1. Clinical breast examination (CBE) and breast self-examination (BSE) are similar in that both
   (A) involve looking and feeling for changes in the breast
   (B) are performed by a trained medical professional
   (C) are performed monthly
   (D) are performed yearly

2. The most common cause of undercompression is
   (A) a faulty compression paddle
   (B) inadequate compression by the technologist
   (C) the patient’s pain tolerance level
   (D) a broken automatic compression device

3. The Health Insurance Portability and Accountability Act (HIPAA) of 1996 has an influence on the radiology department and other hospital departments because of its focus on
   (A) patient record confidentiality
   (B) facility reimbursement
   (C) quality management
   (D) risk management

4. Ductal papilloma is
   (A) a benign proliferation of tissue in the male breast
   (B) a malignant tumor involving ducts
   (C) a collection of blood in the breast occurring after surgery
   (D) benign growths involving the milk ducts

5. The right craniocaudal (CC) projection in a routine imaging series showed a small, irregular-shaped lesion at the posterior margin of the image plus scattered calcifications, including calcification clusters (Fig. 7–1). Typically, the radiologist will recommend ______ as the immediate next step.
   (A) ultrasonography to assess the content of the lesion and provide an analysis of the calcifications
   (B) spot compression, including magnification, to assess calcifications and the margins of the lesion
   (C) magnetic resonance imaging (MRI) to assess for malignancy and to assess any calcifications
   (D) a breast biopsy to check for malignancy
6. A bunch of eight bits equals one
   (A) pixel
   (B) byte
   (C) matrix
   (D) bit depth

7. Which of the following could be used when imaging extremely small breasts in the CC position?
   (A) spatula
   (B) mediolateral (ML) projection
   (C) cleavage view (CV) projection
   (D) exaggerated craniocaudal (XCCL) projection

8. In the tangential (TAN) projection, any tube angulation will depend on
   (A) the size of the patient’s breast
   (B) the location of the abnormality
   (C) the position of the mid-axillary line in relation to the detector
   (D) whether the abnormality is palpable or nonpalpable

9. A small but growing cancer may not be obvious to the individual because it often presents as
   (A) skin irritation
   (B) inverted nipples
   (C) a painless mass
   (D) a painful mass

10. Mammography is more accurate in
    (A) premenopausal women
    (B) postmenopausal women
    (C) women with fibrocystic breast
    (D) women with dense breast tissue

11. In taking medical history, hormone use (both natural and artificial) is taken into account because
    (A) hormones cause breast cancer
    (B) early menarche can increase breast cancer risks
    (C) late menarche can increase breast cancer risks
    (D) contraceptive use lowers the risk for breast cancer

12. One major difference between collimation in mammography and collimation in general radiography is that
    (A) in mammography, the entire detector area is exposed
    (B) decreasing collimation increases exposure in mammography
    (C) mammography uses a variety of beam-limiting devices
    (D) in radiography, the entire detector area is always exposed

13. Line pair per millimeter is the unit of
    (A) matrix size
    (B) spatial resolution
    (C) field of view (FOV)
    (D) bit depth

14. Image brightness is adjusted by changing the
    (A) milliampere second (mAs)
    (B) peak kilovoltage (kVp)
    (C) window level
    (D) window width

15. The retromammary space is filled with
    (A) supportive and connecting tissues
    (B) adipose tissue
    (C) fibroglandular tissue
    (D) blood vessels
16. The fatty versus fibroglandular nature of the breast tissue is affected by which of the following?
   (A) age  
   (B) hormone use  
   (C) number of pregnancies  
   (D) all of the above

17. In positioning for the exaggerated craniocaudal (XCCL) projection, if the shoulder of the affected side is in the way of the compression device,
   (A) push the shoulder down  
   (B) use 5-degree lateral tube angulation  
   (C) use 5-degree medial tube angulation to avoid superposing the shoulder on breast tissue  
   (D) reduce the patient’s lateral rotation

18. In the CC position, the pectoral muscle is seen
   (A) all the time  
   (B) rarely if ever  
   (C) about 30% to 40% of the time  
   (D) about 50% of the time

19. Between ages 20 and 39 years, the American Cancer Society (ACS) recommends CBE every
   (A) year  
   (B) 2 years  
   (C) 3 years  
   (D) 4 years

20. The lesion seen in Figure 7–2 is not palpable and is not associated with nipple or skin changes. It has the characteristics of a(n)
   (A) invasive ductal breast carcinoma  
   (B) mammographically malignant tumor  
   (C) mammographically benign tumor  
   (D) nonspecific lesion; further testing is indicated

21. Regardless of the reason, if the proper amount of compression cannot be applied, which of the following must apply?
   (A) The patient must be informed.  
   (B) The patient’s doctor must be informed.  
   (C) The radiologist must be informed.  
   (D) It must be noted on the patient’s history form.

22. On the CC image, the posterior nipple line (PNL) should extend to the
   (A) level of the nipple  
   (B) posterior breast or edge of the image  
   (C) level of the inframammary fold (IMF)  
   (D) most anterior breast
23. The interspace material of the mammography linear grid is generally made of
   (A) carbon or wood
   (B) aluminum
   (C) any highly radiopaque material
   (D) lead

24. Which section of the breast is poorly visualized on the CC projection?
   (A) medial
   (B) axial
   (C) lateral
   (D) superior

25. Figure 7–3 shows a radiograph of the left mediolateral oblique (MLO) projection. Why should this radiograph be repeated? (The patient’s and technologist’s identifications and the projection have been removed to avoid HIPAA violations.)
   (A) The pectoral muscle should be concave anteriorly.
   (B) The pectoral muscle should be convex anteriorly.
   (C) The IMF is closed.
   (D) The posterior breast tissue is not visualized.

26. Adjusting the image contrast is achieved by
   (A) changing the window level
   (B) decreasing the pixel size
   (C) changing the window width
   (D) increasing the pixel size

27. Which projection could be used to demonstrate a deep medial lesion not seen on CC?
   (A) axillary tail (AT)
   (B) XCCL
   (C) CV
   (D) MLO

28. After a routine four-projection mammographic series, the nipple is not seen in profile on any of the images. Additional projections are done if
   1. the nipple is indistinguishable from a mass
   2. a subareolar abnormality is suspected
   3. the nipple is not marked with a BB (lead shot)
   (A) 1 and 2 only
   (B) 2 and 3 only
   (C) 1 and 3 only
   (D) 1, 2, and 3
The Mammography Quality Standards Act (MQSA) mandates that the average glandular dose received per projection/position during routine mammography screening not exceed

(A) 1 mGy (100 mrad)
(B) 2 mGy (200 mrad)
(C) 3 mGy (300 mrad)
(D) 4 mGy (400 mrad)

The device used to convert the films in an analog imaging system to a digital image is called

(A) a film digitizer
(B) Digital Imaging and Communications in Medicine (DICOM)
(C) an analog-to-digital converter (ADC)
(D) a digital-to-analog converter (DAC)

The computer network that allows images to be viewed at various monitors or transmitted or stored is termed

(A) local area network (LAN)
(B) picture archiving and communications system (PACS)
(C) DICOM
(D) wide area network (WAN)

Which of the following statements about health care records is false?

(A) Health records must include all signed informed consent forms.
(B) Patients have a right to amend their health care records.
(C) Patients can access their health records.
(D) Health care records cannot be used in a court of law.

Montgomery glands are specialized

(A) sweat glands
(B) sebaceous glands
(C) Cooper ligaments
(D) hair follicles

On the radiograph in Figure 7–4, the arrow indicates

(A) a malignant lesion
(B) glandular tissue
(C) muscle
(D) fatty tissue

Your patient’s sister was diagnosed with breast cancer at age 35 years. Your patient is considered to have

(A) a greater risk for breast cancer
(B) a lower risk for breast cancer
(C) no significantly increased risk for breast cancer
(D) a personal history of breast cancer
36. A woman taking hormone replacement therapy may notice changes in the breast, such as
   (A) breast enlargement
   (B) increase in fibroadenomas
   (C) increase in breast cysts
   (D) all of the above

37. Paget’s disease of the breast is a(n)
   (A) infiltrating carcinoma generally limited to the breast
   (B) form of carcinoma associated with changes in the nipple
   (C) benign breast condition that is relatively common
   (D) malignant form of breast carcinoma involving lobules

38. In a digital image, what determines the matrix size?
   (A) the number of bits in each pixel
   (B) the number of pixels in the rows and columns
   (C) the picture elements in the matrix
   (D) the number of gray shades that a pixel can produce

39. A set of computer software standards that permits a wide range of digital imaging programs to understand each other is called
   (A) DIGCOM
   (B) PACS
   (C) DICOM
   (D) PCAS

40. A PACS network typically would include
   (A) digital images from multiple modalities
   (B) images from a single modality only
   (C) all records of patients
   (D) surgical and radiography patient records

41. Women who were exposed to diethylstilbestrol (DES) in utero may have
   (A) a lower risk for breast cancer
   (B) a higher risk for breast cancer if they are also receiving hormone replacement therapy (HRT)
   (C) a lower risk for breast cancer if they are also receiving HRT
   (D) breast tissue that is extra sensitive to radiation

42. In which of the following modified projections is the superior surface of the breast rolled medially?
   (A) rolled medial (RM)
   (B) rolled lateral (RL)
   (C) medial (M)
   (D) lateromedial (LM)

43. Factors that lower breast cancer risk include
   1. having the first child after age 30 years
   2. breastfeeding
   3. late menarche
      (A) 1 and 2 only
      (B) 2 and 3 only
      (C) 1 and 3 only
      (D) 1, 2, and 3

44. PACS stands for
   (A) picture access to communication system
   (B) picture archiving and computer system
   (C) picture archiving and communication system
   (D) pixel access and computer system

45. The computer processing or photostimulable phosphor (PSP) reader functions to
   (A) focus a beam of infrared light on the PSP
   (B) trap excited electrons at a higher energy level
   (C) scan, read, and erase the exposed PSP
   (D) provide energy to trapped electrons
46. *Gynecomastia* is the term for
   (A) a localized abscess
   (B) increased breast tissue in the male breast
   (C) decreased breast tissue in the female breast
   (D) a risk of carcinoma in the male patient

47. Photostimulable luminescence (PSL) is
   (A) emission of bluish-purple light from electrons as they transition from higher energy to a lower energy state
   (B) conversion of light energy to an electrical signal by the photomultiplier tube (PMT)
   (C) conversion of the analog signal to a digital signal by the ADC
   (D) conversion of light into an analog signal by the charge-coupled device (CCD)

48. According to MQSA regulations, which of the following is not required on the final mammographic image?
   (A) date of the examination
   (B) technical factors used
   (C) technologist identification
   (D) projection identification

49. The IMF is located at approximately the level of the
   (A) second to third rib
   (B) third to fourth rib
   (C) fourth to fifth rib
   (D) sixth to seventh rib

50. Identify Cooper’s ligament in Figure 7–5.
   (A) site A
   (B) site C
   (C) site E
   (D) site F

51. Identify the lactiferous sinus in Figure 7–5.
   (A) site B
   (B) site D
   (C) site E
   (D) site F

52. Scattered radiation is reduced during magnification mammography by
   (A) using a small focal spot size
   (B) using a grid
   (C) using the air-gap technique
   (D) increasing the source-to-image receptor distance (SID)

53. Ductography can be used to determine
   (A) the location of lesions in ducts
   (B) whether a lesion is benign or malignant
   (C) changes or abnormalities associated with ducts
   (D) more than one of the above
54. When imaging small breasts, a useful option is
   (A) replacing CC with XCCL
   (B) using ML instead of MLO
   (C) using a spatula to avoid compressing the fingers
   (D) reducing angulation to avoid too much compression of the pectoral muscle

55. During magnification, positioning the breast away from the detector utilizes which law/principle in scatter reduction?
   (A) inverse-square law
   (B) reciprocity law
   (C) heel effect
   (D) line–focus principle

56. A nulliparous woman has a lower risk for breast cancer compared with a woman with a history of
   (A) late menopause
   (B) late menarche
   (C) breast cancer
   (D) early menarche

57. In routine mammography, the primary purpose of the grid is to
   (A) improve image sharpness
   (B) reduce the production of scatter
   (C) reduce patient dose
   (D) increase the subject contrast

58. The implant-displaced (ID) projection is possible on all of the following cases except
   (A) implants placed posterior to the pectoral muscle
   (B) implants placed anterior to the pectoral muscle
   (C) soft implants
   (D) encapsulated implants

59. A palpable mass that is not seen on a diagnostic mammogram generally means that
   (A) breast cancer is ruled out; the mass is probably benign
   (B) other diagnostic testing must be considered
   (C) the mass is likely breast cancer
   (D) the mass is likely caused by fluctuating hormones

60. Which of the following patients has the greatest risk for breast cancer?
   (A) a nulliparous woman age 40 years
   (B) a never-married woman
   (C) a woman age 70 years
   (D) a woman age 30 years

61. A technologist using a 0.1-mm focal spot size is most likely performing
   (A) routine mammography work
   (B) magnification imaging
   (C) spot compression imaging
   (D) stereotactic work

62. Which of the following patients cannot give consent?
   (A) a minor who is married
   (B) a minor serving in the military
   (C) a competent adult
   (D) a mentally challenged adult

63. In the PSP computer reader (CR), the photomultiplier tube
   (A) collects the blue/purple light given off by trapped electrons
   (B) scans the PSP with a red laser light
   (C) provides energy to the trapped electrons in the phosphor layer
   (D) erases the PSP by releasing electrons
64. Which of the following statements is true about imaging the breast?
   (A) Folds and/or wrinkles should be eliminated by pushing them posteriorly.
   (B) Skin folds or wrinkles may be impossible to avoid in older adults.
   (C) When imaging older adults, the study will be compromised by folds and/or wrinkles.
   (D) Folds and/or wrinkles can be eliminated by pulling them anteriorly.

65. The term base of the breast refers to the
   (A) the nipple area of the areola
   (B) areas adjacent to the chest wall
   (C) axilla area of the breast
   (D) lower–outer quadrant of the breast

66. Fibrous tissues are presented radiographically as
   (A) black or radiolucent areas
   (B) gray and less dense areas
   (C) white or denser areas
   (D) black and less dense areas

67. The calcifications seen in Figure 7–6 are characteristic of
   (A) invasive ductal carcinoma
   (B) malignant calcifications
   (C) calcifications caused by plasma-cell mastitis
   (D) numerous oil cysts

68. The MLO projection demonstrates a large encapsulated lesion occupying almost the entire breast. The contour is sharp, and the lesion is radiolucent. This lesion is most likely to be a(n)
   (A) oil cyst
   (B) hematoma
   (C) fibroadenoma
   (D) lipoma

69. The latent image on the PSP can last several hours but will lose
   (A) 50% of its energy in 4 hours
   (B) 50% of its energy in 8 hours
   (C) 25% of its energy in 4 hours
   (D) 25% of its energy in 8 hours

70. Disadvantages of the PSP or computed mammography (CM) technology includes
   (A) reduced repeats
   (B) wide latitude and dynamic range of the system
   (C) PSP’s sensitivity to radiation
   (D) speed of the imaging system

71. In the nonscintillator direct-based flat-panel digital mammography (DM) system, the x-ray beam strikes a
   (A) scintillator
   (B) photoconductor
   (C) thin-film transistor
   (D) photomultiplier
72. Spot compression
   1. applies more compression to a localized area
   2. can be performed with magnification
   3. employs a coned collimated field to limit the area of interest
      (A) 1 only
      (B) 1 and 2 only
      (C) 2 and 3 only
      (D) 1, 2, and 3

73. Identify the lower optical density structure shown in the middle of the breast on Figure 7–7.
   (A) closed IMF
   (B) skin fold
   (C) pectoralis muscle
   (D) vein

74. To reduce the possibility of projecting the abdomen on the MLO image, the technologist could
   (A) have the patient stand just at the detector and bend backward
   (B) have the patient stand away from the detector and bend forward
   (C) have the patient turn medially to image the lateral breast on CC
   (D) image the breast in the lateral position instead

75. A four-projection mammography series shows a solitary tumor, with the halo sign, in the upper–outer quadrant of the left breast. The lesion is partially obscured. The recommended next step is
   (A) biopsy
   (B) ultrasonography
   (C) stereotactic localization
   (D) aspiration

76. Why is the specimen magnified?
   (A) to ensure that the lesion has been completely removed
   (B) to visualize the calcifications within the specimen
   (C) to compare the magnified and nonmagnified images
   (D) to check the number and placement of calcifications

77. In digital mammography, a grossly underexposed image
   (A) appears excessively noisy
   (B) is too light
   (C) is too dark
   (D) appears correctly exposed
78. Which of the following patients is likely to be diagnosed with pathological gynecomastia?
   (A) lactating woman
   (B) older man
   (C) premenopausal woman
   (D) young man

79. Montgomery glands are located on the breast’s
   (A) skin
   (B) nipple
   (C) areola
   (D) muscle

80. Aluminum can be used as the filtration material in
   (A) digital units, when imaging dense breasts
   (B) digital tomosynthesis units
   (C) digital units, when imaging fatty breasts
   (D) digital units, when using molybdenum targets

81. Digital mammography units often use _____ as the target material.
   (A) molybdenum
   (B) rhodium
   (C) aluminum
   (D) tungsten

82. The ACS has recommended that women over age 40 years undergo CBE every
   (A) year
   (B) 2 years
   (C) 3 years
   (D) 4 years

83. When imaging the breast using the CC projection, if the detector is too high or too low, the IMF will be overelevated or underelevated. Overelevation of the IMF will result in
   (A) loss of posterior and superior breast tissue in the image
   (B) loss of anterior and posterior breast tissue in the image
   (C) loss of superior and posterior breast tissue in the image
   (D) loss of inferior and posterior breast tissue in the image

84. Capture elements in the flat-panel detector system can include all of the following except
   (A) photomultiplier
   (B) cesium iodide
   (C) gadolinium oxysulfide
   (D) amorphous selenium

85. Which of the following involves the use of a small-gauge needle to remove cell samples from a suspected cancerous lesion in the breast for cytological analysis?
   (A) core biopsy
   (B) excisional biopsy
   (C) needle localization
   (D) fine-needle biopsy (FNB)

86. A lesion is superimposed by breast tissue in the CC projection. A projection/position used to demonstrate the lesion in the same orientation but free of superimposition is the
   (A) MLO
   (B) ID
   (C) XCCL
   (D) RM
87. In imaging the breast in the MLO projection, compression to the lower, anterior portion of the breast is compromised if
(A) the detector is too high
(B) the pectoral muscle extends to the nipple line
(C) too much axilla and shoulder are under compression
(D) the IMF is not horizontal

88. The term *involution of the breast* describes a process by which
(A) milk is removed from the breast by suckling
(B) breast epithelium proliferates during menstruation
(C) the glandular tissue in the breast is replaced by fat
(D) estrogen use causes an overall decrease in tissue density in the breast

89. In imaging the breast for the CC projection, what technique is used to minimize skin folds in the lateral aspect of the breast?
(A) lifting the posterior lateral aspect of the breast onto the detector
(B) draping the contralateral breast over the corners of the detector
(C) having the patient turn the head to face the ipsilateral breast
(D) the patient’s arm hanging relaxed on the side being imaged, with the humerus externally rotated

90. Phosphor crystals in the flat-panel detector system are classified as ______ phosphors when they are scattered through the phosphor level.
(A) needle
(B) turbid
(C) amorphous
(D) selenium

91. Grid use in magnification mammography is contraindicated because
(A) the use of a grid will increase subject contrast
(B) scatter is already minimized
(C) grid use increases scatter
(D) the use of grids would result in decreased subject contrast

92. The breast can be imaged in the FB projection
(A) to improve visualization of lesions in uppermost aspect of breast by reducing object-to-image receptor distance (OID)
(B) during needle localization to provide a shorter route to inferior lesions
(C) to maximize the amount of tissue visualized in patients with kyphosis
(D) all of the above

93. Figure 7–8 shows a radiograph in the right MLO projection. Why should this image be repeated? (The identifications of the patient and the technologist plus that of the projection have been removed to avoid HIPAA violations.)
(A) The skin marker does not fully cover the skin lesion.
(B) The posterior breast is not imaged.
(C) The anterior breast is not imaged.
(D) The IMF is not visualized.

94. Which statement *best* describes a parallel or linear grid?
(A) Lead strips are aligned adjacent to one another and placed lengthwise in the same direction within the structure of the grid.
(B) Lead strips are aligned at right angles to each other.
(C) Lead strips are designed to take advantage of the divergence of the x-ray beam as it leaves the x-ray tube.
(D) Lead strips are designed to move during the exposure.
98. The repeat rate should be analyzed if the rate changes from the previous measure rate by more than
(A) ±2% points
(B) ±3% points
(C) ±4% points
(D) ±5% points

99. A magnification image of a breast shows several oval-shaped radiolucent lesions with eggshell-like calcifications. These are most likely to be
(A) ductal papilloma
(B) fibroadenomas
(C) oil cysts
(D) hematomas

100. The thin-film transistor (TFT) in the flat-panel detector systems collects
(A) light
(B) pixels
(C) electrons
(D) x-rays

101. In general, the ID series are taken using the
(A) AT and MLO projections
(B) CC and ML projections
(C) CC and MLO projections
(D) CC and LM projections

102. Currently, all technologists or radiographers performing mammography independently must have
(A) satisfied the final requirements of the US Food and Drug Administration (FDA)
(B) completed at least 20 hours of documented training in mammography
(C) performed at least 75 examinations under direct supervision of a qualified technologist
(D) none of the above
103. The criteria for a properly positioned MLO projection includes
   1. concave pectoral muscle on the anterior border
   2. fat visualized posterior to the fibroglandular tissues
   3. an open IMF
      (A) 1 and 2 only
      (B) 2 and 3 only
      (C) 1 and 3 only
      (D) 1, 2, and 3

104. A benign inflammatory condition of the lactiferous ducts leading to nipple discharge, nipple inversion, or periareolar sepsis is called
      (A) ductal ectasia
      (B) Paget’s disease of the breast
      (C) peau d’orange
      (D) ductal papilloma

105. The cells lining the alveoli in lobules are called
      (A) epithelial cells
      (B) myoepithelial cells
      (C) basement cells
      (D) superficial cells

106. Informed consent implies that the patient
      1. has already signed the authorization for treatment
      2. was informed of the procedure or operation, its risks, possible consequences, and any alternative options
      3. the patient was given information about the procedure in his or her language
         (A) 1 and 2 only
         (B) 2 and 3 only
         (C) 1 and 3 only
         (D) 1, 2, and 3

107. The technique for reshaping of the breast is called
      (A) reduction mammoplasty
      (B) mammoplasty
      (C) breast augmentation
      (D) breast biopsy

108. Smaller pixels will result in
      (A) lower spatial resolution
      (B) lower image resolution
      (C) greater spatial resolution
      (D) greater image resolution

109. The detector elements (DELs) are located within the
      (A) scintillator
      (B) TFT
      (C) CCD
      (D) complementary metal-oxide silicon (CMOS)

110. In positioning for the superoinferior oblique (SIO) projection, the _________ of the breast will rest on the detector.
      (A) lateral surface
      (B) superior surface
      (C) medial surface
      (D) inferior aspect

111. The CC projection in males will present the same difficulty as imaging small, firm-breasted females. An added problem may be that
      (A) male patients have more problems with compression
      (B) the male breast is smaller than the smallest female breast
      (C) males have more muscular breast tissue
      (D) hair on the chest of males makes compression difficult
112. For the SIO projection, the central ray is directed
   (A) inferolateral to superomedial
   (B) superomedial to inferolateral
   (C) inferomedial to superolateral
   (D) superolateral to inferomedial

113. Which of the following are considered agencies granting accreditation under FDA regulation?
   (A) State of California
   (B) ACR
   (C) New York State Department of Health
   (D) State of Florida

114. Which alternative projection could be used, in addition to CC, in imaging a patient with a pacemaker?
   (A) ML
   (B) lateromedial oblique (LMO)
   (C) XCCL
   (D) MLO

115. The two main classifications of breast cancer are
   (A) tubular and lobular
   (B) lobular and medullary
   (C) lobular and ductal
   (D) inflammatory and ductal

116. In addition to the patient’s name, all mammographic reports should have the
   (A) final assessment of findings
   (B) hospital number or additional patient identifier
   (C) name of the radiologist
   (D) all of the above
Answers and Explanations

1. (A) Both clinical breast examination (CBE) and breast self-examination (BSE) are examinations in which changes in the shape, contour, and texture of the breast are assessed and the breast is checked for lumps. CBE is performed by a health care professional, whereas BSE is performed by the woman herself. Various organizations now have different recommendations for CBE. The American Cancer Society (ACS) and the Susan G. Komen for the Cure Foundation recommend that CBE be performed at least every 3 years from ages 20 to 39 years and annually from age 40 years. The American College of Obstetricians and Gynecologists (ACOG) and American Medical Association (AMA) recommend starting CBE at age 40 years and annually thereafter. The ACS and the U.S. Preventive Services Task Force (USPSTF) no longer recommend that all women routinely perform BSE, and the USPSTF states that there is a lack of evidence to support the usefulness of CBE. Most societies still promote breast awareness and encourage women to know the look and feel of their breasts. Studies have suggested that women will find cancer while showering, bathing, or dressing, rather than during a specific breast examination. The American Academy of Family Physicians (AAFP) tends to follow the recommendations of the USPSTF. The sensitivity for CBE ranges from 40% to 70%, and specificity ranges from 86% to 99%

2. (B) Studies have shown that although there are many reasons for undercompression, the main reason is lack of communication between the technologist and the patient. The technologist undercompresses the breast either because the patient refuses further compression or is unable to tolerate more compression or the technologist wants to “protect” the patient from further pain. Patients generally tolerate more compression if they fully understand the reason for the compression. Faulty or broken compression devices are generally easily repaired.

3. (A) The Health Insurance Portability and Accountability Act (HIPAA) of 1996 comprises privacy rules that provide all patients with federal protections of their health information. It gives patients an array of rights with respect to their health records and monitors the disclosure of health information needed for patient care.

4. (D) An intraductal papilloma generally occurs near the nipple within the larger ducts but can also occur deep within the breast. The papilloma may produce spontaneous discharge from the nipple or, if located deep within the breast, may appear radiographically as a mass. Ductal papillomas are benign and can be visualized with ductography or galactography. However, ultrasonography is becoming the modality of choice when evaluating ducts.

5. (B) Further imaging depends on the preference of the radiologist. However, whenever possible, imaging should show a lesion in its entirety. Before moving to another modality, such as magnetic resonance imaging (MRI) or ultrasonography, the radiologist is likely to recommend further mammographic examinations, such as spot compression to delineate the margins of the lesion and/or magnification to assess the calcifications. MRI and ultrasonography do not image calcifications well.
6. **(B)** A digital image consists of a box of cells or picture elements (pixels) corresponding to numeric values arranged in rows and columns. Each pixel contains bits of information. The rows and columns form a matrix, and each cell corresponds to a specific location in the image. The matrix size is determined by the number of pixels in the rows and columns. The bit depth is the number of gray shades that a pixel can produce. A bunch of eight bits is a byte (Fig. 7–9).

7. **(A)** The spatula can be used instead of the technologist’s fingers to pull extremely small breasts into position for compression. The mediolateral (ML) projection is a lateral projection. Cleavage view (CV) images the extreme medial breast from the craniocaudal (CC) position and the exaggerated craniocaudal (XCCCL) projection images the extreme lateral breast from the CC position.

8. **(B)** In the tangential (TAN) projection, the technique is to take a skimming projection of the area of interest. Because TAN can be taken in any projection, the degree of obliquity and the projection depends on the location of the abnormality. A BB (lead) marker can be used to establish the area of interest (Fig. 7–10).

9. **(C)** Although pain can be associated with breast cancer, a painless mass is the more common symptom of breast cancer. Painful masses are associated with cysts. Less common symptoms of advanced breast cancer include skin thickening, skin irritation or distortion, and sudden nipple inversion, discharge, erosion, or tenderness.

10. **(B)** On average, mammography can detect up to 90% of breast cancers in women without symptoms and is more accurate in postmenopausal women compared with premenopausal women. Some cancers are not visualized mammographically. The reasons are varied. The patient may have extremely dense breasts, or mammography may not be the best method of detection for a particular type of cancer. Poor imaging techniques applied by the technologist and the interpretation skills of the radiologist can also be contributing factors.

11. **(B)** Hormone use influences breast cancer risk but does not actually cause breast cancer. All factors that increase the number of menstrual cycles in a woman’s lifetime can increase breast cancer risk.

12. **(A)** In general, the use of any beam-limiting device in radiography or mammography requires increased exposure. Both imaging methods use various-sized beam-limiting devices. However, unlike general radiography, where the beam should be limited to the size of the part, in mammography, the entire field (not just the breast) is exposed. This is necessary to reduce extraneous light when viewing the analog image on the view box and, although postprocess masking is possible with digital imaging, the technique has not been altered.
13. (B) The spatial resolution of a digital system is the minimum separation between two objects at which they can be distinguished as two separate objects in the image. In digital imaging, spatial resolution is determined by the pixel size. Smaller pixels have better spatial resolution. Spatial resolution is measured as line pairs per millimeter (lp/mm). The matrix size is determined by the number of pixels in the rows and columns. The bit depth is the number of gray shades that a pixel can produce. The field of view (FOV) sets the collimation for breast size and describes how much of the breast is imaged in the matrix.

14. (C) In digital imaging, the term brightness replaces density (optical density). Brightness can be altered after the exposure. The controlling factors are milliampere second (mAs), processing software, and predetermined digital algorithms. Increasing window level will increase brightness. Window width controls the black-and-white display and, therefore, the contrast. The peak kilovoltage (kVp) plus processing software and digital algorithms will also be factors in controlling contrast.

15. (B) The retromammary space separates the breast from the pectoral muscle. It is filled with a layer of adipose, or fatty, tissue as opposed to the supporting and connective tissue (stroma), blood vessels, and various ductal structures that make up the glandular and fibrous tissues of the breast.

16. (D) Generally, glandular tissues predominate in younger women and adipose, or fatty, tissues in older patients. This ratio is not fixed and depends on the woman’s age and genetic predisposition. It fluctuates with hormone levels, whether the hormonal changes are caused by medication use, pregnancy, lactation, or menopause.

17. (B) The purpose of the XCCL projection is to image the lateral aspect of the breast. After positioning the patient for the craniocaudal (CC) projection, the patient is rotated to bring the outer lateral aspect of the breast on the detector. If the ipsilateral shoulder is in the way, a 5-degree lateral tube angulation can be used to avoid superimposition of the humeral head on the breast. The ipsilateral arm should hang down, and both shoulders should be at the same level. The patient can hold the support bars with the contralateral hand. Pushing the shoulders down will distort the lateral aspect of the breast (Fig. 7–11).

18. (C) Depending on the patient’s body habitus, the pectoral muscle is imaged on the posterior aspect of the breast on about 30% to 40% of all CC projections. It may be visualized unilaterally or bilaterally. Routine CC imaging that includes the pectoral muscle all the time can indicate faulty positioning with loss of visualization of medial or lateral breast tissue.

19. (C) The ACS guidelines for early detection of breast cancer include CBE every 3 years between ages 20 and 39 years and every year after age 40 years. Various organizations now have different recommendations for CBE. The ACS and the Susan G. Komen for the Cure Foundation recommend that CBE be performed at least every 3 years starting between ages 20 and 39 years and annually thereafter. The ACOG and the AMA recommend starting CBE at age 40 years and annually thereafter. The ACS and the USPSTF no longer recommend that all women routinely perform BSE, and the USPSTF states there is lack of evidence to support the usefulness of CBE. Most societies still promote breast awareness and encourage women to know the look and feel of their breasts. Studies have suggested that women will find cancer while showering, bathing, or dressing, rather than during a specific breast examination. The AAFP tends to follow the recommendations of the USPSTF. The sensitivity for CBE ranges from 40% to 70%, and specificity ranges from 86% to 99%.

20. (D) Whenever a large radiating structure or area of architectural distortion (even when superficial) is not associated with skin changes or nipple retraction, the mammography result is considered nonspecific. Further
Answers and Explanations: 13 through 22

21. (D) Although the technologist should inform the radiologist as well as the patient, anything unusual must be documented in the patient’s medical records or on the patient’s medical history form. The patient’s records are a means of communication between the technologist and the radiologist and can be important legal documents used to define what was or was not done to a patient. Records can also be used as evidence in court cases.

22. (B) On the CC projection, the posterior nipple line (PNL) measures the distance from the nipple to the edge of the image. On MLO, the PNL is drawn from the nipple, extending posteriorly to meet the pectoral muscle at a right angle (perpendicularly). The length of

Figure 7–11. Normal craniocaudal (CC) projection can miss tissue in the lateral breast (A); (B) the exaggerated craniocaudal (XCCL) projection demonstrates the missed tissue clearly.

testing is indicated, and a malignancy cannot be ruled out. A definitive diagnosis, such as benign lesion, invasive ductal carcinoma, or malignant tumor, can only be made after a biopsy. This lesion is a radial scar. Radial scars are complex sclerosing lesions. They are not truly scars and are often unrelated to prior surgery or trauma. Some possible causes of the radial scar are localized inflammatory reaction or chronic ischemia with a slow infection. The radial scar can be a benign condition but can be associated with premalignant—atypical ductal hyperplasia—and malignant conditions. A benign radial scar has no central tumor, although there may be long spicules radiating from the center of the lesion. Regardless of the size of the spicules in the benign radial scar, there is no associated skin thickening, dimpling, or nipple reaction. Because of their possible association with malignancy, it is recommended that all stellate lesions, including radial scars, be subjected to biopsy.
eliminating the medial breast tissue could eliminate it from the examination. CC best demonstrates the anterior, central, medial, and posteromedial portions of the breast but is poor at visualizing the lateral breast tissue. In the CC projection, if the breast is too wide to fit on the detector, additional images must be taken to ensure coverage of the medial breast. Although the medial breast is imaged on MLO, superimposition of glandular structures and increased object-to-image receptor distance (OID) and the oblique nature of the projection often cause distortion of that area (Fig. 7–14).

25. (D) The image does not have enough pectoralis muscle and therefore the posterior breast is not visualized. The MLO projection best demonstrates the posterior and upper–outer quadrant of the breast. Considerations when evaluating the MLO projection include the following: The pectoral muscle should be wide superiorly with a convex anterior border and should extend to or below the level of the PNL; the IMF should be open; dense areas of the breast should be adequately penetrated; there should be no drooping of the anterior breast or distortion of the architectural structures; the skin fold must be open; and the abdominal tissue should not overlap the breast tissue.
26. (C) In digital imaging, the term **brightness** replaces **density** (optical density). Brightness can be altered after the exposure. The controlling factors are mAs, processing software, and predetermined digital algorithms. Increasing the window level will increase brightness. The window width controls the black-and-white display and, thus, the contrast. kVp plus processing software and digital algorithms will also be factors in controlling contrast. The pixel size controls the spatial resolution. The smaller the pixels, the greater is the spatial resolution.

27. (C) CV best images the medial breast. MLO best demonstrates the posterior and upper–outer quadrant of the breast. XCCL and AT demonstrate the lateral and axillary portions of the breast, respectively.

28. (D) Placing the nipple in profile is sometimes counterproductive. Breast tissue is not visualized either superiorly, inferiorly, laterally, or medially, depending on the projection and the location of the nipple on the breast. Missed tissue can then lead to undetected breast cancer. If the nipple is not in profile, additional images are needed for the above reasons, but imaging should not be done solely to place the nipple in profile, especially if the nipple is marked with a BB marker (small radiopaque marker) (Fig. 7–15).

29. (C) The low optical density structure indicated by the arrow is the pectoralis muscle. On CC, the pectoralis muscle is seen in approximately 30% to 40% of cases. If the pectoral muscle is seen in all cases, imaging may be missing the medial breast tissue. In any CC projection, the nipple should be centered on the image. However, the breast tissue should not be eliminated to center the nipple. The medial and lateral aspects of the breast must be included in the collimated area. The length of the PNL on the CC view should be within 1 cm of its length on MLO with proper positioning.

30. (A) Although the biggest risk factor for breast cancer is gender (female), having a sister with breast cancer can significantly increase a person’s risk for the disease. A personal history applies only if the patient has had breast cancer.

31. (C) The final rule for mammography, as dictated by the MQSA, states that a single-projection/-position mammogram should not give >3 mGy (300 mrad) glandular dose, on average, when a grid is used and should not exceed 1 mGy (100 mrad) per projection/position without a grid.

32. (A) The analog-to-digital converter (ADC) converts analog signal (light or electronic) from the image receptor or detector to a digital signal, which the computer can manipulate for processing, display, and storage. The ADC assigns each picture element or pixel a value that corresponds to a level of brightness. The entire image is divided into a matrix of pixels based on the brightness of each pixel. The digital-to-analog converter (DAC) converts digitally manipulated data back to an analog (light or electronic) signal, and the film digitizer converts analog-produced radiographs (films) to a digital version via a
scanning device. Digital Imaging and Communications in Medicine (DICOM) is a set of computer software standards that permit a wide range of digital imaging programs to communicate with each other (Fig. 7–16).

33. **(B)** The picture archiving and communications system (PACS) is a computer network that allows digital images from multiple modalities (e.g., general computed tomography [CT], magnetic resonance imaging [MRI], or ultrasonography) to be viewed at a single monitor or various monitors, transmitted, or stored. All equipment used must be DICOM compatible. A PACS system can include a reading station with processing capabilities (e.g., radiologists view reconstructed tomosynthesis images); physician review stations; web access; technologist quality control station; administrative stations; archiving system; and interface to various hospital and radiology systems. DICOM is a set of computer software standards that permits a wide range of digital imaging programs to communicate with each other. A local area network (LAN) is a computer network serving a limited or small geographical area. Typically, LAN devices will share a server loaded with appropriate applications and data for the LAN user group. An example of a LAN network could be the computer network serving a group of CT scanners, monitors, and a single storage device or a hospital network. A wide area network (WAN) is a computer network serving a large geographical area. Typically, WAN

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*Figure 7–15. Nipple not in profile (A & B) patient positioning; radiograph showing the nipple not in profile (C). (Reproduced with permission from Peart O: *Mammography and Breast Imaging PREP: Program Review and Exam Prep*. 2nd ed. New York, NY: McGraw-Hill Education; 2018.)*
35. **(B)** The Montgomery glands (glands of Montgomery) are seen as protrusions on the surface of the areola and are actually specialized sebaceous glands. (The openings to the protrusions are called Morgagni tubercles.) They usually become more prominent during pregnancy and lactation and secrete a fluid that helps lubricate the nipple and the areola.

36. **(D)** Estrogen and progesterone are two hormones that are responsible for numerous physiological changes in the breast. Estrogen is responsible for ductal proliferation and progesterone for lobular proliferation. Once a woman starts hormone therapy (either estrogen only therapy or estrogen and progesterone therapy), the changes can be spotty, causing lumps or increased interstitial fluids (cysts), but will generally result in an overall increase in glandular tissue.

37. **(B)** Paget’s disease of the breast (first described by Jean Paget in 1874) is a rare form of ductal carcinoma associated with eczematous changes of the nipple. Generally, it presents as a malignant nipple lesion. The term infiltrating carcinoma implies that the cancer has left the point of origin and is spreading into the surrounding tissues.

38. **(B)** A digital image consists of a box of cells or picture elements (pixels) corresponding to numeric values arranged in rows and columns. Each pixel contains bits of information. The number of bits per pixel determines the shade of gray demonstrated. The rows and columns form a matrix, and each cell corresponds to a specific location in the image. The matrix size is determined by the number of pixels in the rows and columns. The bit depth is the number of gray shades that a pixel can produce. With a greater bit depth, there will be more shades of gray, and therefore the image will provide more information (a more accurate visualization of the object).

39. **(C)** PACS is a computer network that allows digital images from multiple modalities, e.g., general CT, MRI, and ultrasonography, to be viewed at various monitors and transmitted networks can be transmitted by major carriers, such as a telephone or cable company.

34. **(D)** Patient health records may contain the patient demographic information (name, date of birth, health record number, and other identifying information); clinical observations and complete medical and surgical history; reports of relevant physical examinations; signed informed consents, if relevant; diagnostic or therapeutic orders; physician orders for procedures; documentation of the amount, date, and time of any medication administered; reports of all diagnostic tests; and documentation of evaluations or treatments. Patients have the right to access and amend their health records. When amending the health records, the original entry is not altered and the amendment becomes part of the record. Health records are legal documents and are admissible as evidence in a court of law.
or stored. DICOM is a set of computer software standards that permits a wide range of digital imaging programs to communicate with each other. The options DIGCOM and PCAS are detractors.

40. **(A)** PACS is a computer network that allows digital images from multiple modalities, e.g., general CT, MRI, or ultrasonography, to be viewed at a single monitor, at various monitors and transmitted or stored. All equipment used must be DICOM compatible. PACS can include a reading station with processing capabilities (e.g., radiologists view reconstructed tomosynthesis images); physician review stations; web access; technologist quality control station; administrative stations; archiving system; and interface to various hospital and radiology systems.

41. **(B)** Diethylstilbestrol (DES) was used by pregnant women in the United States during the period 1940 to 1971. It was used to prevent miscarriages, and studies have shown that women who took DES during pregnancy had a slightly increased risk of breast cancer. Women who were exposed to DES in utero, that is, if their mothers took DES while they were pregnant, may also have a slightly increased risk of breast cancer after age 40 years. Hormone replacement therapy (HRT) will also cause an increase in breast cancer risk. A woman who took DES and is also taking HRT will therefore have a higher risk for developing breast cancer compared with a woman who took DES but did not use HRT.

42. **(A)** In the rolled positions, the superior surface of the breast is rolled in one direction and the lower (inferior) surface in the other direction. For the rolled medial (RM) projection, the patient is positioned for CC. From the CC position, the superior portion of the breast is rolled medially, and the inferior portion is rolled laterally. For the rolled lateral (RL) projection, the patient is positioned for CC. From the CC position, the superior portion of the breast is rolled laterally, and the inferior portion is rolled medially. RM and RL are both useful in separating the glandular structures of the breast to resolve issues of superimposed structures. The lateromedial (LM) projection is a 90-degree lateral projection, with the x-rays traveling from lateral to medial, and magnification (M) produces a magnified image of an area (Fig. 7–17).

43. **(B)** Breast cancer risk decreases among women who have their first child before age 30 years, who breastfeed, or who experience late menarche or early menopause. Studies have suggested that reproductive hormones influence the occurrence of breast cancer and can increase breast cancer risk. Factors affecting the risk for breast cancer could include any factor that affects the reproductive hormones, such as early menarche (before 12 years); late menopause (after 55 years); late age at first full-term pregnancy (after 30 years); the use of oral contraceptives; and the use of hormone replacement therapy.

44. **(C)** PACS is a computer network that allows digital images from multiple modalities, e.g., general CT, MRI, or ultrasonography, to be viewed at various monitors or a single monitor and transmitted or stored.

**Figure 7–17.** The rolled positions (rolled medial [RM] and rolled lateral [RL]) can be used to remove superimposed lesions.
45. (C) In the computed mammography (CM) imaging system, the image is captured on photostimulable phosphor (PSP). In the process of PSP image capture, the x-ray photon strikes the phosphor crystals in the PSP. This action causes the electrons in the crystals to move from the normal orbital location to a higher level. This is the latent image formation. The number of electrons affected is directly proportional to the amount of energy absorbed by the PSP. Some but not all of the electrons raised to a higher energy level will spontaneously return to their resting state. The image plate (IP) containing the PSP is placed in a computer PSP reader. The computer reader functions to open the IP and remove the PSP and then to scan, read, and erase the exposed PSP. A red laser light source scans the PSP to extract the image data. The laser light causes electrons at high-energy (latent image) to release energy absorbed from the x-ray beam as blue-purple light and to return to a lower energy resting state. The blue-purple light released is collected by the light guide and used to record the image. The entire process takes about 60 seconds. After scanning the PSP, it is returned to the IP and the IP is ejected from the computer reader (Fig. 7–18).

46. (B) Gynecomastia is a benign increase of tissue in the male breast. It can occur bilaterally or unilaterally. Gynecomastia does not increase the risk of breast cancer for male patients (Fig. 7–19).

47. (A) When the IP is placed in a computer reader, the PSP is extracted and an infrared laser light scans the PSP plate. The red laser light provides energy to the trapped electrons in the phosphor of the PSP plate. The laser causes the metastable electrons to return to the ground state. The electrons emit a blue-purple visible light as they relax to the lower energy levels. Photostimulable luminescence (PSL) is the emission of bluish-purple light from electrons as they transition from higher energy to a lower energy state (Fig. 7–20).

48. (B) Although the MQSA recommends that technical factors appear on the image, this is not an MQSA requirement.
General requirements are

- name of patient and additional patient identifier
- date of examination
- projection and right or left marker—placed near the axilla using the standardized codes

- facility name and location (must include city, state, and zip code)
- technologist identification
- mammography unit identification (if more than one unit per site)
- cassette/screen identification (analog imaging systems)

49. (D) The breast can reach superiorly from the clavicle (second or third rib) and inferiorly to meet the abdominal wall at the level of the sixth or seventh rib. This lowest point of the breast is called the inframammary fold (IMF) or inframammary crease.

50. (F) Cooper’s ligaments are fibrous membranes that support the lobes providing shape and form to the breast. The ligaments attach to the base of the breast and extend outward attaching to the anterior superficial fascia of the skin.

51. (C) Starting at the terminal ductal lobular unit (TDLU), the collecting ductal system gradually widens in tree-like branches forming segmental ducts. Immediately behind the nipple, it further distends to form an ampulla, also called the lactiferous sinus. This is a pouch-like structure immediately behind the nipple. The ducts again narrow to end at the nipple (Fig. 7–21).

52. (C) Scattered radiation is produced whenever the useful beam intercepts any object causing it to diverge. There are two methods of reducing the amount of scattered radiation reaching the detector: limiting the x-ray
necessary and would unnecessarily increase the exposure dose to the patient. Increasing the source-to-image receptor distance (SID) reduces magnification but does not reduce the amount of scatter production. It is not an option in magnification mammography, where the SID is fixed. The small focal spot is necessary to increase resolution, but this does not affect the amount of scattered radiation reaching the detector.

53. (D) Ductography will not determine if a lesion is malignant or benign, but it can determine the location and number of lesions or changes associated with the ducts. Only a cytological or histological analysis can accurately determine the true nature of the lesion.

54. (C) In some women, the breast is very thin, and the technologist’s fingers are compressed before compression is completed. A rubber spatula can be used to hold the breast in place before compression takes over. ML does not image the posterior breast and cannot replace MLO, and too much pectoral muscle is not normally an issue with small breasts. XCCL images the lateral aspect of the breast, with the x-ray beam directed cranio-caudally.

55. (A) Positioning the breast away from the detector takes advantage of the inverse-square law: The intensity of the scattered radiation is reduced because the distance between the detector and the object is increased. The term \textit{heel effect} denotes the process that causes the radiation intensity at the cathode side of the x-ray field to be higher than that on the anode side. The line–focus principle is used in an angled design of the tube target, which allows a large area for heating while maintaining a small focal spot. The reciprocity law states that the optical density produced on a radiograph is equal for any combination of milliamperes and exposure times as long as the product of milliamperes and milliseconds is equal (Figs. 7–22 and 7–23).

56. (C) Risk factors increase a woman’s risk for breast cancer. These factors can be of relatively
high risk, moderate risk, and minor risk. High-risk factors include gender (female), age, genetic factors, and family or personal history of breast cancer. Moderate risk factors include having one first-degree relative with breast cancer, having atypical hyperplasia confirmed on biopsy, high radiation dose to the chest area, and high bone density after menopause. Minor risk factors are associated

with hormone use or changes in the body and include not having children or having the first child after age 30 years, not breastfeeding, early menarche (before age 12 years) or late menopause (after age 55 years), postmenopausal obesity, recent and long-term use of HRT or oral contraceptives, alcohol consumption, and obesity.

57. (D) Grids do not improve image sharpness; the sharpness of an image is affected by the focal spot size, SID, OID, and motion. Grids increase patient dose and reduce the amount of scattered radiation striking the detector but do not affect the production of scatter radiation. Grid use will, however, result in increased subject contrast. (See Fig. 7–13.)

58. (D) As long as the implant is soft and remains free of encapsulation, the implant-displaced (ID) projection is possible. Once the implant is encapsulated, it is difficult, if not impossible, to displace it. Most modern implants are placed behind the pectoral muscle (subpectoral or retropectoral placement) versus placement in front of the pectoral muscle (subglandular or retromammary placement) as was done in the past. The placement of the implant behind the pectoral muscle allows for better imaging and better displacement of the implants for ID projections. Implants placed behind the pectoral muscle are also less likely to become encapsulated.

59. (B) On average, mammography can detect up to 90% of breast cancers in women without symptoms and is more accurate in postmenopausal women than in premenopausal women. Some cancers are not visualized mammographically. The reasons are varied. The patient may have extremely dense breasts, or mammography may not be the best method of detection for a particular type of cancer. Poor imaging techniques by the technologist and the interpretation skills of the radiologist can also be contributing factors. If the result of mammography is normal and the patient feels a palpable mass, the mass could be normal or abnormal. The
The following can give informed consent: competent adults; legal guardians or representatives of incompetent adults; individuals obligated by court order; emancipated minors (14–18 years) or minors who are married, individuals serving in the military, self-supporting (living on own), pregnant (a pregnant minor can give consent for her child but not for herself), and those suffering from certain conditions, such as sexually transmitted disease (STD).

63. (A) When the IP is placed in a computer reader, the PSP is extracted, and an infrared laser light scans the PSP. The red laser light provides energy to the trapped electrons in the phosphor of the PSP plate. The laser causes the metastable electrons to return to the ground state. The electrons emit a blue-purple visible light as they relax to the lower energy levels. PSL is the emission of bluish-purple light from electrons as they transition from higher energy to a lower energy state. A photomultiplier tube (PMT), photodetector (PD), or charge-coupled device (CCD) will collect the blue-purple light given off by the trapped electrons as they return to their normal neutral state. The PMT will convert the light energy to an electrical or electronic signal that is transmitted to an analog-to-digital converter (ADC). The digital signal is sent to a computer for processing. After processing, the signal is sent as an image to the liquid crystal display (LCD). Instead of a CCD, some systems use complementary metal-oxide silicon (CMOS) to convert light into an analog signal that is sent to the ADC. CMOS is a semi-conductor transistor similar to the CCD in that it has either a fiber optic coupling or a lens system. Each array of metal-oxide-semiconductor capacitors (MOS capacitors) represents a pixel. CMOS is smaller than the CCD and will therefore take up less space (see Fig. 7–18).

64. (B) Skin folds or wrinkles will not always be present but, when present, may be impossible to avoid in older adults. The best method is to smooth the folds or wrinkles by using the index finger during compression. However,

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**Figure 7–24.** A size of the lesion at detection can depend on a variety of factors. 
1. size found by chance (3.6–4.2 cm) 
2. size with occasional breast self-examination (BSE) 
3. size found with regular BSE (approximately 2 cm) 
4. size found by 1st or regular mammograms (1 cm) 
5. size found by regular mammograms on fatty breast (5 mm)
avoid pushing breast tissue outside of the compression field posteriorly to eliminate a fold or wrinkle. Pulling breast tissue anteriorly will increase the number of folds or wrinkles in the compressed breast. Added projections will be needed if any breast tissue is eliminated when smoothing wrinkling or folds.

65. (B) The breast includes the nipple, the IMF, and the tail of Spence. The tail of Spence (tail, axilla, or axillary tail are other names used) describes the area of the breast stretching up into the axilla. The base describes the region where the IMF is located and the area of breast that is closest to the chest wall. The apex is the nipple region and the most anterior part of the breast.

66. (C) Fibrous tissue is usually described with glandular tissue together as fibroglandular densities. X-rays pass more easily through fatty tissue than through fibrous or glandular tissue. Fatty areas appear radiolucent (black on the mammogram). The fibroglandular or fibrous tissue is more radiopaque than fatty tissue and shows as areas of lower optical density (white) on the mammogram (Fig. 7–25).

67. (B) Figure 7–6 shows casting-type calcifications, which are often malignant. The shape of the cast is determined by the uneven production of calcifications and the irregular necrosis of the cellular debris. The contours of the cast are always irregular optical density, width, and length, and the cast is always fragmented. A calcification is seen as branching when it extends into adjacent ducts. The width of the ducts will determine the width of the castings. A diagnosis of invasive ductal carcinoma is only made on cytological or histological analysis. Oil cysts are eggshell-like calcifications, and plasma cell mastitis is composed of large linear periductal or intraductal calcifications.

68. (D) Of the choices, the only huge radiolucent breast lesion is a lipoma, which is a common benign tumor composed of fatty tissue. Another large lesion is the fibroadenolipoma or hamartoma. It is a benign proliferation of fibrous, glandular, and fatty tissue surrounded by a thin capsule of connective tissue. The oil cyst is benign and appears mammographically as eggshell-like calcifications, and plasma cell mastitis manifests as large linear periductal or intraductal calcifications. Both fibroadenoma and hematoma are seen as circular–oval lesions with mixed densities and generally will not occupy the entire breast. (See Fig. 3–19.)

69. (D) The latent image formed on the PSP can last for several hours but loses 25% of its energy in 8 hours. Fading is the term used to describe the time it takes for the latent image to disappear.

70. (C) The advantages of PSP technology or CM include the following: It has wide latitude and dynamic range; CM is a faster imaging system compared with screen film; repeats are reduced; there is less chance of lost films; and the better workflow is better. The disadvantages of CM include the following: It has lower spatial resolution (the digital imaging system can manipulate the pixel values after the exposure which compensates for the lower spatial resolution, but CM is not as effective as flat-panel technology or digital mammography (DM) in compensating for the lower resolution of the imaging system); CM’s IPs can be easily damaged during transport; CM uses PSP, which is susceptible to scratches in the computer reader; low exposure can create a noisy image; and the PSP located in the IP is very sensitive to radiation, which can contribute to a noisy image (Fig. 7–26).

71. (B) Non–scintillator-based imaging systems have a direct two-step process: (1) The x-ray beam strikes the photoconductor (e.g., amorphous selenium [a-Se]), and the a-Se converts x-ray to electrons; (2) electrons migrate to the thin-film transistor (TFT), after which the signal is sent to the workstation monitor (Fig. 7–27).
Figure 7–25. Different tissue density in the breast. All fatty (A); scattered fibroglandular tissue (B); heterogeneously dense (C); extremely dense (D).
Figure 7–26. Computed mammography (CM) reader (A); scanning the imaging plate (IP) (B); the patient identification and projection information is input by scanning it to the barcode reader.

Figure 7–27. Flat-panel detector system—direct capture (A); indirect capture (B). (Reproduced with permission from Peart O: Mammography and Breast Imaging PREP: Program Review and Exam Prep. 2nd ed. New York, NY: McGraw-Hill Education; 2018.)
72. (B) Spot compression increases compression to the area of suspected abnormality, allowing the tissue to spread more evenly and eliminating pseudomasses. Because of the need to reduce extraneous light (increased visualization of breast tissue), coned collimated images are not taken when imaging with spot compression (Fig. 7–28).

73. (B) This is a skin fold. Closed IMF is not visualized on the CC projection. The pectoralis muscle is seen at the far posterior aspect of the breast, and veins, when calcified, show as high optical density tubular structures.

74. (B) If the patient stands away from the detector and bends forward, her chest will move forward and hopefully the protruding abdomen will project away from the imaging area. If this does not achieve the desired result, and the abdomen still protrudes on the IMF, the technologist cannot sacrifice posterior and lateral tissue to image the anterior breast. Two projections would be required—a lateral projection of the anterior breast and MLO for the posterior and upper–outer quadrant of the breast. Care must be taken to get an open fold.

75. (B) Mammographically, a halo around a lesion suggests that the lesion is circumscribed and could be a benign tumor. If the lesion is suspected to be benign, further testing is needed to assess the benign or suspicious nature of the lesion. Ultrasonography would be the best next step to differentiate a solid lesion versus a cystic lesion.

76. (B) The specimen should always be compressed and radiographed to ensure that it was completely removed. If calcifications are present, the lesion should be magnified to ensure that all the calcifications were removed.

77. (A) Analog receptors can produce an acceptable image within a range of 30% underexposure and 50% overexposure. In digital imaging, if a graph of the optical density (called the signal) and the relative exposure is plotted, the relationship is not the characteristic curve (also called Hurter and Driffield [H & D] or sensitometric curve); rather, it is a straight line (Fig. 7–29). The digital image therefore has much wider latitude compared with images in analog mammography systems. This ability to adjust the final image (thus reducing the need for repeats) is one of the greatest advantages of digital imaging. Digital imaging can produce an acceptable image at 50% underexposure and 100% overexposure. This means that digital imaging can correct exposure factors 100% greater than or 50% less than the normal range. The disadvantage is that visual cues of overexposure and underexposure are not easily seen. Overexposure is seen as decreased contrast. The image will not show an overexposure...
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where the filters used are often the same element as the x-ray tube target. Matching the filter to the same element as the x-ray tube target will allow the K-characteristic x-rays to pass while blocking the higher and lower energy Bremsstrahlung x-rays. In digital units, if the tube target is tungsten, Rh can be used for the fatty breast and silver (Ag) for the large or dense breast. Some tungsten targets use Mo for fatty breasts and Rh for dense breasts.

81. (D) With tungsten targets, Bremsstrahlung x-rays will predominate at energies above and below the 17 to 24 kiloelectron volts (keV) range. Although tungsten emits “harder” spectrum rays, the wider dynamic range can be utilized in digital imaging. Molybdenum targets produce characteristic x-rays in the 17 to 19 keV range after a photoelectric interaction. These are ideal for imaging fatty breasts when using an analog system. The characteristic x-ray produced using rhodium targets are similar to that from molybdenum, but because rhodium has a slightly higher atomic number, more Bremsstrahlung x-rays are produced, and the K-characteristic x-rays will be 3 to 4 keV higher, which provides a better penetration of the dense breast in the analog systems. Aluminum can be used as the filtration material in digital tomosynthesis and photon counting systems.

82. (A) It is recommended that a woman above age 40 years have a clinical breast examination (CBE) at about the same time as annual mammography, even if the woman has no symptoms and no significantly higher risk for breast cancer. Breast self-examination (BSE) is an examination of the breast by the patient herself. Various organizations now have different recommendations for CBE. The American Cancer Society (ACS) and the Susan G. Komen for the Cure Foundation recommend that CBE be performed at least every 3 years, starting between ages 20 and 39 years and annually starting at age 40 years. The American College of Obstetricians and Gynecologists (ACOG) and the

( black image until the saturation point). An underexposure is seen as quantum noise, an excessively noisy image.

78. (B) Gynecomastia is a benign proliferation of tissue in the male breast. The condition usually has a high rate of spontaneous regression and can occur at birth, during teenage years (can last up to 18 months), or in males above age 50 years. It is often seen bilaterally but can be unilateral. Gynecomastia is not associated with increased risk for breast cancer in males.

79. (C) The Montgomery glands (glands of Montgomery) are seen as protrusions on the surface of the areola. They are actually specialized sebaceous glands that usually become more prominent during pregnancy and lactation.

80. (B) Aluminum (Al) is used as the filtration in some digital tomosynthesis units and photon-counting imaging systems. Molybdenum (Mo) and rhodium (Rh) are often used as target and filtration materials in analog units,
American Medical Association (AMA) recommend starting CBE at age 40 and annually thereafter. The ACS and the U.S. Preventive Services Task Force (USPSTF) no longer recommend that all women routinely perform BSE, and the USPSTF states that there is a lack of evidence to support the usefulness of CBE. Most societies still promote breast awareness and encourage women to know the look and feel of their breast. Studies have suggested that women will find cancer while showering, bathing, or dressing, rather than during a specific breast examination. The American Academy of Family Physicians (AAFP) tends to follow the recommendations of the USPSTF. The sensitivity for CBE ranges from 40% to 70%, and specificity ranges from 86% to 99%.

83. (D) When imaging for the CC projection, the detector must be level with the entire length of the raised IMF. If the detector is too high, the posterior and inferior breast will not be imaged. If the detector is too low, the superior and posterior breast tissue is missed (Fig. 7–30).

84. (A) Capture elements function to collect or capture the x-rays. In mammography, these can include cesium iodide (CsI), which is used to releases light photons; gadolinium oxysulfide (GdOS), which is also a scintillator; and amorphous selenium (a-Se), a photoconductor used in nonscintillator detectors. Photomultipliers are used in the computer reader. They collect the blue-purple light given off by the trapped electrons as they return to their normal state and convert the light energy to an electrical signal. (See Fig. 7–27.)

85. (D) In core biopsy, a cylinder of tissue is removed by using a 14-gauge or higher-gauge needle (Fig. 7–31). The core biopsy sample is larger than that obtained with fine-needle biopsy (FNB). Tissue samples from core biopsy are assessed histologically. FNB is performed with a small-gauge (20- to 23-gauge), needle to remove cellular material for cytological analysis. The accuracy of the procedure is dependent on the skills of
Excisional biopsy refers to surgical biopsy, where the entire lesion as well as the surrounding margins of normal-appearing tissue is removed. Wire localization is a procedure during which the location of a non-palpable lesion or calcifications in the breast are identified by placing a thin needle into the breast. The needle is guided through the lesion or calcifications under the guidance of mammography or ultrasonography, and a small hook wire is left in place to mark the site of the suspected abnormality before surgery (Fig. 7–32).

86. (D) RM or RL are both useful projections that help separate the glandular structures of the breast to resolve questions of superimposition. The ID projection is used in imaging the augmented breast clear of the implants. MLO is a routine projection and would not be used as an additional projection. XCCL is best for imaging the posterolateral parts of the breast with the x-ray traveling craniocaudally.

Figure 7–31. The biopsy gun traverses the lesion to remove a sampling (A); wire localization technique showing the hook wire in place in the lesion (B). (Reproduced with permission from Peart O: Mammography and Breast Imaging PREP: Program Review and Exam Prep. 2nd ed. New York, NY: McGraw-Hill Education; 2018.)

Figure 7–32. Radiograph showing drooping of the anterior breast on the mediolateral oblique (MLO) projection. (Reproduced with permission from Peart O: Lange Q&A: Mammography Examination. 3rd ed. New York, NY: McGraw-Hill Education; 2015.)
87. (C) If too much shoulder muscle and axilla are allowed in the compression field, the axilla will be compressed, but the thickness of the axilla will not allow for compression of the lower breast. The high placement of the detector unnecessarily elevates the shoulder, pulling breast tissue from the compression field. There will be poor pectoral muscle and possibly missed posterior breast, but compression of the lower breast is not usually compromised. The pectoral muscle must be demonstrated to the level of the nipple. A horizontal IMF is important for CC positioning but not for MLO (Fig. 7–32).

88. (C) As a woman ages, declining hormone levels affect both the stroma and the epithelium of the breast. The breast loses its supporting structure, which is replaced by fat, producing a smaller breast or a larger, more pendulous breast because of the loss of the epithelial structures and stroma and the gain of fat. The ductal system remains, but the lobules shrink and collapse. This process generally speeds up at menopause and may continue for 3 to 5 years. It is referred to as atrophy or involution. Increased estrogen or hormone levels, which occur during menstruation, result in an increase in breast stroma and epithelium, leading to denser breast tissue.

89. (D) The arm position will help minimize skin folds. The patient’s ipsilateral arm should hang relaxed by her side, with the humerus rotated externally. If there is a persistent fold, the technologist can slide a finger under the compression device to roll the folds posteriorly and laterally. Patient should face forward with her head turned toward the contralateral breast. (A) will maximize visualization of the posterior lateral tissue. (B) and (C) will improve visualization of the medial breast (Fig. 7–33).

90. (B) Turbid phosphors have crystals distributed throughout the phosphor level. They produce lateral spreading of light, which can reduce the spatial resolution of the image. Turbid phosphors include barium fluorobromide and europium, barium fluoroiodide with europium, barium strontium-fluoride baromide-iodide, gadolinium oxysulfide, and rubidium chloride. Needle phosphors have crystals growing in columns. They have less lateral spread of light and better spatial resolution (e.g., cesium iodide). a-Se is a photoconductor. It is used to convert x-ray to electrons.

91. (B) Grids are used to reduce scatter and increase subject contrast. However, grid use is contraindicated in magnification mammography because the large air gap acts as a grid in reducing scattered radiation. Grid use in magnification is therefore not necessary and would unnecessarily increase the exposure dose to the patient.

92. (D) The from below (FB) projection best visualizes the central and medial abnormalities
high on the chest wall and can be done for all these reasons. The beam is directed inferior to superior.

93. (D) The image is missing the IMF. There is sufficient pectoralis muscle, as well as the posterior and anterior portions of the breast, because the pectoralis muscle extends below the posterior nipple line. The skin fold in the far posterior breast is minimal and does not obscure breast tissue. The fact that the skin marker does not fully cover the lesion is not a major problem. The MLO projection best demonstrates the posterior and upper–outer quadrant of the breast. Considerations when evaluating the MLO projection includes the following: The pectoral muscle should be wide superiorly with a convex anterior border and should extend to or below the level of the posterior nipple line; the IMF should be open; dense areas of the breast should be adequately penetrated; there should be no drooping of the anterior breast and distortion of the architectural structures; and abdominal tissue should not overlap the breast tissue.

94. (A) Parallel grid designs are common in mammography. Here the lead strips are aligned adjacent and parallel to each other and placed lengthwise in grid structure. Parallel grids allow central ray angulation in the direction of the lead strips only and will remove scatter in one direction. Option (B) describes the crossed (cross-hatch or criss-cross) grid design. This is similar to having two linear grids with their linear patterns at right angles to each other. Crossed grids do not permit any central ray angulation and will clean up scatter in both directions. Option (C) describes the focused grid, where the lead strips are virtually parallel in the midsection, but at the periphery they incline slightly toward the center of the grid. The focused grid must be used at its designed SID to avoid grid cutoff and work well with mammography units that are designed to operate at a fixed SID. Grid cutoff is the unwanted absorption of the primary beam by the lead strips of the grid. Option (D) describes the moving grid. Grids can be stationary or moving. The stationary grid will sometimes produce observable images of the grid lines. The moving grid “moves” during exposure. In breast imaging, the grid is a reciprocating grid that moves back and forth versus the oscillating grid that moves in a circular pattern (Fig. 7–34).

95. (B). The presence of workstations monitors also allows for rapid image viewing and also serves to maintain quality assurance of the
images. The mammographer can immediately determine whether to repeat the examination at the acquisition workstation (AWS). Workstations also allow for postprocessing of an image while viewing the changes being made. The AWS monitors are typically low resolution, 2- to 3-megapixel monitors. The review workstation (RWS) monitors (sometime called interpretation monitors) used by the radiologist for interpretation are critical in digital imaging, and all diagnostic interpretation must be conducted on monitors certified by a physicist. These monitors should be a minimum of 4 megapixels although 5 megapixels or above is recommended. Typical monitors are 21.3 in., 5-megapixel, monochrome LCD. They are of high contrast, with wide viewing angle and a luminance of up to 750 cd/m² (candels per square meter). Many have a luminance equalizer and calibration function to enable smooth grayscale display. Illuminance describes the intensity of light incident on a surface. Luminance describes the brightness of a light source.

96. (A) When the x-ray beam strikes a scintillator, such as cesium iodide, the cesium iodide converts x-rays to light. A CCD converts light to electrons. When the x-ray beam strikes the photoconductor, such as a-Se, the a-Se converts x-rays to electrons. Instead of the CCD, some systems use CMOS, which is used to convert light into an analog signal that is sent to the ADC. CMOS is a semiconductor transistor similar to the CCD in that it has either a fiberoptic coupling or a lens system. Each array of MOS capacitors represents a pixel. CMOS is smaller than CCD and will therefore take up less space.

97. (B) When the x-ray beam strikes the photoconductor (e.g., amorphous selenium [a-Se]), the a-Se converts x-ray to electrons. When the x-ray beam strikes the scintillator (e.g., cesium iodide), the cesium iodide converts x-ray to light. A CCD also converts light to electrons. Instead of the CCD, some systems use CMOS to convert light into an analog signal that is sent to the ADC. CMOS is a semiconductor transistor similar to the CCD in that it has either a fiberoptic coupling or a lens system. Each array of MOS capacitors represents a pixel. CMOS is smaller than CCD and will therefore take up less space.

98. (A) The overall repeat rate should be approximately ≤2%, but a rate of 5% is adequate. If the repeat rate exceeds the acceptable level (2–5 percentage points) or if repeat or reject rates change from the previously measured rate by more than ±2 percentage points, the change should be investigated and corrective action taken.

99. (C) Oil cysts show mammographically as high optical density tumors with lucent centers and eggshell-like calcifications. They usually form as a result of fat necrosis or are slowly calcifying hematomas. Fat necrosis is death of fatty tissue in the breast that can occur spontaneously but is usually the result of a biopsy or injury. When the fat tissue dies, it changes to oil. The body then forms a capsule around the oil to protect itself. The capsule generally has a thin layer of calcifications, which have an eggshell-like appearance on the mammogram. Oil cysts are benign. Ductal papillomas are benign masses associated with the ducts and are not seen mammographically. A fibroadenoma is a benign radiolucent mass that may or may not contain calcifications. A hematoma is seen as a circular-oval lesion with mixed optical density. It is a benign mass associated with injury or surgery. (See Fig. 3–18.)

100. (C) TFTs in the flat-panel detector systems are used to collect electrons from the detector elements (DELS). The electrons are then extracted off the TFT array and sent to the ADC, which sends the digital signal to the computer as an image. The TFT is a device made of electrodes, photoconductor, storage capacitor, and other components. A common material is amorphous silicon (a-Si) or a-Se. a-Si is a photoconductor that can be deposited on thin films (hence the name thin-film diodes or transistors).
101. (C) The ID projection is a method of imaging the augmented breast. The method displaces the implant posteriorly to exclude it from the compression area. ID projections are taken in addition to the routine projections. In general, the routine series of projections for a patient with breast augmentation would include routine CC of both breasts, routine MLO of both breasts, CC with ID of both breasts, and MLO with ID of both breasts (Fig. 7–35).

102. (D) Under the final regulations of the US Food and Drug Administration (FDA), all technologists satisfying the interim regulations can still perform mammography. All new technologists must complete at least 40 hours of documented training in mammography under the supervision of a qualified instructor or, before April 28, 1999, have satisfied the requirements of the interim regulation of the FDA. The 40 hours must include 27.5 hours of the mammography course and...
12.5 hours of documented performance of a minimum of 25 examinations under direct supervision of a qualified technologist. At least 8 of the 40 hours must document training in each mammography modality in which the technologist intends to practice (e.g., digital or tomosynthesis) if the technologist started working in the new modality after April 28, 1999. The mammography course must include breast anatomy and physiology, positioning and compression, quality assurance/quality control techniques, and imaging of patients with breast implants.

103. (B) Of the two routine projections, MLO offers imaging of the maximum amount of breast tissue on a single projection. The MLO projection best demonstrates the posterior and upper–outer quadrant of the breast. Considerations when evaluating the MLO projection include the following: The pectoral muscle should be wide superiorly with a convex anterior border and should extend to or below the level of the posterior nipple line; the IMF should be open; dense areas of the breast should be adequately penetrated; there should be no drooping of the anterior breast and distortion of the architectural structures; the skin fold must be open; and the abdominal tissue should not overlap the breast tissue (Fig. 7–36).

104. (A) Ductal ectasia is a benign inflammatory condition of the ducts, which leads to nipple discharge, nipple inversion, or periareolar sepsis. The condition may resemble breast carcinoma. Paget’s disease of the breast is a special form of ductal carcinoma associated with changes of the nipple. Peau d’orange is a condition where the skin of the breast becomes thickened and dimpled, resembling an orange; this may be the result of either benign or malignant conditions. Ductal papillomas are benign masses associated with the ducts and are not usually seen mammographically.

105. (A) In the immature breast, the ducts and alveoli in the lobule are lined by a two-layer epithelium of cells. After puberty this epithelium proliferates, forming three alveolar cell types: superficial (luminal) A cells, basal B cells (chief cells), and myoepithelial cells forming the innermost layer or basal surface of the epithelium. Beneath the epithelium is connective tissue that helps keep the epithelium in place. Between the epithelium and the connective tissue is a layer called the basement membrane. The basement membrane provides support and acts as a semi-permeable filter under the epithelium (Fig. 7–37).
106. (B) To give consent, patients must have all the information that they need to make decisions about their health care. Information must be related in a language the patient can understand. This information includes the nature of the procedure; purpose of the procedure; possible risks associated with the procedure, including complications or side effects, the benefits, and the desired outcome; any alternative procedures that could be performed; and the risks and benefits of alternative procedures.

107. (B) Mammoplasty is the general term used when describing reshaping of the breast. The breast can be lifted to reduce a sagging breast, enlarged (augmented), or reconstructed after the removal of a tumor. Reduction mammoplasty is the term used to describe the reduction of the size of the breast by removing excess breast tissue. Breast biopsy involves removal of breast tissue for histological testing.

108. (C) Each pixel contains bits of information, and the number of bits per pixel determines the shade of gray demonstrated. A digital image can have between 25,000 and 1,000,000 pixels, and the smaller the pixels, the greater is the spatial resolution. The greater the number of pixels, the greater is the image resolution, and the number of bits per pixel determines the shade of gray demonstrated or the bit depth. The level of gray will determine the overall image quality or contrast resolution.

109. (B) The DELs (or dexels) are located within the TFT. The DEL is a part of the complex circuit device of the TFT. The DEL is the sensitive component of the TFT, which collects electrons emitted from either a-Se or a-Si, both of which represent individual components of a digital image. Each square in the TFT matrix can have sensitive and nonsensitive areas. The fill factor is the ratio of the sensitive area to the entire detector area and is usually expressed as a percentage. Fill factor will affect the spatial resolution and signal-to-noise ratio. A typical fill factor is 80%. DEL size controls the recorded detail, or spatial resolution, for the flat-panel device. DEL size also contributes to the image blur present in a flat-panel detector. The larger DELs in a flat-panel detector cause more image blur. The technologist cannot change the size of the DEL, which is fixed by the individual manufacturer.

110. (C) In the superoinferior oblique (SIO) projection, the beam is directed from the superolateral to the inferomedial surface of the breast; therefore, the medial breast is closest to the detector (Fig. 7–38).

111. (D) In general, imaging of the male breast will present the same difficulty as that of a
be used for patients with Infusaport [port-a-cath] inserted for long-term chemotherapy treatment, the patient with kyphosis, and patients who have had recent open-heart surgery. ML is not a good substitute because it is poor at imaging the posterior and lateral aspects of the breast. XCCL best images the posterolateral breast tissue.

115. (C) Ductal carcinoma occurs in 90% of all women with breast cancer. Lobular carcinoma affects 5% to 10% of women with breast cancer. Other forms of breast carcinoma, including medullary carcinoma, account for <10% of the total breast cancer cases.

116. (D) These are MQSA requirements. The assessment of findings refers to the final result (e.g., benign). Additional patient identifiers could be the patient’s age, date of birth, or medical record number. The report must also identify the interpreting radiologist.


