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# CONTENT SPECIFICATIONS FOR THE EXAMINATION IN MAMMOGRAPHY



Publication Date: March 2009  
Implementation Date: July 2009

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The purpose of the ARRT Examination in Mammography is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of technologists employed in this specialized area. These content specifications are based on the results of a nationwide practice analysis recently conducted by ARRT.<sup>1</sup>

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

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<b>Content Category</b>	<b>Number of Questions<sup>2</sup></b>
A. Patient Care: Education and Assessment	12
B. Instrumentation and Quality Assurance	27
C. Anatomy, Physiology, and Pathology	23
D. Mammographic Technique and Image Evaluation	22
E. Breast Imaging Procedures	<u>31</u>
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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: Education and Assessment (12)

### 1. Patient Communication (3)

- a. pre-exam instructions (e.g. removal of deodorant, clothing, etc.)
  - b. explanation of mammographic procedure
    - 1. establish patient rapport
    - 2. psychological and emotional support
    - 3. address physical and mental limitations
  - c. ACS guidelines for mammography screening
  - d. breast self-examination (BSE)
  - e. clinical breast examination (CBE)
- b. signs and symptoms
    - 1. pain
    - 2. lump
    - 3. thickening
    - 4. nipple discharge
    - 5. skin changes
    - 6. nipple and areolar changes
    - 7. edema
    - 8. erythema
    - 9. dimpling
  - c. documentation of medical history and clinical findings

### 2. Patient Assessment (risks of breast cancer; implication for imaging) (6)

- a. epidemiology of breast cancer
  - 1. incidence
  - 2. risk factors
    - a) female gender
    - b) advancing age
    - c) personal history of breast cancer
    - d) personal history of other cancers
    - e) family history of breast cancer
    - f) genetic predisposition
    - g) race
    - h) abnormal breast biopsy
    - i) early menarche
    - j) late menopause
    - k) nulliparity
    - l) late age at primiparity
    - m) previous breast radiation
    - n) exposure to DES (diethylstilbestrol)
    - o) obesity
    - p) hormone replacement therapy (HRT)

### 3. Treatment Options<sup>1</sup> (3)

- a. surgical options
  - 1. lumpectomy
  - 2. lumpectomy and radiation therapy
  - 3. lumpectomy with axillary dissection and radiation therapy
  - 4. simple mastectomy
  - 5. modified radical mastectomy
  - 6. prophylactic mastectomy
- b. nonsurgical options
  - 1. radiation therapy
  - 2. chemotherapy
  - 3. hormonal therapy (e.g., tamoxifen)
- c. reconstruction
  - 1. implant
  - 2. TRAM flap
  - 3. latissimus dorsi
- d. tumor staging

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<sup>1</sup> The mammographer is expected to understand the definitions and basic descriptions of these terms.

## B. Instrumentation and Quality Assurance (27)

### 1. Design Characteristics of Mammography Units (5)

- a. kVp range
- b. mammography tube (anode, filtration, window, focal spot, etc.)
- c. compression devices
- d. automatic exposure control (AEC)
- e. grids
- f. system geometry (SID, OID, magnification, etc.)
- g. density settings

### 2. Acquisition and Display (5)

- a. analog
  1. film
  2. screens and cassettes
  3. processor
  4. viewboxes
- b. digital
  1. image receptors
    - a) full field digital mammography-computed radiography (FFDM-CR)
    - b) full field digital mammography-direct radiography (FFDM-DR)
  2. workstations
    - a) acquisition
    - b) review
  3. hard copy devices (e.g. laser printer)
  4. PACs
- c. computer aided detection (CAD)

### 3. Quality Assurance and Evaluation (5)

- a. accreditation and certification
  1. agencies (ACR, FDA)
  2. purpose
  3. process
  4. frequency
- b. MQSA regulations
  1. personnel requirements
  2. record keeping (assessment categories; image ID and labeling; maintenance of images and reports, communication of results to providers and patient)
  3. medical outcomes audit
  4. required policies (e.g. infection control, consumer complaint)

(Section B continues on the following page)

## B. Instrumentation and Quality Assurance (continued)

### 4. Quality Control (12)

- a. technologist tests<sup>3</sup>
  - 1. general tests
    - a) phantom images
    - b) visual checklist
    - c) repeat analysis
    - d) viewboxes and viewing conditions
    - e) compression force
  - 2. analog QC tests
    - a) darkroom cleanliness
    - b) processor quality control
    - c) screen cleanliness
    - d) fixer retention test
    - e) darkroom fog
    - f) screen-film contact
  - 3. digital QC tests
    - a) monitor cleaning
    - b) laser imager QC test
    - c) detector calibration
    - d) flat field/artifact evaluation
    - e) system resolution test (modulation transfer function [MTF], signal to noise [SNR], contrast to noise [CNR])
    - f) monitor calibration QC and SMPTE pattern
- b. medical physicist tests<sup>4</sup>
  - 1. general QC tests
    - a) mammographic unit assembly evaluation
    - b) collimation assessment
    - c) evaluation of system resolution
    - d) AEC system performance assessment
    - e) uniformity of screen speed
    - f) artifact evaluation
    - g) image quality evaluation
    - h) kVp accuracy and reproducibility
    - i) beam quality assessment (half-value layer measurement)
    - j) breast entrance exposure, AEC reproducibility, average glandular dose, and radiation output rate
    - k) viewbox luminance and room illuminance
    - l) assessing the mammography sites' quality control program
    - m) compression paddle alignment
  - 2. QC tests specific to digital
    - a) system/spatial resolution (CNR, SNR, MTF, flat field)
    - b) printer check
    - c) review workstation tests

#### Focus of Questions:

- 1. purpose
- 2. frequency
- 3. equipment and procedure
- 4. performance criteria
- 5. corrective action

#### Focus of Questions:

- 1. purpose
- 2. frequency

<sup>3</sup> The technologist tests for film-screen mammography (listed in the *ACR Mammography Quality Control Manual (1999)*) and the technologist tests for digital mammography are covered. The mammographer is expected to have a detailed understanding of these tests.

<sup>4</sup> The medical physicist tests listed in the *ACR Mammography Quality Control Manual (1999)* and the medical physicist tests for digital mammography are covered. The mammographer is expected to have a basic understanding of these tests.

## C. Anatomy, Physiology, and Pathology (23)

### 1. Localization Terminology (2)

- a. clock position
- b. quadrants

### 2. External Anatomy (3)

- a. breast margins
- b. nipple
- c. areola
- d. Montgomery's glands
- e. Morgagni's tubercles
- f. skin
  1. sebaceous glands
  2. sweat glands
  3. hair follicles
- g. axillary tail
- h. inframammary fold
- i. margin of pectoralis major

### 3. Internal Anatomy (5)

- a. fascial layers
- b. retromammary space
- c. fibrous tissues
- d. glandular tissues
  1. lobules
  2. terminal ductal lobular unit (TDLU)
- e. adipose tissues
- f. Cooper's ligaments
- g. pectoral muscle
- h. vascular system
- i. lymphatic system

### 4. Histology (3)

- a. terminal ductal lobular unit (TDLU)
  1. extralobular terminal duct
  2. intralobular terminal duct
  3. acinus (ductal sinus)
- b. cellular components
  1. epithelial cells
  2. myoepithelial cells
  3. basement membrane

### 5. Pathology (10)

- a. breast imaging terminology
  1. density
  2. mass and margins
    - a) circumscribed
    - b) indistinct
    - c) spiculated
  3. architectural distortion
  4. asymmetric density
  5. characteristics of calcifications
    - a) amorphous or indistinct
    - b) pleomorphic or heterogeneous
    - c) casting
- b. benign conditions and their mammographic appearances
  1. cyst
  2. galactocele
  3. fibroadenoma
  4. lipoma
  5. hamartoma
  6. papilloma
  7. ductal ectasia
  8. hematoma
  9. abscess and inflammation
  10. fat necrosis
  11. radial scar
  12. calcification
  13. lymph nodes
  14. gynecomastia
- c. high risk conditions and their mammographic appearances
  1. lobular carcinoma in situ (LCIS)
  2. atypical ductal hyperplasia
  3. atypical lobular hyperplasia
  4. papilloma
- d. malignant conditions and their mammographic appearances
  1. ductal carcinoma in situ (DCIS)
  2. invasive/infiltrating ductal carcinoma
  3. invasive lobular carcinoma
  4. inflammatory carcinoma
  5. Paget's disease
  6. sarcoma
  7. lymphoma
  8. calcification
  9. stellate mass

## D. Mammographic Technique and Image Evaluation (22)

### 1. Technical Factors (11)

- a. kVp
- b. mAs
- c. density setting
- d. automatic exposure control (AEC)
- e. manual technique
- f. compression thickness
- g. target/filter combination
- h. focal spot
- i. grids
- j. magnification techniques

### 2. Evaluation of Image Quality (11)

- a. positioning
- b. compression
- c. exposure
- d. contrast
- e. sharpness
- f. noise
- g. artifacts
- h. collimation
- i. labeling
- j. motion

## E. Breast Imaging Procedures (31)

### 1. Mammographic Positioning<sup>5</sup> (17)

- a. standard views
  1. craniocaudal (CC)
  2. mediolateral oblique (MLO)
- b. additional views
  1. mediolateral (ML)
  2. lateromedial (LM)
  3. exaggerated craniocaudal (XCCL)
  4. cleavage (CV)
  5. axillary tail (AT)
  6. tangential (TAN)
  7. rolled (RL, RM, RS, RI)
  8. caudocranial (FB)
  9. lateromedial oblique (LMO)
  10. superolateral-to-inferomedial oblique (SIO)
  11. implant displaced (ID)
- c. positioning techniques
  1. spot compression
  2. magnification
  3. triangulation

### 2. Special Patient Situations (6)

- a. chest wall deformities
- b. irradiated breast
- c. reduction mammoplasty
- d. post-surgical breast
- e. males
- f. kyphotic patients
- g. protruding abdomens
- h. pacemaker
- i. infusa-port (port-a-cath)
- j. implants
- k. lactating breast
- l. mosaic breast

### 3. Imaging Options (8)

- a. mammography
  1. screening
  2. diagnostic
- b. breast ultrasound
- c. MRI
- d. sentinel node mapping
- e. interventional procedures<sup>6</sup>
  1. breast specimen imaging
  2. core biopsy
  3. cyst aspiration
  4. ductography
  5. fine needle aspiration
  6. needle localization

<sup>5</sup> The mammographer is expected to know positioning as presented in the *ACR Mammography Quality Control Manual* (1999). Approximately 6 of the 17 items in this section will cover the standard views (CC and MLO).

<sup>6</sup> The mammographer is expected to have the basic knowledge required to assist with these procedures.