



The Mammography Examination

The purpose of The American Registry of Radiologic Technologists® (ARRT®) Mammography Examination is to assess the knowledge and cognitive skills underlying the intelligent performance of the tasks typically required of the technologists who perform mammography. Using a nationwide survey, the ARRT periodically conducts a practice analysis to develop a task inventory which delineates or lists the job responsibilities typically required of staff mammography technologists.¹ An advisory committee then determines the knowledge and cognitive skills needed to perform the tasks on the task inventory and these are organized into the content categories within this document. The document is used to develop the examination. The results of the most recent practice analysis have been applied to this document. Every content category can be linked to one or more activities on the task inventory. The complete [task inventory](#) is available at [arrt.org](#).

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

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

Content Category	Number of Scored Questions ²
A. Patient Factors	35
B. Instrumentation	43
C. Breast Imaging Procedures	37
Total	115

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 25 unscored (pilot) questions.



A. Patient Factors (35)

I. Patient Care: Education and Assessment (12)

A. Patient Communication

1. pre-exam instructions
(e.g.,* removal of deodorant, clothing)
2. explanation of mammographic procedure
 - a. establish patient rapport
 - b. psychological and emotional support
 - c. address physical and mental limitations
 - d. typical patient dose
 - e. importance of having prior images available
3. ACS guidelines for mammography screening
4. breast self-examination (BSE)
5. clinical breast examination (CBE)
6. informed consent

B. Patient Assessment (risks for breast cancer; implication for imaging)

1. epidemiology of breast cancer
 - a. incidence
 - b. risk factors
 1. female gender
 2. advancing age
 3. personal history of breast cancer
 4. personal history of other cancers
 5. family history of breast cancer
 6. genetic predisposition
 7. race
 8. abnormal breast biopsy
 9. early menarche
 10. late menopause
 11. nulliparity
 12. late age at primiparity
 13. previous breast radiation
 14. obesity
 15. hormone replacement therapy (HRT)
 16. breast tissue density (tissue composition)

2. signs and symptoms

- a. pain
- b. lump
- c. thickening
- d. nipple discharge
- e. skin changes
- f. nipple and areolar changes
- g. edema
- h. erythema
- i. dimpling

3. documentation of medical history and clinical findings

4. previous mammograms
 - a. review prior to exam
 - b. verify for interpreting physician

C. Treatment Options¹

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

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

(Section A continued on the following page.)

*e.g., This is used here and in the remainder of this document to indicate examples of the topics covered, but not a complete list.



A. Patient Factors (continued)

2. Anatomy, Physiology and Pathology (23)

A. Localization Terminology

1. clock position
2. quadrants
3. triangulation

B. External Anatomy

1. breast margins
2. nipple
3. areola
4. angle of pectoral muscle
5. Morgagni tubercles
6. skin
 - a. sebaceous glands
 - b. sweat glands
 - c. hair follicles
7. axillary tail
8. inframammary fold

C. Internal Anatomy

1. fascial layers
2. retromammary space
3. fibrous tissues
4. glandular tissues
 - a. lobules
 - b. terminal ductal lobular unit (TDLU)
5. adipose tissues
6. Cooper ligaments
7. pectoral muscle
8. vascular system
9. lymphatic system
10. Montgomery glands

D. Histology and Cytology

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

E. Pathology

1. mammographic appearance and reporting terminology (e.g. BI-RADS®)
 - a. asymmetry (one view finding)

b. focal asymmetry (two view finding)

- c. mass and margins
 1. circumscribed
 2. indistinct
 3. spiculated

d. characteristics of calcifications

1. round or punctate
2. amorphous or indistinct
3. coarse heterogeneous
4. fine heterogeneous

e. architectural distortion

f. assessment categories

g. recommendations

2. benign conditions and their mammographic appearances

a. cyst

b. galactocele

c. fibroadenoma

d. lipoma

e. hamartoma

f. papilloma

g. ductal ectasia

h. hematoma

i. abscess and inflammation

j. fat necrosis

k. calcifications

l. lymph nodes

m. gynecomastia

3. high risk conditions and their mammographic appearances

a. lobular carcinoma in situ (LCIS)

b. atypical ductal hyperplasia

c. atypical lobular hyperplasia

d. radial scar

e. papilloma with atypia

f. calcifications

4. malignant conditions and their mammographic appearances

a. ductal carcinoma in situ (DCIS)

b. invasive/infiltrating ductal carcinoma

c. invasive lobular carcinoma

d. inflammatory carcinoma

e. Paget disease of the breast

f. sarcoma

g. lymphoma

h. calcifications



B. Instrumentation (43)

I. Equipment Operation and Quality Assurance (25)

- A. Design Characteristics of Mammography Units
 - 1. kVp range
 - 2. mammography tube (e.g., anode, filtration, window, focal spot)
 - 3. compression devices
 - 4. grids
 - 5. system geometry (e.g., SID, OID, magnification)
- B. Digital Acquisition, Display and Informatics
 - 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. interpretation
 - 3. hard copy devices (e.g., laser printer)
 - 4. digital image display and informatics
 - a. HIS/RIS
 - b. networking (e.g., HL7, DICOM)
 - c. workflow (e.g., inappropriate documentation, lost images, mismatched images, corrupt data)
 - d. PACS
 - 1. lossy compression
 - 2. lossless compression
 - 5. computer aided detection (CAD)

C. Quality Assurance and Evaluation

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

(Section B continues on the following page.)



B. Instrumentation (continued)

D. Quality Control²

- I. technologist tests
 - a. general tests
 1. phantom images
 2. visual checklist
 3. repeat analysis
 4. viewing conditions
(e.g., lighting and viewboxes)
 5. compression force
 - b. digital QC tests
 1. monitor cleanliness
 2. laser imager QC test
 3. artifact evaluation
(e.g., flat field, detector calibration)
 4. system resolution test
(e.g., modulation transfer function [MTF], signal-to-noise ratio [SNR], contrast-to-noise ratio [CNR])
 5. monitor calibration QC and test pattern
(e.g., SMPTE, AAPM task group 18 templates)

FOCUS OF QUESTIONS

1. Purpose
2. Frequency
3. Equipment and Procedure
4. Performance Criteria
5. Corrective Action

(Section B continues on the following page.)

²The technologist general tests and medical physicist tests listed are referenced in the ACR Mammography Quality Control Manual (1999). Digital QC tests for the technologist and the medical physicist tests will also be covered. The technologist is expected to have a detailed understanding of all the technologist QC tests and a basic understanding of the medical physicist QC tests.



B. Instrumentation (continued)

2. medical physicist tests
 - a. general QC tests
 1. mammographic unit assembly evaluation
 2. collimation assessment
 3. evaluation of system resolution
 4. automatic exposure system performance assessment
 5. artifact evaluation
 6. image quality evaluation
 7. kVp accuracy and reproducibility
 8. beam quality assessment (half-value layer measurement)
 9. breast entrance exposure, automatic exposure reproducibility, average glandular dose and radiation output rate
 10. viewbox luminance and room illuminance
 11. assessing the mammography site quality control program
 12. compression paddle alignment
 - b. QC tests specific to digital
 1. system/spatial resolution (e.g., CNR, SNR, MTF)
 2. printer check
 3. interpretation workstation tests

FOCUS OF QUESTIONS

1. Purpose
2. Frequency

(Section B continues on the following page.)



B. Instrumentation (continued)

2. Mammographic Technique and Image Evaluation (18)

A. Technical Factors

1. kVp
2. mAs
3. automatic exposure
4. manual exposure
5. compression thickness
6. target/filter
7. focal spot
8. grids
9. magnification

B. Evaluation of Image Quality

1. positioning
2. compression
3. exposure
4. contrast
5. sharpness
6. noise
7. artifacts
8. collimation
9. labeling
10. motion



C. Breast Imaging Procedures (37)

I. Mammographic Positioning³ (23)

- A. Standard Views
 - 1. craniocaudal (CC)
 - 2. mediolateral oblique (MLO)
- B. Additional Views
 - 1. mediolateral (ML)
 - 2. lateromedial (LM)
 - 3. exaggerated craniocaudal (XCCL, XCCM)
 - 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)
 - 12. nipple in profile
 - 13. anterior compression
 - 14. spot compression
 - 15. magnification

2. Special Needs and Imaging Procedures (14)

- A. Special Patient Situations
 - 1. chest wall deformities
 - 2. irradiated breast
 - 3. reduction mammoplasty
 - 4. post-surgical breast
 - 5. males
 - 6. kyphotic patients
 - 7. protruding abdomens
 - 8. pacemaker
 - 9. infusa-port (port-a-cath)
 - 10. implants
 - 11. lactating breast
 - 12. large breast
- B. Imaging Modalities
 - 1. mammography
 - a. screening
 - b. diagnostic
 - c. digital breast tomosynthesis (DBT/3D)
 - 2. breast ultrasound
 - 3. breast MRI
 - 4. sentinel node mapping
 - 5. interventional procedures⁴
 - a. breast specimen imaging
 - b. core biopsy (i.e., stereotactic, ultrasound)
 - c. cyst aspiration
 - d. ductography/galactography
 - e. fine needle aspiration
 - f. needle localization
 - g. clip placement

³ The mammographer is expected to know positioning as presented in the *ACR Mammography Quality Control Manual* (1999). Approximately 6 of the 23 items in this section will cover the standard views (CC and MLO).

⁴ The mammographer is expected to have the basic knowledge of these procedures.