Specialized Topics in Areas of Radiologic Sciences
P.O. Box 2931 Toledo, Ohio 43606 419-471-1973
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# Unit 45

# Digital Radiography and PACS

by

Christi E. Carter, MSRS, RT ®
&
Beth L. Veale, M.Ed., RT ® (QM)

First Edition

Prepared by: Carolyn J. Frigmanski, M.A.,B.S.R.T. ®
Founder, S.T.A.R.S.

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Unit 45: **Digital Radiography and PACS** by Christi E. Carter, MSRS, RT ® and Beth L. Veale, M.Ed., RT ®(QM)
Please complete the answer sheet at the conclusion of this post test & return it to the **S.T.A.R.S.** office.

**Chapter 1**

1. Digital imaging was first used in medical applications with the advent of

   a. magnetic resonance imaging
   b. computed tomography
   c. ultrasound
   d. nuclear medicine

2. The term used to describe moving images via telephone lines to and from various locations is

   a. remote radiography
   b. kinetic imaging
   c. teleradiology
   d. via communication

3. Computed radiography was first introduced commercially in the United States in 1983 by

   a. Eastman Kodak
   b. Siemans Corporation
   c. General Electric
   d. Fuji Medical Systems of Japan

4. The digital radiography system utilizing devices to absorb x-rays and convert them into light is

   a. indirect capture
   b. digital analysis
   c. analog conversion
   d. direct conversion

5. The imaging modality in which the latent image formation results when x-rays strike a phosphor, get deposited in the phosphor and released when stimulated by light from a reader is called

   a. conventional film/screen radiography
   b. computed radiography (CR)
   c. digital radiography (DR)
   d. electron capture radiography

6. When utilizing CR and DR, radiographic contrast is ***primarily*** controlled by the function of

   a. filtration
   b. grid ratio
   c. imaging processing look-up table
   d. phosphor scintillation

7. The abbreviation used to identify standards to allow imaging modalities to communicate is

   a. PACS b. DICOM c. RIS d. HIS

## Chapter 2

8. The amount of memory needed to store one alphanumeric character is called a

a. bit b. bus c. 1 megabyte d. byte

9. The brain of the computer consisting of a small chip in the motherboard is called the

a. central processing unit (CPU)
b. random access memory
c. bus
d. read-only memory

10. _____ is short-term storage for open programs.

a. central processing unit (CPU)
b. the bus
c. random access memory
d. read-only memory

11. The interface connection used between most devices commonly used today is

a. IDE b. USB c. serial d. SCSI

12. The main respository for programs and documents on a personal computer is called the

a. soft drive b. operating system c. network card d. hard drive

13. The CD can hold up to approximately _____ MB of data.

a. 250 b. 500 c. 780 d. 1,000

14. An individual controllable set of dot triads is called a

a. pixel b. matrix c. dot pitch d. aspect ratio

15. The monitor used traditionally in radiography applications due to its superior resolution is

a. low definition b. plasma screen c. high definition d. CRT

## Chapter 3

16. The computer network in which each computer is considered equal without control over others is

a. local area b. peer-to-peer c. server-based d. wide area

17. The communication medium that uses glass threads to transport data on the network is called

a. coaxial cable b. wireless c. fibroptic cable d. twisted-pair wires

18. In network communication, the layer that moves bits from one place to another is identified as

a. 1 b. 2 c. 3 d. 4

19. The geometric network layout that has the devices connected to a central hub or switch is called a

a. ring b. bus c. mesh d. star

20. DICOM was developed by the National Electrical Manufacturers Association (NEMA) and the

a. American Society of Radiologic Technologists
b. American College of Radiology
c. American Registry of Radiologic Technologists
d. American Medical Association

21. The system standard generally used in communications between radiology and hospital information systems is

a. DICOM b. ANSI c. HL-7 d. SDO

**Chapter 4**

22. The phosphor used in computed radiography(CR) imaging plates is in the family of crystals called

a. barium fluorohalide
b. lithium fluoride
c. rare earth
d. amorphous

23. The laser in the CR reader emits _____ light.

a. blue b. red c. green d. ultraviolet

24. A device/system that represents changing values as continuously variable physical quantities is

a. digital b. synchronous c. fluctuating d. analog

25. The spatial resolution in computed radiography systems has a lp/mm. range of

a. 1-3 b. 2-4 c. 2.55 – 5 d. 5-7

26. The relative "speed" in a CR system when compared to conventional film/screen systems is

a. 100 b. 200 c. 400 d. higher than 600

27. To erase the image on a CR imaging plate, _____ energy must be applied.

a. light b. laser c. ultraviolet d. microwave

**Chapter 5**

28. The optimal kVp ranges for CR imaging plates is

a. 30 – 50 b. 60 – 110 c. 70 – 90 d. 80 – 120

29. The CR reader scans the imaging plate at a relatively constant frequency of _____ x _____ pixels.

a. 256 x 256 b. 512 x 512 c. 1024 x 1024 d. 2,000 x 2,000

30. The exposure indicator that identifies the amount of luminescence emitted as 1 mR at 80 kVp with a value of 200 is known as the

a. latitude value b. speed factor c. S or sensitivity number d. algorithm rate

31. The image data recognition mode that involves the user selection of the exposure index or sensitivity number and latitude value is described as

a. automatic b. fixed c. semiautomatic d. multiple manual

32. A plate reading artifact that appears as a residual image left on the imaging plate is due to

a. incorrect erasure setting
b. old age of the imaging plate
c. faulty transport through the reader
d. a defective laser

**Chapter 6**

33. The crystal used in flat-panel detectors is

a. cesium iodide
b. amorphous silicon
c. barium fluorohalide
d. amorphous selenium

34. The device composed of a photosensitive array made up of small pixels that store electrons is the

a. flat-panel detector
b. charged-coupled device
c. thin-film transistor
d. field-effect transistor

35. The DR process involving the conversion of x-rays to light and then an electron signal is known as

a. direct b. indirect c. scintillation d. latent

36. More than _____ _____ pixels can be read and converted to a digital image in less than 1 second.

a. 10 thousand b. 500 thousand c. 1 million d. 3 million

37. The oldest indirect-conversion DR system used is the

a. charge-coupled devices (CCD)
b. flat-panel detectors
c. thin-film transistors
d. cesium iodide crystals

38. The specialized pixel sensors developed by NASA are called

a. space age sensor
b. thin-film transistors
c. charge-coupled devices (CCD)
d. complementary metal oxide silicon (CMOS)

39. The measurement of the percentage of x-rays that is absorbed when they hit the detector is called

a. remnant radiation
b. quantum inefficiency
c. detective quantum efficiency (DQE)
d. scatter factor

40. DQE is increased the most by utilizing

a. scanned projection radiography
b. direct capture DR
c. computed radiography (CR)
d. conventional film/screen system

41. The system with the highest spatial resolution is

a. conventional film/screen system
b. direct capture DR
c. computed radiography (CR)
d. indirect capture DR

42. The artifact that exists when grid lines interfere with the pixel rows is classified as

a. cutoff b. cleanup c. banding d. moire'

43. If exposures are taken too rapidly, there may not be enough time for each previous exposure to transfer the entire signal thereby creating

a. pixel variations
b. matrix deterioration
c. electronic memory artifact
d. phantom images

**Chapter 7**

44. The stage in DR image processing and manipulation that occurs in the computer where the algorithms determine the histogram is known as

a. preprocessing
b. matrix manipulation
c. postprocessing
d. plotting

45. A graphic representation of the optical densities in a collimated area by the CR reader is called the

a. algorithm b. histogram c. latitude value d. S or sensitivity number

46. To produce a wider histogram, radiographers need to select

a. high energy kVp
b. low mAs values
c. high mAs values
d. low energy kVp

47. The theorem applied to sampling a signal and its frequency to ensure maximum resolution is

a. Gurney-Mott
b. Poisson distribution
c. Nyquist
d. statistical sampling

48. When sampling, a wraparound image results from

a. aliasing b. automatic rescaling c. look-up table d. latitude error

49. A histogram of the luminescence values derived during image acquisition is called

a. mixed algorithm b. preprocessing c. look-up table d. latitude value

50. The amount of error that can be made and still result in the capture of a quality image is known as

a. aliasing b. automatic rescaling c. look-up table d. latitude value

51. The term used to describe detail or sharpness in DR systems is referred to as

a. high-pass filtering
b. spatial frequency resolution
c. smoothing
d. low-pass filtering

52. Image brightness is controlled by

a. modulation transfer function
b. algorithm level
c. edge enhancement
d. window parameters

53. Veil glare can be eliminated in CR by

a. shuttering b. filtering c. using grids d. higher window levels

54. If an anatomic area is too large to fit on one cassette, special software can create a composite by

a. orientation b. annotation c. stitching d. minification

55. Patient demographics can be displayed on an electronic image by utilizing

a. lead markers b. bar code label scans c. light-emitting devices d. paper labels

56. Historical images can be accessed by using the PACS system function called

a. archive query b. manual send c. electronic send d. history search

**Chapter 8**

57. The file room of a PACS system is known as the

a. central processing unit
b. random access memory
c. client server
d. archive server

58. The term used to describe the reading of images from outside of the hospital walls is

a. remote radiology b. distance imaging c. teleradiology d. internet access

59. The display workstation monitor that will soon take over the entire PACS display market is

a. cathode ray tube (CRT)
b. multiviewer lightbox
c. liquid crystal display (LCD)
d. high definition monitor

60. The reading station that has the best monitor and highest quality hardware is used for

a. radiographer quality control
b. radiologist viewing
c. file room management
d. teleradiology functions

61. The quality control station for radiographers usually has a _____ K monitor.

a. 1 b. 2 c. 3 d. 4

62. Many hospitals are moving away from printing patient films by creating

a. laser copies
b. DVDs (digital versatile disks)
c. paper based reproductions
d. CDs (compact disks)

63. The function that allows the user to move through images, studies and patients is called

a. navigation b. image manipulation c. archiving d. hanging

64. The function that allows the user to view the current or previous examinations is called

a. hanging b. study c. archiving d. client

65. The range of gray values that are being viewed is manipulated by the

a. histogram b. dynamic range c. window d. mode selection

66. The annotation function should ***not*** be used to identify the patient's

a. position b. age c. right or left side d. gender

67. The release of patient demographics, images and other data must comply with regulations by the

a. The Joint Commission
b. American Medical Association
c. American College of Radiology
d. Health Insurance Portability and Accountability Act

68. The advanced function at the reading station for users to assign colors based on the intensity of the tissue is called

a. multiplanar reconstruction
b. volume rendering technique
c. maximum intensity projection
d. shaded surface display

**Chapter 9**

69. One of the fastest growing components of any PACS is the

a. archive b. software c. server capacity d. demographics files

70. The master database of everything in the archive is contained by the

a. image storer b. hard drive c. image manager d. memory disks

71. The short-term tier that contains the parity disk is RAID

a. 0 b. 1 c. 3 d. 5

72. The long-term storage product using an array is a

a. tape b. optical disk c. floppy disk d. magnetic disk

73. The optical disk that utilizes blue laser technology is

a. digital versatility
b. ultra density
c. magneto-optical
d. laser disk

74. The magnetic tape technology that has a storage capacity between 40 and 160 gigabytes (GB) is

a. digital linear
b. linear tape open
c. linear energy open -3
d. advanced intelligent

75. The magnetic disk storage that operates as a high-speed, special purpose network that links different kinds of data storage devices is called

a. direct attached storage
b. network attached storage
c. storage area network
d. archival storage

76. A company that provides outsourcing of archiving and management functions with a pay-per-use service charge is known as

a. disaster recovery
b. remote record storage
c. long term storage
d. application provider

**Chapter 10**

77. The gold standard for film digitization is

a. optical b. laser c. charge-coupled devices d. electronic

78. The film digitizing function to analyze densities seen on an image and to alert the radiologist of questionable densities is referred to as

a. computed aided diagnosis
b. radiologist assisted diagnosis
c. density variation diagnosis
d. pathologic density analysis

79. The imager using heat to process the latent image is termed

a. wet b. laser c. dry d. light

80. Dry film contains crystals composed of

a. silver halide b. silver bromide c. calcium tungstate d. silver behenate

81. A digital versatile disk (DVD) is composed of layers of aluminum and

a. silver b. gold c. polyester plastic d. tin

**Chapter 11**

82. A comprehensive set of activities designed to monitor and maintain systems that produce a product is called

a. acceptance testing
b. product evaluation
c. quality control
d. quality standardization

83. The system requiring the involvement of all levels of individuals serving as team members to develop and insure quality is referred to as

a. continuous quality improvement
b. total quality management
c. quality assurance mechanism
d. quality control

84. The American College of Radiology suggests that quality control tasks be performed at least

a. daily b. monthly c. semi annually d. annually

85. The weakest link in the digital imaging chain is most often the

a. digitizer b. storage devices c. file manager d. monitor

86. In daily evaluation of the monitor, the number of luminescence patches to be clearly visualized is

a. 5 b. 10 c. 16 d. 25

87. In monthly evaluation of a CRT monitor, the luminescence reading should be greater than ____$cd/m^2$.

a. 170 b. 250 c. 300 d. 500

88. All annual testing and acceptance testing should be performed by a qualified

a. quality control technologist
b. medical physicist
c. chief technologist
d. radiologist

89. One of the daily/weekly quality control activities for a dry laser imager is to measure the steps on the test pattern using a

a. photometer b. sensitometer c. magnifying lens d. densitometer

90. After acceptance, workstation processing speed and image transfer speed testing should occur

a. daily b. whenever problems occur c. weekly d. monthly

91. The term used to describe the constantly monitored measure involving the completion of all images at the modality and their transfer to the PACS is called

a. data integrity b. compression record c. data transfer d. image integration

92. Lossless compression involves a _____ compression ratio.

a. 1:1 b. 2:1 c. 3:1 d. 4:1

93. The term used to monitor and document the frequency of down time in a digital imaging system is

a. system down time
b. non-production time
c. non-functional timeframe
d. system up-time

94. The term used to describe several employees who are trained by the commercial vendors on all aspects of the digital imaging system with the purpose to train others are called

a. training experts
b. clinical specialists
c. super users
d. user experts

95. Training protocols and employee retraining should occur whenever

a. the commercial vendors are there
b. a new version of software is installed
c. federal or state inspections are approaching
d. a lawsuit may occur regarding competence

**Chapter 12**

96. According to the authors, ***one*** of the three general areas used to define image quality is

a. noise b. density c. kilovoltage d. distance

97. According to the authors, ***one*** of the daily quality control duties for radiographers is to

a. evaluate speed b. check kVp c. check mA linearity d. erase imaging plates

98. Artifacts created by the laser printer when used manually as a copier can result in a false-positive diagnosis produced from

a. bad toner b. misaligned roller c. dirt and fingerprints d. poor contact

99. According to the authors, ***one*** of the weekly quality control duties for the radiographer is

a. perform snesitometry
b. clean CRT screens
c. evaluate marker errors
d. reject analysis

100. According to the authors, ***one*** of the monthly quality control duties for the radiographer is

a. clean cassettes
b. check medication errors
c. clean receptors
d. reject analysis

101. There is no way to positively link an image with a performing radiographer without the use of

a. personal ID markers
b. electronic initials
c. electronic signature
d. plastic markers

102. Positioning errors may be the common cause of

a. visible artifacts
b. incorrect algorithm
c. misalignment of the part on the imaging plate
d. window closure

103. When cleaning the imaging plate, the radiographer should wear

a. latex gloves
b. gloves and a gown
c. sterile protective apparel
d. lint-free cotton gloves

104. Imaging plates must be discarded according to state and the United States Environmental Protection Agency regulations because they contain a small amount of

a. silver b. barium c. aluminum d. tin

105. Reproducibility of exposures should be a + or - _____ percentage within established exposure parameters.

a. 1 b. 2 c. 5 d. 10

106. High contrast white spots seen on a screen usually indicate

a. dust b. metal deposits c. crystal flaws d. intrinsic damage

107. According to the authors, the exposure function of the reader must be tested at least once

a. a day b. a week c. a month d. every 6 months

108. Line-pair testing patterns are used to determine

a. density b. quantum mottle c. resolution d. pixel depth

109. One of the service personnel quality control responsibilities involves

a. phosphor accuracy testing
b. artifact identification
c. reject reasons
d. matrix evaluation

110. One of the radiation physicist's responsibilities involves

a. employee orientation
b. service history analysis
c. monthly inservices
d. diagnostic reporting accuracy

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**Answer Sheet for: Unit 45 Digital Radiography and PACS by Christi E. Carter, MSRS, RT ® and Beth L. Veale, M.Ed., RT ® (QM)**

**Please place your lettered selection for each question in the respective box and return *ONLY this post test sheet to* S.T.A.R.S.**

| | | | | | |
|---|---|---|---|---|---|
| 1. | 13. | 25. | 37. | 49. | 61. |
| 2. | 14. | 26. | 38. | 50. | 62. |
| 3. | 15. | 27. | 39. | 51. | 63. |
| 4. | 16. | 28. | 40. | 52. | 64. |
| 5. | 17. | 29. | 41. | 53. | 65. |
| 6. | 18. | 30. | 42. | 54. | 66. |
| 7. | 19. | 31. | 43. | 55. | 67. |
| 8. | 20. | 32. | 44. | 56. | 68. |
| 9. | 21. | 33. | 45. | 57. | 69. |
| 10. | 22. | 34. | 46. | 58. | 70. |
| 11. | 23. | 35. | 47. | 59. | 71. |
| 12. | 24. | 36. | 48. | 60. | 72. |

**Answer Sheet for: Unit 45 Digital Radiography and PACS by Christi E. Carter, MSRS, RT ® and Beth L. Veale, M.Ed., RT ® (QM)**

**Please place your lettered selection for each question in the respective box and return *ONLY this post test sheet to* S.T.A.R.S.**

| | | | |
|---|---|---|---|
| 73. | 85. | 97. | 109. |
| 74. | 86. | 98. | 110. |
| 75. | 87. | 99. | |
| 76. | 88. | 100. | |
| 77. | 89. | 101. | |
| 78. | 90. | 102. | |
| 79. | 91. | 103. | |
| 80. | 92. | 104. | |
| 81. | 93. | 105. | |
| 82. | 94. | 106. | |
| 83. | 95. | 107. | |
| 84. | 96. | 108. | |