

**Specialized Topics in Areas of Radiologic Sciences**  
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## **Unit 47:**

# **Quality Management in the Imaging Sciences**

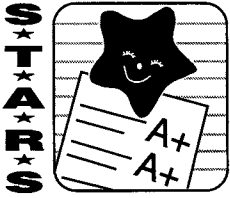
**By**

**Jeffrey Papp**

**Prepared by: Carolyn J. Frigmanski, M.A., B.S.R.T. ®  
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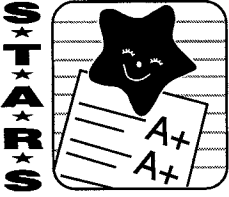
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### Unit 47: Quality Management in the Imaging Sciences by Jeffrey Papp

Please complete the answer sheet at the end of this post test and return it to the S.T.A.R.S. office.

#### Chapter 1

- The term \_\_\_\_\_ quality describes the use of statistical data to measure outcomes.
  - expected
  - actual
  - perceived
  - specific
- The first federal law or step to reduce human exposure to radiation from electronic products was
  - Radiation Control for Health and Safety Act
  - Consumer Assurance of Radiologic Excellence Act
  - Occupational Health and Safety Act
  - Consumer-Patient Radiation Health and Safety Act
- The organization that requires hospitals and other healthcare providers to perform and document specific quality management procedures is the
  - Department of Health and Human Services
  - National Center for Devices and Radiological Health
  - Food and Drug Administration
  - Joint Commission on Accreditation of Healthcare Organizations (Since the printing of this book the Joint Commission on Accreditation of Healthcare Organizations is now called the Joint Commission).
- Routine performance evaluations are considered Level \_\_\_\_\_ in quality control programs.
  - I
  - II
  - III
  - IV
- Continuous quality improvement requires \_\_\_\_\_ to provide information or an institution with goods and services.
  - input
  - consumers
  - action
  - suppliers
- There are \_\_\_\_\_ major categories of key process variables.
  - 3
  - 5
  - 7
  - 10
- A collection of individuals who work on specific tasks to solve particular situations are called
  - problem-solving teams
  - quality circles
  - focus groups
  - work teams

8. \_\_\_\_\_ of care is defined as the level of benefits when services are rendered under ordinary circumstances by average practitioners for typical patients.
- a. Continuity    b. Appropriateness    c. Effectiveness    d. Efficacy

### Chapter 2

9. The term \_\_\_\_\_ is used for information or measurements that are acquired by evaluating a particular sample.
- a. population    b. frequency    c. continuous variable    d. data set
10. The \_\_\_\_\_ is the one value that occurs with the greatest frequency in a data set.
- a. mean    b. mode    c. median    d. range
11. The term used to describe the random distribution in which the variance is equal to the mean is
- a. Poisson distribution    c. Gaussian distribution  
b. variance    d. range
12. The information analysis tool that displays data in the form of a bar graph is called a
- a. flow chart    b. Pareto chart    c. histogram    d. scatter plot
13. A successful quality management program requires a communication network developed and implemented by the
- a. quality control technologist    c. radiologist/physician  
b. quality management technologist    d. administrator
14. The average natural radiation exposure received to the U.S. population per year is \_\_\_\_\_ mrems.
- a. 250    b. 360    c. 425    d. 500
15. Proper filtration can reduce the patient's entrance skin dose by as much as \_\_\_\_\_%.
- a. 50    b. 65    c. 75    d. 90
16. Intermittent fluoroscopy can reduce the patient's entrance skin dose by as much as \_\_\_\_\_%.
- a. 50    b. 65    c. 75    d. 90

### Chapter 3

17. The proper relative humidity % range in the darkroom is
- a. 30-60    b. 40-60    c. 50-70    d. 60-75
18. Proper \_\_\_\_\_ in the darkroom is essential to minimize the risk of darkroom disease.
- a. humidity    b. ventilation    c. cleanliness    d. filtration

19. When blue-violet film is used, the safelight filter should be \_\_\_\_\_ colored.
- a. red                      b. yellow                      c. amber                      d. magenta
20. Some new modality film types are sensitive to all colors of visible light and called
- a. orthochromatic      b. panchromatic      c. polychromatic      d. multi-chromatic
21. Darkroom fog level should be **less than** \_\_\_\_\_ optical density units.
- a. 0.05                      b. 1.0                      c. 1.5                      d. 2.0
22. Temperature range for film storage should be between \_\_\_\_ and \_\_\_\_ degrees Fahrenheit.
- a. 45-65                      b. 55-75                      c. 55-80                      d. 60-75
23. Viewbox quality control testing requires the use of a
- a. densitometer      b. sensitometer      c. penetrometer      d. photographic light meter
24. Most image duplicating units emit \_\_\_\_\_ light.
- a. white                      b. infrared                      c. ultraviolet                      d. black

#### Chapter 4

25. The processing solution that removes unexposed and undeveloped silver halide crystals is the
- a. developer      b. fixer                      c. wetting                      d. stop bath
26. The oxidation/reduction reaction is carried out by the
- a. developing or reducing agents                      c. stop bath components  
b. fixing agents                      d. preservatives
27. The most readily available and common solvent is
- a. water                      b. sulfuric acid                      c. hydroquinone                      d. sodium chloride
28. The pH of the developing solution should range between \_\_\_\_\_.
- a. 5-9                      b. 8-12                      c. 10-11.5                      d. 12-14
29. Permanent hardening of the emulsion is called
- a. buffering                      b. sequestering                      c. clearing                      d. tanning
30. Processing chemicals are considered to be
- a. eco-friendly      b. hazardous                      c. environmentally safe      d. non-threatening

31. The solar roller is also referred to as the \_\_\_\_\_ roller.  
a. entrance      b. planetary      c. turnaround      d. master

32. The **least** desirable processor location is  
a. bulk inside      b. bulk outside      c. totally inside      d. daylight

### Chapter 5

33. Developing time should be kept within  $\pm$  \_\_\_\_ to \_\_\_\_% of the manufacturer's specifications.  
a. 1-2      b. 2-3      c. 3-4      d. 4-5

34. The instrument needed to measure specific gravity is the  
a. hydrometer      b. scale      c. galvanometer      d. penetrometer

35. Processors should be shut down after \_\_\_\_ hours if no films have been processed.  
a. 1      b. 2      c. 3      d. 4

36. An optical density of 1 above the base + fog is called  
a. contrast indicator      c. speed indicator  
b. maximum density      d. minimum density

37. Excessive optical density on an image is indicative of  
a. unsafe darkroom      c. oxidized developer  
b. underreplenishment      d. high developer temperature

### Chapter 6

38. The unit of measurement for precious metals such as silver is the  
a. troy ounce      b. pound      c. gram      d. sterling pound

39. Silver is reclaimed from the  
a. developer      b. stop bath      c. fixer      d. rinse

40. The federal pollution law that bans the placement of toxic substances in public waterways and sewer systems is  
a. Clean Water Act of 1984      c. Resources Conservation/Hazardous Waste Act of 1976  
b. Water Control Act of 1972      d. Resource Conservation and Recovery Act of 1987

41. The type of silver recovery system most recommended by manufacturers is  
a. recirculating electrolytic      c. chemical precipitation  
b. metallic replacement      d. terminal electrolytic

42. The most valuable film for maximum silver recovery is
- a. scrap exposed      b. archival      c. green      d. rare-earth
43. The shortest exposure time for a single-phase x-ray generator is \_\_\_\_\_ seconds.
- a. 1/120      b. 1/60      c. 1/20      d. 1/15
44. The identification of voltage waveforms for each type of x-ray generator is called
- a. peak      b. pulse      c. ripple      d. phase
45. X-ray photons must scatter at least \_\_\_\_ times before they can enter the control booth.
- a. two      b. three      c. four      d. five
46. Lead aprons and gloves should have a minimum of \_\_\_\_\_ millimeters of lead-equivalent thickness.
- a. 0.5      b. 0.75      c. 1.0      d. 1.25
47. Radiation intensity can be measured in a specific metric name of
- a. Gray      b. Sievert      c. Becquerel      d. coulombs/kilogram
48. The best method to determine adequate filtration is to measure
- a. peak kVp      c. half-value filtration  
b. inherent filtration      d. added filtration
49. The timer on single-phase x-ray units is checked with a device called a
- a. penetrometer      b. spinning top      c. oscillator      d. digital LED
50. Any variation in mA and timer reciprocity must be within  $\pm$  \_\_\_\_\_ %.
- a. 10      b. 15      c. 20      d. 25
51. The \_\_\_\_\_ focal spot is the rectangular surface on the anode where electrons strike.
- a. effective      b. line      c. track      d. actual
52. Light field-radiation field congruence can be evaluated with a
- a. pinhole camera      c. eight or nine penny test  
b. sensitometer      d. star resolution test
53. The overload protection mechanism should **not** permit an exposure that exceeds \_\_\_\_\_ % of the tube capacity for a single exposure.
- a. 50      b. 65      c. 80      d. 90



65. The reproducibility variance of exposure must be **less than** \_\_\_\_\_%.
- a. 0.05 (5)      b. 0.10 (10)      c. 0.20 (20)      d. 0.30 (30)
66. A dosimeter and stepwedge are used with a homogenous phantom to evaluate
- a. voltage waveform      c. mA linearity  
b. maximum exposure rate      d. timer variation

67. For gastrointestinal (GI) studies, lag times up to \_\_\_\_\_% are acceptable.
- a. 5      b. 10      c. 15      d. 20

### Chapter 10

68. The computer matrix is made up of tiny squares called
- a. voxels      b. pixels      c. bytes      d. bits
69. Barium fluorohalide or cesium bromide crystals doped with europium are found in
- a. imaging plates      c. input phosphors  
b. intensifying screens      d. output phosphors
70. One of the major advantages of computed radiography versus conventional radiography is
- a. better resolution      b. inexpensive      c. lower repeat rate      d. narrow latitude range
71. The device that converts the signal from each pixel into a digital form is the
- a. active matrix array      c. flat-panel detector  
b. thin film transistor      d. analog-to-digital converter
72. To compare image quality among digital systems, physicists evaluate
- a. modulation transfer function      c. Nyquist frequency  
b. detective quantum efficiency      d. fill factor
73. Full inspections of digital radiography imaging systems should be performed by the
- a. medical physicist      c. quality management technologist  
b. quality control technologist      d. biomedical engineer
74. The feature that can allow an image to be captured and displayed on a monitor is called
- a. image restoration      c. road mapping  
b. image enhancement      d. last frame-held
75. All digital imaging modalities display the final image on some type of electronic display referred to as
- a. "hard-copy" viewing      b. real-time viewing      c. static viewing      d. "soft-copy" viewing

76. Liquid crystal displays should have at least a(an) \_\_\_\_\_ degree or higher viewing angle.
- a. 50                      b. 60                      c. 70                      d. 80
77. The laser camera was first introduced in diagnostic imaging in
- a. 1976                      b. 1983                      c. 1995                      d. 2000
78. The term(s) used to describe images that are transmitted over a wide area network (WAN) from one location to another is
- a. picture archiving                      c. teleradiography  
b. management network                      d. hospital information system
79. The first bone densitometry system was
- a. single-energy x-ray absorptiometry                      c. quantitative computed tomography  
b. dual-energy x-ray absorptiometry                      d. single photon absorptiometry

### Chapter 11

80. The most frequent reason repeat radiographs are required in facilities with quality control procedures is
- a. positioning      b. underexposure                      c. overexposure                      d. patient motion
81. Scratches that run parallel to the direction of film travel are called
- a. pi lines                      b. hesitation marks                      c. guide shoe marks      d. reticulation marks
82. Which artifact listed below is categorized as an exposure artifact?
- a. radiation fog      b. quantum mottle                      c. insufficient optical density      d. static
83. Dark bands that differ widely in brightness in digital imaging systems are termed
- a. phantom images                      c. foreign body shadows  
b. histogram errors                      d. halos
84. The percentage or fraction of cases diagnosed correctly is referred to as
- a. accuracy                      c. sensitivity  
b. positive prediction value                      d. negative prediction value

### Chapter 12

85. To maximize the amount of photoelectric effect, the kilovoltage range is usually
- a. 20-30                      b. 40-50                      c. 50-60                      d. 60-70
86. Mammography x-ray tubes typically use a \_\_\_\_\_ window.
- a. tinted glass      b. silicon                      c. beryllium                      d. lead glass

87. The target material with an atomic number of 42 is
- a. tungsten      b. molybdenum      c. rhodium      d. aluminum
88. The postprocessing function in full-field digital mammography systems that permits manipulation of the dynamic range is
- a. window widening      c. tissue equalization  
b. annotation      d. window leveling
89. Both the Mammography Quality Standards and Mammography Standards Reauthorization Acts require \_\_\_\_\_ inspection of facilities including a physics survey.
- a. annual      b. semiannual      c. biannual      d. triannual
90. The minimum acceptable half-value layer for x-ray tubes with a measured operating voltage of 20 is
- a. 0.2      b. 0.25      c. 0.3      d. 0.35
91. Fluorescent bulbs in viewbox illuminators should be changed every
- a. year      b. 2 years      c. 3 years      d. 4 years
92. A minimum of \_\_\_\_\_ mammography exams during a 24-month period is a required continuing experience requirement for technologists.
- a. 100      b. 200      c. 300      d. 400+
93. A breast phantom contains 50% glandular and \_\_\_\_\_% adipose tissue.
- a. 20      b. 25      c. 50      d. 75
94. Repeat analysis should be performed on a(an) \_\_\_\_\_ basis.
- a. daily      b. weekly      c. monthly      d. quarterly
95. Inspections by a certified inspector from the Food and Drug Administration is scheduled every
- a. year      b. 2 years      c. 3 years      d. 5 years
96. The certified inspector will request the charting of sensitometric film strips for the previous
- a. 3 months      b. 6 months      c. 12 months      d. 24 months
97. The use of unqualified personnel in performing mammographic examinations is considered to be a(an)
- a. serious incident      c. serious adverse event  
b. adverse event      d. incident

98. The most serious finding for a mammography facility in the inspection report is Level

- a. I                      b. II                      c. III                      d. IV

### Chapter 13

99. The American College of Radiology CT Accreditation Phantom is primarily constructed from a \_\_\_\_\_-equivalent material.

- a. aluminum      b. water              c. carbon              d. oxygen

100. The ability to visualize the minimum distance between two objects to be seen as separate is

- a. low-contrast spatial resolution      c. subject contrast  
b. image uniformity                      d. high-contrast spatial resolution

101. The portion of the CT image that contains no useful information is referred to as

- a. mottle              b. artifact              c. noise              d. void

102. Water constitutes \_\_\_\_\_% of soft tissue in the human body.

- a. 40                      b. 60                      c. 90                      d. 100

103. Slice thickness and linearity tests should be performed

- a. monthly              b. quarterly              c. semiannually              d. annually

### Chapter 14

104. Quality control phantoms are \_\_\_\_\_ materials in an oil or water solution.

- a. paramagnetic      b. magnetic              c. diamagnetic              d. ferromagnetic

105. The signal-to-noise ratio (SNR) test should be conducted \_\_\_\_\_.

- a. daily                      b. weekly                      c. monthly                      d. quarterly

106. The SNR phantom should occupy at least \_\_\_\_\_% of the field of view.

- a. 50                      b. 65                      c. 80                      d. 85

107. The quality control test conducted to evaluate the land marking locations is called

- a. detectability      b. slice position              c. slice thickness              d. spatial linearity

### Chapter 15

108. When a phantom made of water-based gel is used, \_\_\_\_\_ may occur

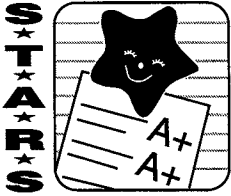
- a. deterioration      b. degradation              c. corruption              d. desiccation

109. The widest echo signal level that can be detected and displayed is called
- a. sensitivity      b. resolution      c. contrast      d. echogenicity
110. Dust filters should be free of lint and dirt to prevent
- a. artifacts      b. overheating      c. noise      d. quantum mottle
111. The comparison of depth of visualization should be within \_\_\_\_\_ centimeter(s).
- a. 1.0      b. 1.5      c. 2.0      d. 2.5
112. A swirling pattern with the background texture may be noticed and usually due to
- a. bad elements      c. phantom manufacturing  
b. inadequate blending      d. defective transducer
113. String test objects are used to evaluate \_\_\_\_\_.
- a. a-mode      b. b-mode      c. real-time      d. Doppler devices

#### Chapter 16

114. Scintillation cameras in nuclear medicine utilize \_\_\_\_\_ energy.
- a. x-ray      b. ultraviolet      c. infrared      d. gamma
115. The scintillation or light photon interacts with the
- a. collimator      c. computer  
b. photomultiplier tube (PMT)      d. pulse height analyzer (PHA)
116. The energy of technetium-99m is \_\_\_\_\_ keV.
- a. 140      b. 180      c. 200      d. 250
117. Most contemporary gamma cameras have count rates of \_\_\_ to \_\_\_ counts per second.
- a. 60,000-80,000      b. 100,000-120,000      c. 120,000-150,000      d. 150,000-200,000
118. A radionuclide that has combined with a nonradioactive chemical molecule is called a(an)
- a. isotope      b. radiopharmaceutical      c. radioisotope      d. radiochemical
119. The ALARA concept should maintain radiation doses to personnel working in radiation areas of a medical institution to **less than** \_\_\_\_\_% of the federal limits of occupational exposure.
- a. 5      b. 10      c. 15      d. 20
120. A CAUTION, HIGH RADIATION AREA sign is posted when mrem in any one hour exceeds
- a. 25      b. 50      c. 100      d. 200





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**Answer Sheet for: Unit 47 Quality Management in the Imaging Sciences by Jeffrey Papp**

**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.

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73.	85.	97.	109.	
74.	86.	98.	110.	
75.	87.	99.	111.	
76.	88.	100.	112.	
77.	89.	101.	113.	
78.	90.	102.	114.	
79.	91.	103.	115.	
80.	92.	104.	116.	
81.	93.	105.	117.	
82.	94.	106.	118.	
83.	95.	107.	119.	
84.	96.	108.	120.	