CONTENT SPECIFICATIONS FOR THE EXAMINATION FOR THE LIMITED SCOPE OF PRACTICE IN RADIOGRAPHY

Content Specifications Effective with the January 2006 Examination

The purpose of the American Registry of Radiologic Technologists examination for the Limited Scope of Practice in Radiography is to assess the knowledge and cognitive skills required to radiograph selected anatomic regions (chest, extremities, etc.). These content specifications represent a subset of the content specifications that were developed for general radiography through the ARRT Practice Analysis Project. The ARRT administers the examination at a state's request under contractual arrangement and provides the results directly to the state. This examination is not associated with any type of certification by the ARRT.

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 general radiographers. For example, if an individual is licensed to take radiographs only of the spine, then that individual should be as knowledgeable about the spine as the general radiographer. However, that individual is not expected to demonstrate knowledge of radiographic procedures related to other anatomic regions (e.g., skull, chest). All individuals licensed in limited scope radiography are required to demonstrate fundamental knowledge and cognitive skill in the basic areas of radiation protection, equipment operation, image production and evaluation, and patient care.

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 RADIOGRAPHIC PROCEDURE modules, depending on the type of license for which they have applied.

Core Module		**Number of Questions**	**Testing Time**
A.	Radiation Protection	35	
B.	Equipment Operation and Quality Control	12	
C.	Image Production and Evaluation	38	
D.	Patient Care and Education	15	
	Total for Core Module	100	1 hr, 40 min
Radiographic Procedure Modules			
E.1	Chest	20	20 min
E.2	Extremities	25	25 min
E.3	Skull/Sinuses	20	20 min
E.4	Spine	25	25 min
E.5	Podiatric Radiography	20	20 min

A. RADIATION PROTECTION (35)

I. Biological Aspects of Radiation (7)

A. Radiosensitivity

1. dose-response relationships
2. relative tissue radiosensitivities (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. Repeat Exposure Reduction

1. patient positioning
2. patient communication

F. Image Receptors (e.g., types, relative speed)

III. Personnel Protection (8)

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)

IV. Radiation Exposure and Monitoring (8)

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

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

B. EQUIPMENT OPERATION AND QUALITY CONTROL (12)

I. Principles of Radiation Physics (4)

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 (4)

A. Components of Basic Radiographic Unit

1. operating console
2. x-ray tube construction
   a. electron sources
   b. target materials
   c. induction motor
3. manual exposure controls
4. beam restriction devices

B. X-Ray Generator, Transformers, and Rectification System

1. basic principles
2. phase, pulse, and frequency

III. Quality Control of Radiographic Equipment and Accessories (4)

A. Beam Restriction

1. light field to radiation field alignment
2. central ray alignment

B. Recognition of Malfunctions

C. Image Receptor Systems

1. artifacts
2. maintenance

D. Shielding Accessories (e.g., lead apron testing)

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*Basic equipment concepts only.

C. IMAGE PRODUCTION AND EVALUATION (38)

I. Selection of Technical Factors (24)

A. Factors Affecting Radiographic Quality (X indicates topics covered on the examination)

	1. Radiographic Density	2. Radiographic Contrast	3. Recorded Detail	4. 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. filtration	X	X		
g. film-screen combinations	X		X	
h. beam restriction	X	X		
i. motion			X	
j. anode heel effect	X			
k. patient factors (e.g., size, pathology)	X	X	X	X
l. angle (tube, part or receptor)			X	X

B. Technique Charts

1. caliper measurement
2. fixed versus variable kVp
3. special considerations
   a. anatomic and pathologic factors
   b. pediatrics

C. Image Receptors

1. film-screen combinations
   a. film characteristics
      1. film contrast
      2. film latitude
      3. exposure latitude
   b. screen characteristics
      1. phosphor type
      2. relative screen speed
      3. single versus double film/ screen system

(Section C continues on the following page)

C. IMAGE PRODUCTION AND EVALUATION (cont.)

II. Image Processing and QualityAssurance (6)

A. Film Storage

B. Cassette Loading

C. Image Identification

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

D. Automatic Film Processor

1. components*
   a. developer
   b. fixer
   c. wash
   d. dry
2. systems
   a. transport
   b. replenishment
   c. temperature regulation
   d. recirculation
   e. dryer
3. maintenance
   a. start up and shut down procedure
   b. removal and cleaning of crossover assembly
   c. sensitometric monitoring
4. system malfunction
   a. observable effects (e.g., artifacts, fluctuations in density, contrast)
   b. possible causes (e.g., improper temperature, contamination, roller alignment, replenishment, water flow)

E. Film Archiving

III. Criteria for Image Evaluation (8)

A. Density (mAs, distance, film-screen combination)

B. Contrast (kVp, filtration)

C. Recorded Detail (motion, poor film-screen contact)

D. Distortion (magnification, OID, SID)

E. Demonstration of Anatomical Structures (positioning, tube-part-image receptor alignment)

F. Identification Markers (anatomical, patient, date)

G. Patient Considerations (pathologic conditions, motion)

H. Artifacts (film handling artifacts, static, pressure artifacts)

I. Fog (age, chemical, radiation, temperature, safelight)

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*Specific chemicals in the processing solutions will not be covered (e.g., glutaraldehyde).

D. PATIENT CARE AND EDUCATION (15)

I. Ethical and Legal Aspects (3)

A. Patient's Rights

1. informed consent (e.g.,oral, implied)
2. confidentiality (HIPAA)
3. additional rights (e.g., Patient's Bill of Rights)
   a. privacy
   b. extent of care (e.g., DNR)
   c. access to information
   d. living will; health care proxy
   e. research participation

B. Legal Issues

1. examination requisition
2. common terminology (e.g., battery, negligence, malpractice)
3. legal doctrines (e.g., *respondeat superior*, *res ipsa loquitur*)

C. Professional Ethics

II. Interpersonal Communication (2)

A. Modes of Communication

1. verbal/written
2. nonverbal (e.g., eye contact, touching)

B. Challenges in Communication

1. patient characteristics
2. explanation of medical terms
3. strategies to improve understanding (e.g., explanation of current procedure)

C. Patient Education (e.g., explanation of current procedure)

III. Infection Control (6)

A. Terminology and Basic Concepts

1. asepsis
   a. medical
   b. surgical
   c. sterile technique
2. pathogens
   a. fomites, vehicles, vectors
   b. nosocomial infections

B. Cycle of Infection

1. pathogen
2. source or reservoir of infection
3. susceptible host
4. method of transmission
   a. contact (direct, indirect)
   b. droplet
   c. airborne/suspended
   d. common vehicle
   e. vector borne

C. Standard Precautions

1. handwashing
2. gloves, gowns
3. masks
4. medical asepsis (e.g., equipment disinfection)

D. Additional or Transmission-Based Precautions (e.g., hepatitis B, HIV, rubella, tuberculosis)

1. airborne (e.g., respiratory protection, negative ventilation)
2. droplet (e.g., particulate mask, restricted patient placement)
3. contact (e.g., gloves, gown, restricted patient placement)

E. Disposal of Contaminated Materials

1. linens
2. needles
3. patient supplies (e.g., tubes, emesis basin)

(Section D continues on the following page)

D. PATIENT CARE AND EDUCATION (cont.)

IV. Physical Assistance and Transfer (2)

A. Patient Transfer and Movement
   1. body mechanics (balance, alignment, movement)
   2. patient transfer

B. Assisting Patients with Medical Equipment (e.g., oxygen delivery systems)

C. Routine Monitoring
   1. equipment (e.g., stethoscope, sphygmomanometer)
   2. vital signs (e.g., blood pressure, pulse, respiration, temperature)
   3. physical signs and symptoms (e.g., motor control, severity of injury)
   4. documentation

V. Medical Emergencies (2)

A. Allergic Reactions (e.g., latex)

B. Cardiac or Respiratory Arrest (e.g., CPR)

C. Physical Injury or Trauma

D. Other Medical Disorders (e.g., seizures, diabetic reactions)

E. SPECIFIC RADIOGRAPHIC PROCEDURES

(see chart and notes below)

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

ANATOMIC MODULE [1]	# QUESTIONS PER MODULE
I. Chest	
A. Routine	16
B. Other	4
TOTAL	**20**
II. Extremities	
A. Lower (toes, foot, calcaneus, ankle, tibia, fibula, knee, patella, and distal femur)	11
B. Upper (fingers, hand, wrist, forearm, elbow, and humerus)	11
C. Pectoral Girdle (shoulder, scapula, clavicle, and acromioclavicular joints)	3
TOTAL	**25**
III. Skull/Sinuses	
A. Skull	8
B. Paranasal Sinuses	8
C. Facial Bones (nasal bones, orbits)	4
TOTAL	**20**
IV. Spine	
A. Cervical Spine	8
B. Thoracic Spine	6
C. Lumbosacral Spine	8
D. Sacrum, Coccyx, and Sacroiliac Joints	2
E. Scoliosis Series	1
TOTAL	**25**
V. Podiatric	
A. Foot	14
B. Ankle	5
C. Calcaneus (Os Calcis)	1
TOTAL	**20**

FOCUS OF QUESTIONS [2]

1. **Positioning** (topographic landmarks, body positions, path of central ray, etc.)

   emphasis: high

2. **Anatomy** (including physiology, basic pathology, and related medical terminology)

   emphasis: medium

3. **Technical Factors** [2] (including adjustments for circumstances such as body habitus, trauma, pathology, breathing techniques, casts, splints, etc.)

   emphasis: low

4. **Equipment and Accessories** (grids or Bucky, compensating filter, automatic exposure control (AEC), computerized radiography (CR), direct digital radiography (DDR), picture archival and communication system (PACS).

   emphasis: low

Notes:

1. Examinees take one or more anatomic modules, depending on the type of license they have applied for. Each anatomic module has exactly 20 or 25 test questions, depending on the module (see chart above). The number of questions within a module should be regarded as approximate values.

2. The anatomic modules may include questions about the four areas listed under *FOCUS OF QUESTIONS* on the right side of the chart. The PODIATRIC module does not include questions on any of the *technical factors* or specialized equipment/accessories section.

Attachment A

Radiographic Positions and Projections

I. Chest

A. Chest
1. PA upright
2. lateral upright
3. AP Lordotic
4. AP supine
5. lateral decubitus
6. posterior oblique
7. anterior oblique

II. Extremities

A. Toes
1. AP
2. oblique
3. lateral

B. Foot
1. AP angle toward heel
2. medial oblique
3. lateral oblique
4. mediolateral
5. lateromedial
6. sesamoids, tangential
7. AP weight bearing
8. lateral weight bearing

C. Calcaneus (Os Calcis)
1. lateral
2. plantodorsal, axial
3. dorsoplantar, axial

D. Ankle
1. AP
2. AP mortise
3. mediolateral
4. oblique, 45º internal
5. lateromedial
6. AP stress views

E. Tibia, Fibula
1. AP
2. lateral
3. oblique

F. Knee
1. AP
2. lateral
3. AP weight bearing
4. lateral oblique 45º
5. medial oblique 45º
6. PA
7. PA axial – intercondylar fossa (tunnel)

G. Patella
1. lateral
2. supine flexion 45º (Merchant)
3. PA
4. prone flexion 90º (Settegast)
5. prone flexion 55º (Hughston)

H. Femur (Distal)
1. AP
2. mediolateral

I. Fingers
1. PA finger
2. lateral
3. oblique
4. AP thumb
5. oblique thumb
6. lateral thumb

J. Hand
1. PA
2. lateral
3. oblique

K. Wrist
1. PA
2. oblique 45º
3. lateral
4. PA for scaphoid
5. scaphoid (Stecher)
6. carpal canal

L. Forearm
1. AP
2. lateral

M. Elbow
1. AP
2. lateral
3. external oblique
4. internal oblique
5. AP partial flexion
6. axial trauma (Coyle)

N. Humerus
1. AP
2. lateral
3. AP neutral
4. scapular Y
5. transthoracic lateral

O. Shoulder
1. AP internal and external rotation
2. inferosuperior axial
3. posterior oblique (Grashey)
4. tangential
5. AP neutral
6. transthoracic lateral
7. scapular Y

P. Scapula
1. AP
2. lateral, anterior oblique
3. lateral, posterior oblique

Q. Clavicle
1. AP
2. AP angle 15-30º cephalad
3. PA angle 15-30º caudad

R. Acromioclavicular joints
1. AP bilateral with and without weights

III. Skull/Sinuses

A. Skull
1. AP axial (Towne)
2. lateral
3. PA (Caldwell)
4. PA
5. submentovertical (full basal)

B. Facial Bones
1. lateral
2. parietoacanthial (Waters)
3. PA (Caldwell)
4. PA (modified Waters)

C. Nasal Bones
1. parietoacanthial (Waters)
2. lateral
3. PA (Caldwell)

D. Orbits
1. parietoacanthial (Waters)
2. lateral
3. PA (Caldwell)

E. Paranasal Sinuses
1. lateral
2. PA (Caldwell)
3. parietoacanthial (Waters)
4. submentovertical (full basal)
5. open mouth parietoacanthial (Waters)

IV. Spine

A. Cervical spine
1. AP angle cephalad
2. AP open mouth
3. lateral
4. anterior oblique
5. posterior oblique
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 45º
6. anterior oblique 45º
7. AP L5-S1, 30-35º cephalad
8. AP right and left bending
9. lateral flexion and extension

C. Sacrum and Coccyx
1. AP sacrum, 15-25º cephalad
2. AP coccyx, 10-20º caudad
3. lateral sacrum and coccyx, combined
4. lateral sacrum or coccyx, separate

D. Sacroiliac Joints
1. AP
2. posterior oblique
3. anterior oblique

E. Scoliosis Series
1. AP/PA scoliosis series (Ferguson)

V. Podiatric

A. Foot
1. dorsal plantar (DP)
2. medial oblique
3. lateral oblique
4. lateral
5. sesamoidal axial

B. Ankle
1. AP
2. AP mortise
3. AP medial oblique
4. AP lateral oblique
5. lateral

C. Calcaneus (Os Calcis)
1. axial calcaneal
2. Harris and Beath (ski-jump)

Attachment B

Standard Terminology for Positioning and Projection

Radiographic View: Describes the body part as seen by the x-ray film 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 film
2. *posterior position* – facing the radiographic tube
3. *oblique position* – (erect or lying down)

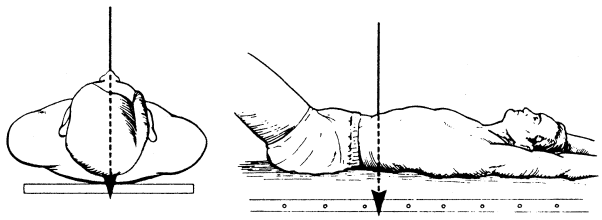
    a. anterior (facing the film)

        i. *left anterior oblique* — body rotated with the left anterior portion closest to the film.
        ii. *right anterior oblique* — body rotated with the right anterior portion closest to the film

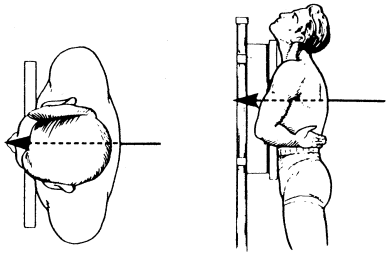
    b. posterior (facing the radiographic tube)

        i. *left posterior oblique* — body rotated with the left posterior portion closest to the film.
        ii. *right posterior oblique* — body rotated with the right posterior portion closest to the film

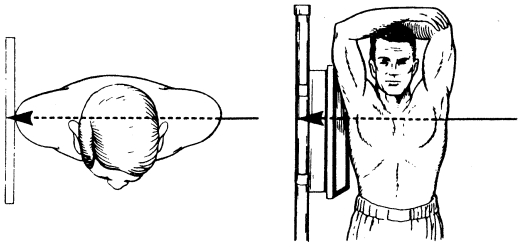
Anteroposterior Projection



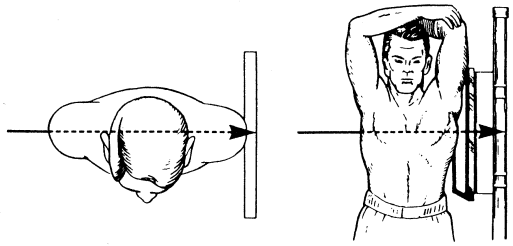
Posteroanterior Projection



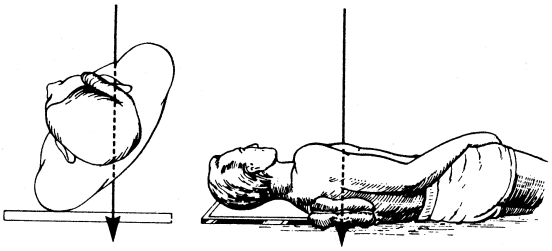
Right Lateral Position



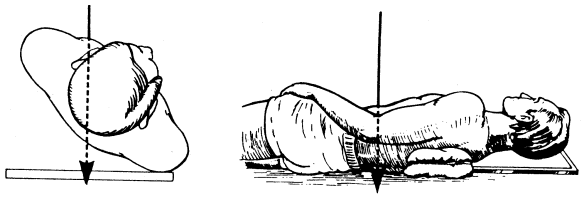
Left Lateral Position



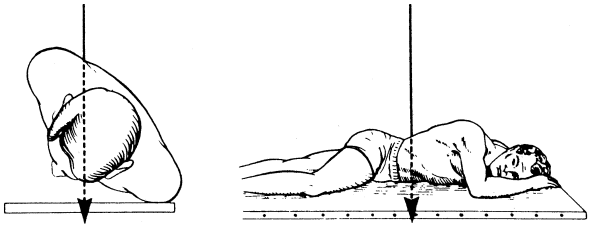
Left Posterior Oblique Position



Right Posterior Oblique Position



Left Anterior Oblique Position



Right Anterior Oblique Position