

Specialized Topics in Areas of Radiologic Sciences
P.O. Box 2931 Toledo, Ohio 43606 419-471-1973
E-mail: info@xrayhomestudies.com
www.xrayhomestudies.com

Unit 45

Digital Radiography and PACS

by

Christi E. Carter, MSRS, RT ®

&

Beth L. Veale, M.Ed., RT ® (QM)

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

Expiration date: Annual Renewal 9 Category A c.e.

See order form for current expiration date.

S
*
T
*
A
*
R
*
S



Specialized Topics in Areas of Radiologic Sciences

P.O. Box 2931 Toledo, Ohio 43606

Phone: 419-471-1973

Website: www.xrayhomestudies.com

Dear Participant,

Welcome to your selected S.T.A.R.S. developed continuing education units!!

These units consist of the text(s) on the desired topic and a multiple question, short answer post test. These units have been approved by the American Society of Radiologic Technologists. The number of Category A c.e.u.s is included on the order form and last page of the post test of each unit. **Our order form and new topics can be viewed online on our web site and always contains the renewal dates if you are interested in checking it out! Please feel free to share this information!**

- **All unit post tests must be returned for Units 1-22 for the designated c.e.u. credit.**
- **If you have only post test(s) for any unit higher than 22, the post test(s) are the only page(s) to be returned. Please remember that others may share your published texts & only order post tests to get c.e.u. credit too.**
- **Units 1 - 12 have also been approved by the Ohio Department of Health for c.e.u.s for radiographers for Ohio state license purposes.**

To secure your c.e.u.s, you must complete the reading & post test questions with a 75% or higher score on the individual units within the set. If you have received a 75% or higher score on each post test, we will forward your certificate immediately and keep your post tests for our records. If you did not get a 75% on a post test, we will send it back to you uncorrected for your evaluation and re-submission. No refund will be provided for unsatisfactory personal performance on any unit purchased.

- ***You need to return the post test pages only to the following address:***

• ***S.T.A.R.S. P.O. Box 2931 Toledo, Ohio 43606***

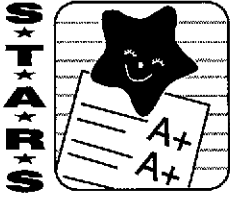
You may place a maximum of 5 sheets of post test pages in one standard size business envelope with the current accepted postage amount. Your post test pages will be checked on the same day or within 24 hours or less upon receipt to our office. **DO NOT FAX YOUR POST TESTS** because the A.S.R.T. requires that we must keep original records for 3 years and faxes fade over time!!

Please feel free to contact me at our e-mail address: info@xrayhomestudies.com or at the office at (419) 471 - 1973. If I am not available for your call, please leave a message on the answering machine and I will return your call as quickly as possible. We would love to hear from you and others!

Thank you for choosing S.T.A.R.S. for your continuing education needs.

Sincerely,

**Carolyn J. Frigmanski, M.A., B.S.R.T. ®
Founder, S.T.A.R.S.**



Specialized Topics in Areas of Radiologic Sciences

P.O. Box 2931 Toledo, Ohio 43606 419-471-1973

E-mail: info@xrayhomestudies.com

www.xrayhomestudies.com

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

- Digital imaging was first used in medical applications with the advent of
 - magnetic resonance imaging
 - computed tomography
 - ultrasound
 - nuclear medicine
- The term used to describe moving images via telephone lines to and from various locations is
 - remote radiography
 - kinetic imaging
 - teleradiology
 - via communication
- Computed radiography was first introduced commercially in the United States in 1983 by
 - Eastman Kodak
 - Siemens Corporation
 - General Electric
 - Fuji Medical Systems of Japan
- The digital radiography system utilizing devices to absorb x-rays and convert them into light is
 - indirect capture
 - digital analysis
 - analog conversion
 - direct conversion
- 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
 - conventional film/screen radiography
 - computed radiography (CR)
 - digital radiography (DR)
 - electron capture radiography
- When utilizing CR and DR, radiographic contrast is *primarily* controlled by the function of
 - filtration
 - grid ratio
 - imaging processing look-up table
 - phosphor scintillation
- The abbreviation used to identify standards to allow imaging modalities to communicate is
 - PACS
 - DICOM
 - RIS
 - HIS

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 c. American College of Radiology
b. American Medical Association 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 c. maximum intensity projection
b. volume rendering technique 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 c. magneto-optical
b. ultra density 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 sensitometry
- 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

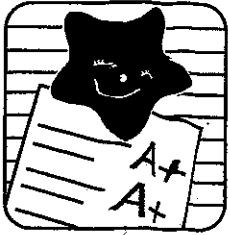
- a. visible artifacts
- b. incorrect algorithm
- c. misalignment of the part on the imaging plate
- d. window closure

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 c. reject reasons
b. artifact identification d. matrix evaluation
110. One of the radiation physicist's responsibilities involves
- a. employee orientation c. monthly inservices
b. service history analysis d. diagnostic reporting accuracy

S
*
T
*
A
*
R
*
S



Specialized Topics in Areas of Radiologic Sciences

P.O. Box 2931 Toledo, Ohio 43606

Phone: 419-471-1973

Website: www.xrayhomestudies.com

The ASRT Department of Education has approved the post-test for 9 Category A Continuing Education credit(s). Credit for this post-test expires on expiration date. See order form for

Please complete the following information so that you can obtain a signed certificate from an official from S.T.A.R.S. when you receive a 75% or higher score. **(Please print)**

Name _____

Address _____

City _____ State _____ Zip Code _____

Social Security Number _____ Date _____

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.	