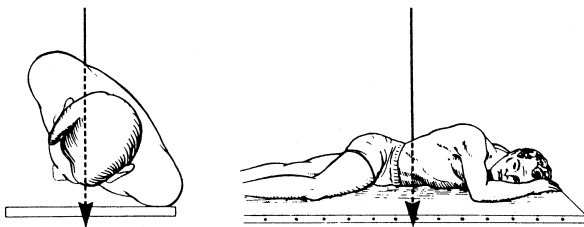
Left Posterior Oblique Position



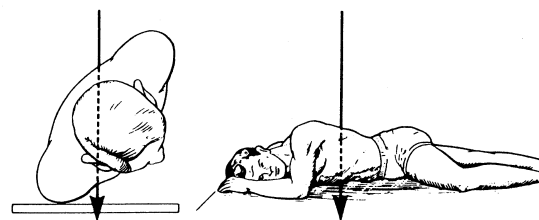
Right Posterior Oblique Position



Left Anterior Oblique Position



Right Anterior Oblique Position





### Attachment C ARRT Standard Definitions

|                     |  |
|---------------------|--|
| Digital Radiography | Digital Radiography includes both computed radiography and direct radiography.<br><u>Computed Radiography (CR)</u> systems use storage phosphors to temporarily store energy representing the image signal. The phosphor then undergoes a process to extract the latent image.<br><u>Direct Radiography (DR)</u> systems have detectors that directly capture and readout an electronic image signal.  |
| Spatial Resolution  | The sharpness of the structural edges recorded in the image.   |
| Receptor Exposure   | The amount of radiation striking the image receptor.   |
| Brightness          | Brightness is the measurement of the luminance of an area in a radiographic image displayed on a monitor. It is calibrated in units of candela (cd) per square meter.  |
| Contrast            | Contrast is the visible difference between any two selected areas of brightness levels within the displayed radiographic image. It is determined primarily by the processing algorithm (mathematical codes used by the software to provide the desired image appearance). The default algorithm determines the initial processing codes applied to the image data.<br><u>Grayscale</u> refers to the number of brightness levels (or gray shades) visible on an image and is linked to the bit depth of the system.<br><u>Long Scale</u> is the term used when slight differences between gray shades are present (low contrast) but the total number of gray shades is great.<br><u>Short Scale</u> is the term used when considerable or major differences between gray shades are present (high contrast) but the total number of gray shades is small. |
| Dynamic Range       | The range of exposures that may be captured by a detector.   |
| Receptor Contrast   | The fixed characteristic of the receptor. Most digital receptors have an essentially linear response to exposure. This is impacted by <b>contrast resolution</b> (the smallest exposure change or signal difference that can be detected). Ultimately, contrast resolution is limited by the <b>quantization</b> (number of bits per pixel) of the analog-to-digital convertor.  |
| Exposure Latitude   | The range of exposures which produces quality images at appropriate patient dose.  |
| Subject Contrast    | The magnitude of the signal difference in the remnant beam as a result of the different absorption characteristics of the tissues and structures making up that part.  |



**Attachment D**  
**Task Inventory for Limited Scope of Practice in Radiography Examination**

| <b>Activity</b>   | <b>Content Categories</b>       |
|---|---------------------------------|
| 1. Confirm patient's identity.  | PC.1.A.2.A., PC.1.B., IP.1.D.   |
| 2. Evaluate patient's ability to understand and comply with requirements for the requested examination.   | PC.1.B.                         |
| 3. Obtain pertinent medical history.  | PC.1.A.2.A., PC.1.B.            |
| 4. Manage complex interpersonal interactions within the workplace in an effective manner.   | PC.1.B.2.                       |
| 5. Review imaging examination request to verify accuracy and completeness of information (e.g., patient history, clinical diagnosis, physician's orders). | PC.1.A.2.A.                     |
| 6. Respond as appropriate to imaging study inquiries from patients.   | PC.1.B.                         |
| 7. Assume responsibility for medical equipment attached to patients (e.g., IVs, oxygen) during the imaging procedures.                                    | PC.1.C.2.                       |
| 8. Follow environmental protection standards for handling and disposing of bio-hazardous materials (e.g., sharps, blood, and body fluids).                | PC.1.E.3.E.                     |
| 9. Provide for patient safety, comfort, and modesty.  | PC.1.A., PC.1.C.                |
| 10. Notify appropriate personnel of adverse events or incidents (e.g., patient fall, wrong patient imaged).   | PC.1.A.2.A., PC.1.C.3., IP.1.D. |
| 11. Communicate scheduling delays to waiting patients.  | PC.1.B.                         |
| 12. Demonstrate and promote professional and ethical behavior.  | PC.1.A., PC.1.B.                |
| 13. Verify informed consent as necessary.   | PC.1.A.1.A., PC.1.B.            |
| 14. Communicate relevant information to others (e.g., M.D.s, RNs, other radiology personnel).   | PC.1.A., PC.1.B., PC.1.C.3.D.   |
| 15. Explain procedure instructions to patient or patient's family.  | PC.1.B.3.                       |
| 16. Practice Standard Precautions.  | PC.1.E.3.                       |
| 17. Follow appropriate procedures when caring for patients with communicable diseases.  | PC.1.E.3., PC.1.E.4., PC.1.E.5. |
| 18. Use immobilization devices, as needed, to prevent patient movement and/or ensure patient safety.  | PC.1.A.2.D., P.                 |
| 19. Use proper body mechanics when assisting a patient.   | PC.1.C.1.A.                     |
| 20. Use patient transfer devices when needed.   | PC.1.C.1.B.                     |
| 21. Use sterile or aseptic technique when indicated.  | PC.1.E.2.                       |
| 22. Follow environmental protection standards for handling hazardous materials.   | PC.1.F.                         |
| 23. Obtain vital signs.   | PC.1.C.3.A.                     |



**Content Categories**

Legend: PC = Patient Care,  
S = Safety, IP = Image Production,  
P = Procedures

**Activity**

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|--|---|
| 24. Recognize and communicate the need for prompt medical attention.   | PC.1.C.3., PC.1.D.                              |
| 25. Administer emergency care.   | PC.1.C.2., PC.1.C.3., PC.1.D.                   |
| 26. Explain post-procedural instructions to patient or patient's family.   | PC.1.B.3.                                       |
| 27. Maintain confidentiality of patient information.   | PC.1.A.1.B., PC.1.A.3.                          |
| 28. Clean, disinfect, or sterilize facilities and equipment, and dispose of contaminated items in preparation for next examination.  | PC.1.E.2., PC.1.E.3.                            |
| 29. Document required information on patient's medical record (e.g., imaging procedure documentation, images).<br>a. On paper<br>b. Electronically   | PC.1.B.1.A., PC.1.C.3.D.,<br>IP.1.D., IP.2.B.6. |
| 30. Evaluate the need for and use of protective shielding.   | S.2.A.2., S.2.B.3.                              |
| 31. Take appropriate precautions to minimize radiation exposure to the patient.  | S.2.A.  |
| 32. Question female patient of child-bearing age about date of last menstrual period or possible pregnancy and take appropriate action (e.g., document response, contact physician).   | PC.1.B., S.1.B.5., S.1.B.6.                     |
| 33. Restrict beam to the anatomical area of interest.  | S.2.A.3., IP.1.A.1.G.,<br>IP.1.A.2.G.           |
| 34. Set technical factors to produce diagnostic images and adhere to ALARA.  | S.2.A., IP.1.A., IP.1.B.                        |
| 35. Document radiographic procedure dose.  | S.2.A.6., IP.2.B.6.E.                           |
| 36. Prevent all unnecessary persons from remaining in area during x-ray exposure.  | S.2.B.4.B.                                      |
| 37. Take appropriate precautions to minimize occupational radiation exposure.  | S.2.B.  |
| 38. Advocate radiation safety and protection.  | S.1.B., S.2.A., S.2.B.4.B.                      |
| 39. Describe the potential risk of radiation exposure when asked.  | PC.1.B.3., S.1.B.                               |
| 40. Wear a personnel monitoring device while on duty.  | S.2.B.4.A.                                      |
| 41. Evaluate individual occupational exposure reports to determine if values for the reporting period are within established limits.   | S.2.B.4.B.                                      |
| 42. Determine appropriate exposure factors using the following:<br>a. Fixed kVp technique chart<br>b. Variable kVp technique chart<br>c. Calipers (to determine patient thickness for exposure)<br>d. Anatomically programmed technique* | IP.1.A., IP.1.B.                                |

\* Applies to specific modules



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|---|---------------------------------------|
| 43. Select radiographic exposure factors.<br>a. Automatic Exposure Control (AEC)*<br>b. kVp and mAs (manual)  | IP.1.A., IP.1.B., IP.1.C.             |
| 44. Operate radiographic unit and accessories including:<br>a. Fixed unit<br>b. Mobile unit (portable)  | IP.2.A.1., IP.2.A.2., IP.2.A.3.       |
| 45. Operate electronic imaging and record keeping devices including:<br>a. Computed radiography (CR) with photostimulable storage phosphor (PSP) plates<br>b. Direct radiography (DR)<br>c. Picture archiving and communication system (PACS)<br>d. Hospital information system (HIS)<br>e. Radiology information system (RIS)<br>f. Electronic medical record (EMR) system | IP.2.A.3., IP.2.B.                    |
| 46. Modify technical factors to correct for noise in a digital image.   | IP.1.D.3.B., IP.2.C.                  |
| 47. Remove all radiopaque materials from patient or table that could interfere with the image (e.g., clothing removal, jewelry removal).  | PC.1.B.3.A., IP.2.C.8.                |
| 48. Perform post-processing on digital images in preparation for interpretation.  | IP.2.B.4.                             |
| 49. Use radiopaque anatomical side markers at the time of image acquisition.  | IP.1.E., IP.2.C.7.                    |
| 50. Add electronic annotations on digital images to indicate position or other relevant information (e.g., time, upright, decubitus, post-void).  | PC.1.A.2.E., IP.1.E., IP.2.C.7.       |
| 51. Select equipment and accessories (e.g., grid*, compensating filter*, shielding) for the examination requested.  | S.2.A.2., P.                          |
| 52. Explain breathing instructions prior to making the exposure.*   | PC.1.B.3.A., IP.1.A.3.H., P.          |
| 53. Position patient to demonstrate the desired anatomy using anatomical landmarks.   | P.                                    |
| 54. Modify exposure factors for circumstances such as involuntary motion, casts and splints*, pathological conditions, or patient's inability to cooperate.   | IP.1.A.3.H., IP.1.A.3.J., IP.1.B., P. |
| 55. Verify accuracy of patient identification on image.   | IP.1.E., IP.2.C.7.                    |
| 56. Evaluate images for diagnostic quality.   | IP.2.C., IP.2.D., P.                  |
| 57. Respond appropriately to digital exposure indicator values.   | IP.2.C.1.                             |
| 58. Determine corrective measures if image is not of diagnostic quality and take appropriate action.  | IP.2.C., P.                           |
| 59. Identify image artifacts and make appropriate corrections as needed.  | IP.2.C.8.                             |
| 60. Store and handle image receptor in a manner which will reduce the possibility of artifact production.   | IP.2.C.8., IP.2.C.9., IP.2.D.3.       |

\* Applies to specific module





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**Activity**

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| 61. Visually inspect, recognize, and report malfunctions in the imaging unit and accessories.  | IP.2.C.8., IP.2.D.2.                     |
| 62. Recognize the need for periodic maintenance and evaluation of radiographic equipment affecting image quality and radiation safety (e.g., shielding, image display monitor, light field, central ray detector calibration). | IP.2.D.                                  |
| 63. Perform routine maintenance on digital equipment including:<br>a. Detector calibration<br>b. CR plate erasure<br>c. Equipment cleanliness<br>d. Test images  | IP.2.D.3.                                |
| 64. Adapt radiographic procedures for patient condition (e.g., age, size, trauma, pathology) and location (e.g., mobile, surgical, isolation).   | PC.1.C., PC.1.E., S.2.A.5.,<br>IP.1., P. |
| 65. Select appropriate geometric factors (e.g., SID, OID, focal spot size, tube angle).  | IP.1.A.                                  |

**Position patient, x-ray tube, and image receptor to perform the following diagnostic examinations:**

- |                       |                |
|-----------------------|----------------|
| 66. Chest             | P.1.A.         |
| 67. Cervical spine    | P.4.A.         |
| 68. Thoracic spine    | P.4.B.         |
| 69. Scoliosis series  | P.4.E.         |
| 70. Lumbar spine      | P.4.C.         |
| 71. Sacrum/coccyx     | P.4.D.         |
| 72. Sacroiliac joints | P.4.D.         |
| 73. Skull             | P.3.A.         |
| 74. Facial bones      | P.3.C.         |
| 75. Nasal bones       | P.3.C.         |
| 76. Orbits            | P.3.C.         |
| 77. Paranasal sinuses | P.3.B.         |
| 78. Toes              | P.2.A., P.5.A. |
| 79. Foot              | P.2.A., P.5.A. |
| 80. Calcaneus         | P.2.A., P.5.C. |
| 81. Ankle             | P.2.A., P.5.B. |
| 82. Tibia/fibula      | P.2.A.         |

\* Applies to specific modules



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**Activity**

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|                              |        |
|------------------------------|--------|
| 83. Knee/patella             | P.2.A. |
| 84. Distal femur             | P.2.A. |
| 85. Fingers                  | P.2.B. |
| 86. Hand                     | P.2.B. |
| 87. Wrist                    | P.2.B. |
| 88. Forearm                  | P.2.B. |
| 89. Elbow                    | P.2.B. |
| 90. Humerus                  | P.2.B. |
| 91. Shoulder                 | P.2.C. |
| 92. Scapula                  | P.2.C. |
| 93. Clavicle                 | P.2.C. |
| 94. Acromioclavicular joints | P.2.C. |