

Medical Imaging Systems

Chapter 1

1. Which of the following are examples of devices using standard optics?
 - a. Endoscopy
 - b. Microscopy
 - c. Fibers
 - d. A & B
2. What uses electromagnetic waves to excite water atoms inside the human body?
 - a. Ultrasound
 - b. X-ray
 - c. MRI
 - d. Nuclear Medicine
3. What modality uses x-rays to reconstruct slice and volume data?
 - a. MRI
 - b. Radiography
 - c. PET
 - d. CT
4. _____ essentially are electromagnetic waves that can be described by their amplitude, wavelength, and phase.
 - a. X-rays
 - b. MRI
 - c. CT
 - d. PET
5. What are molecules that are marked with radioactive atoms called?
 - a. Nuclides
 - b. Tracers
 - c. Electrons
 - d. Contrast
6. What uses high-frequency sound waves to penetrate bodily tissue?
 - a. MRI
 - b. CT
 - c. Ultrasound
 - d. PET
7. Sound waves are emitted from a _____ that is in direct contact with the body.
 - a. Probe
 - b. Scope
 - c. Fiber
 - d. Filament
8. True or false. The measurement principle of optical coherence tomography (OCT) is quite similar to US.
 - a. True
 - b. False

Chapter 2

9. Often, the independent variable _____ is a physical dimension.
- f
 - t
 - x
 - y
10. The output _____ of the signal is also called the dependent variable.
- t
 - f
 - y
 - x
11. Signals can be further categorized into deterministic and _____ signals.
- Stochastic
 - Randomized
 - Noise
 - Variable
12. True or False. Complex numbers are an extension to real numbers.
- True
 - False
13. The Dirac function is also called _____.
- Delta function
 - Impulse function
 - Constant function
 - A & B
14. Another basic operation to combine a signal and a system is _____.
- Correlation
 - Convolution
 - Delta function
 - Constant function
15. What is used to represent a continuous signal using only discrete frequencies?
- Fourier series
 - Fourier transformer
 - Rectangular function
 - Fourier coefficients
16. According to the Discrete System Theory all signals can only be stored and processed at discrete time instances in a _____.
- Transformer
 - Digital computer
 - Circuit
 - Sampling station
17. The process of transforming a continuous-time signal into a discrete time signal is called _____.
- Sampling
 - Convolution
 - Impulse train
 - None of the above

18. Which of the following are common noise sources?
- a. Quantization
 - b. Thermal noise
 - c. Acquisition noise
 - d. A & B
19. What is a simple system that allows only slow changes of the signal called?
- a. Low-pass filter
 - b. High-low filter
 - c. Slow filter
 - d. Signal filter

Chapter 3

20. An image is usually regarded as a function f that maps image coordinates_____to intensity values.
- a. Y, Z
 - b. A, B
 - c. X,
 - d. X, Z
21. What provides information about the distribution of the intensity values of an image?
- a. Grayscale
 - b. Image domain
 - c. Filters
 - d. Histograms
22. The cumulative distribution function (CDF) sums up the_____entries.
- a. Signal
 - b. Value
 - c. Histogram
 - d. Numerical
23. How many bits can a computer monitor display for each color channel?
- a. 8
 - b. 12
 - c. 16
 - d. 20
24. True or false. In CT, the gray values have known physical properties and allow interpretation of the material.
- a. True
 - b. False
25. Hounsfield units from the -1,000 to 1,000 range cover which of the following?
- a. Air
 - b. Soft tissue
 - c. Contrast agents
 - d. All the above
26. A different approach to enhance the display of an image is_____.
- a. Histogram normalization
 - b. Histogram equalization
 - c. Histogram balance
 - d. Histogram impedance

27. What is a common problem in image processing?
- a. Edge detection
 - b. Edge intensity
 - c. Edge changes
 - d. Edge restriction
28. Filtering and the transformation of the image is determined by the_____.
- a. Filter center
 - b. Filter kernel
 - c. Filter edge
 - d. Filter width
29. True or false. Average/Mean/Box Filter is the most basic filter.
- a. True
 - b. False
30. The better choice for blurring an image than the averaging filter is the_____ filter.
- a. Gaussian
 - b. Lean
 - c. Fourier
 - d. Linear
31. The Prewitt and_____ filters are a combination of a blurring and a derivative filter.
- a. Gaussian
 - b. Fourier
 - c. Sobel
 - d. Lena

Chapter 4

32. What term describes medical procedures with little operative trauma?
- a. Low-risk
 - b. Noninvasive
 - c. Low-cost
 - d. Minimally invasive
33. Minimally invasive surgery usually takes_____due to a smaller incision and worse orientation.
- a. a shorter time
 - b. a longer time
 - c. the same time
 - d. none of the above
34. Which of the following is needed for minimally invasive abdominal surgery?
- a. Endoscope
 - b. Trocars
 - c. Surgical instruments
 - d. All the above
35. What is placed in the body for a fast exchange of instruments?
- a. Endoscope
 - b. Retractor
 - c. Trocar
 - d. Laparoscope

36. The workflow of an endoscopic procedure is described by_____steps.
- Four
 - Five
 - Six
 - Seven
37. What gas is used to inflate the abdomen during an endoscopic procedure?
- Nitrous
 - Oxygen
 - Carbon dioxide
 - Helium
38. During minimally invasive surgery the orientation and navigation within the body depends on the experience of the_____.
- Surgeon
 - Scrub nurse
 - Staff
 - Assistant
39. Which of the following is a popular acquisition technique for endoscopic images?
- Stereo vision setups
 - Structural light
 - Time-to-flight
 - All the above
40. What is described as an intuitive acquisition technique that is similar to human vision and depth estimation?
- Time-of-flight
 - Stereo vision
 - Structural light
 - 3-D point
41. True or false. At the time the text was written minimally invasive structured light systems were not available.
- True
 - False
42. Which of the following tackles 3-D reconstruction from a completely different view?
- Time-of-flight
 - Stereo vision
 - Structural light
 - Image molding
43. Current time-of-flight devices exhibit low data quality and_____.
- Low image resolution
 - Low image contrast
 - Low image detail
 - Low image brightness

Chapter 5

44. Objects with a diameter smaller than_____μm cannot be recognized by the naked eye.
- 45
 - 60
 - 75
 - 90

45. Which of the following cannot be seen by the naked eye?
- a. Bacteria
 - b. Cells
 - c. Molecules
 - d. All the above
46. How many rules are there to describe image formation from a geometrical optics perspective?
- a. Two
 - b. Three
 - c. Four
 - d. Five
47. The compound microscope uses at least _____ a converging lens.
- a. Two
 - b. Three
 - c. Four
 - d. Five
48. What is the microscope lens closer to the specimen called?
- a. Eyepiece
 - b. Compound lens
 - c. Objective lens
 - d. Component lens
49. The microscope user observes the sample through the _____.
- a. Compound lens
 - b. Eyepiece
 - c. Objective lens
 - d. Component lens
50. In modern microscopes, the _____ is characterized by its magnification and numerical aperture.
- a. Objective lens
 - b. Compound lens
 - c. Eyepiece
 - d. Component lens
51. What plays the role of concentrating light coming from a light source at the specimen?
- a. Compounder
 - b. Condenser
 - c. Detector
 - d. Simulator
52. What is the most common technique for bright field microscopy?
- a. Cytology
 - b. Histology
 - c. Pathology
 - d. A & B
53. The most common form of stain in histology is a mixture of hematoxylin and _____.
- a. Eosin
 - b. Formaldehyde
 - c. Giemsa
 - d. Fuchsine

54. In slide preparation, what stops a great part of the biologic process and ensures a proper slide quality?
- a. Giemsa
 - b. Hematoxylin
 - c. Fixation
 - d. Block of wax
55. A fluorescence microscope has at least _____ shortcomings.
- a. Two
 - b. Three
 - c. Four
 - d. Five

Chapter 6

56. MRI provides visualization of which of the following?
- a. Soft-tissue contrast
 - b. Visualizing blood flow
 - c. Tissue perfusion
 - d. All the above
57. The “magnetic needles” in our body commonly used for MRI are _____ nuclei.
- a. Oxygen
 - b. Hydrogen
 - c. Carbon
 - d. Nitrogen
58. Hydrogen nuclei have an intrinsic property known as _____.
- a. Tilt
 - b. Waves
 - c. Spin
 - d. Frequency
59. What is the process that causes the net magnetization to constantly approach equilibrium called?
- a. Relaxation
 - b. Rotation
 - c. Centering
 - d. Rotation
60. True or false. Different tissues such as fat and water will end relaxation at different time points.
- a. True
 - b. False
61. Recovery of longitudinal magnetization is achieved by a process called _____.
- a. Magnetization vector
 - b. Equilibrium
 - c. Spin-lattice relaxation
 - d. Net magnetization
62. Which of the following is a contrast or weighting choice for MRI imaging?
- a. T1 weighting
 - b. T2 weighting
 - c. Proton density
 - d. All the above

63. The parameters that control the particular weighting of a spin echo sequence are the echo time (TE) and the_____.
- Spin time
 - Parameters
 - RF pulses
 - Repetition time (TR)
64. Repetition time (TR) is the period of time between successive_____.
- Net magnetization
 - RF pulses
 - Spin times
 - Signal decay
65. Which of the following is a concept based on the gradient coil system?
- Slice selection
 - Spatial encoding
 - Equilibrium
 - A & B
66. k-space is often referred to as_____space.
- Open
 - Closed
 - Fourier
 - A & B
67. True or false. The purpose of an MRI examination is to fill the k-space with data so that an image can be reconstructed.
- True
 - False
68. What describes the sequence of RF pulses that are applied in repetition to successfully acquire the whole k-space of an object?
- Pulse sequences
 - Frequency direction
 - Phase direction
 - Phase encoding
69. Which of the following **is not** a principle of spin echo?
- A 60-degree pulse flips the magnetization into the transverse plane
 - Dephasing due to random nuclei interactions and field inhomogeneities sets in
 - After a waiting period of TE/2, a 180-degree pulse inverts the magnetization
 - After a waiting period TE/2, all magnetic moments have refocused
70. The gradient echo pulse sequence utilizes partial flips with angles below_____.
- 45 degrees
 - 60 degrees
 - 90 degrees
 - 120 degrees

Chapter 7

71. What was one of the first x-rays by Wilhelm Rontgen?
- His own hand
 - His wife's hand
 - Albert Von Kolliker's hand
 - Albert Von Kolliker's foot

72. Rontgen received the first Nobel prize for Physics in_____.
a. 1896
b. 1900
c. 1901
d. 1905
73. Victor Electric Company, founded in 1893 in Chicago is now known as_____.
a. Phillips Medical Systems
b. General Electric Healthcare
c. Siemens Healthineers
d. Fuji Healthcare
74. An x-ray tube is made of_____with a cathode and a solid metal anode.
a. Glass
b. Plastic
c. Metal
d. Tungsten
75. The_____is tilted by a certain angle to direct x-rays in the right direction.
a. Cathode
b. Housing
c. Tube
d. Anode
76. The metallic plate that removes low-energy x-rays is called a_____.
a. Shell
b. Filter
c. Cover
d. Collimator
77. Which of the following is a relevant interaction that can occur when x-rays pass through matter?
a. Interaction with atomic electrons
b. Interaction with nucleus
c. Interaction with electric fields associated to atomic electrons and atomic nuclei
d. All the above
78. Which of the following is not a physical effect contributing to attenuation?
a. Photon count
b. Photon direction
c. Photon energy
d. Photon origin
79. The photoelectric effect was originally described by_____.
a. Marie Curie
b. Albert Einstein
c. Niels Bohr
d. Phillip Lenard
80. A Compton electron is also called a_____.
a. Charged electron
b. Recoil electron
c. Shell electron
d. Deflected electron

81. What is the predominant kind of scattering at low x-ray energies?
- a. Compton scatter
 - b. Photoelectric effect
 - c. Rayleigh scattering
 - d. Pair production
82. What are vacuum tubes that are used to convert x-rays into visible light called?
- a. Image intensifier
 - b. X-ray tube
 - c. Output phosphor tube
 - d. Camera tube
83. When were image intensifiers introduced?
- a. 1920s
 - b. 1930s
 - c. 1940s
 - d. 1950s
84. The aluminum input window of the image intensifier is approximately_____thick.
- a. 1 mm
 - b. 2 mm
 - c. 3 mm
 - d. 4 mm
85. The input phosphor is made of_____.
- a. Zinc-cadmium
 - b. Magnesium alloy
 - c. Cesium iodide
 - d. Titanium alloy
86. Flat panel detectors were introduced in the_____.
- a. 1960s
 - b. 1970s
 - c. 1980s
 - d. 1990s
87. What is an undesirable effect in medical imaging systems?
- a. Probabilistic noise
 - b. Artifacts
 - c. Weight
 - d. A & B
88. The main application for radiography is the examination of_____and changes in the skeletal system.
- a. Organs
 - b. Fractures
 - c. Tissues
 - d. Muscles
89. What is described as a sequence of radiographic images acquired periodically at a certain frame rate called?
- a. Computed tomography
 - b. MRI
 - c. Fluoroscopy
 - d. Radiography

90. What refers to the imaging of arteries and veins to analyze properties such as shape, size, lumen, or flow rate?
- a. Fluoroscopy
 - b. Angiography
 - c. Endoscopy
 - d. Arteriography

Chapter 8

91. What year was the first CT scanner built?
- a. 1961
 - b. 1966
 - c. 1971
 - d. 1975
92. Who introduced the spiral CT in 1990?
- a. Sir Godfrey Hounsfield
 - b. Willi Kalender
 - c. Allan Cormack
 - d. Johann Radon
93. In the early days, CT data acquisition took approximately _____ minutes per rotation.
- a. 2
 - b. 3
 - c. 4
 - d. 5
94. What is the underlying mathematical principle of the image formation process in CT imaging called?
- a. Radon transform
 - b. Fourier theory
 - c. Helix theory
 - d. Kalender theory
95. X-ray projections can be converted to line integrals using _____ law enabling the application of Radon's idea to CT reconstruction.
- a. Beer's
 - b. Stingle's
 - c. Bahner's
 - d. Puckett's
96. True or false. Various ramp-like filters are used depending on the desired image characteristics, typically involving a trade-off between a smooth image appearance and a higher spatial resolution.
- a. True
 - b. False
97. A second approach to CT reconstruction defines the problem as a system of _____ equations.
- a. Nonlinear
 - b. Linear
 - c. Equal
 - d. Standard
98. For direct measurement of spatial resolution a _____ phantom can be used.
- a. Bar
 - b. Linear
 - c. Cube
 - d. Smooth

99. When an x-ray passes through an object, lower energy photons are more easily absorbed than higher energy photons, the effect is called_____.
- a. Streaking
 - b. Image hardening
 - c. Beam hardening
 - d. Cupping
100. Beam hardening results in streak and_____artifacts.
- a. Noise
 - b. Cupping
 - c. Wavy
 - d. Bricking

Chapter 9

101. Which of the following **is not** an x-ray phase-contrast system?
- a. Propagation-based system
 - b. Edge illumination system
 - c. Analyzer-based system
 - d. Square-based system
102. Which is probably the simplest phase-sensitive design?
- a. Propagation-based design
 - b. Edge illumination design
 - c. Analyzer-based design
 - d. Speckle-tracking design
103. Which system operates on monochromatic X-rays?
- a. Propagation-based system
 - b. Edge illumination system
 - c. Analyzer-based system
 - d. Speckle-tracking system
104. One of the most promising phase-sensitive setups for medical applications is the so-called_____.
- a. Talbot-Lau interferometer (TLI)
 - b. Young interferometer
 - c. Harper interferometer
 - d. Traders' interferometer
105. The Talbot-Lau interferometer makes use of the_____effect.
- a. Sampling effect
 - b. Interference effect
 - c. Modeling effect
 - d. Averaging effect
106. The Talbot-Lau interferometer consists of_____rectangular gratings in the beam line.
- a. One
 - b. Two
 - c. Three
 - d. Four

Chapter 10

107. What type of imaging is used to observe biological processes?
- Chemical
 - Structural
 - Functional
 - Nuclear
108. In nuclear medicine, functional imaging relies on _____ that are tagged to tracers that congregate in different regions of diagnostic interest in the body.
- Radioisotopes
 - Cells
 - Molecules
 - Particles
109. Functional imaging methods in the field of nuclear medicine is also known as _____.
- Cellular imaging
 - Molecular imaging
 - Structural imaging
 - Transmission imaging
110. 3-D images can be reconstructed from 2-D projections is a process called _____.
- Reformatting
 - Image shifting
 - SPECT
 - Image transmission
111. The use of naturally decaying radioisotopes for medical imaging did not occur until _____.
- 1925
 - 1927
 - 1930
 - 1935
112. Who was the first to use radioisotopes and imaging equipment to investigate the body's biochemistry?
- Dmitri Mendeleev
 - Marie Curie
 - George de Hevesy
 - Albert Einstein
113. What year did George de Hevesy win the Nobel Prize for Chemistry?
- 1943
 - 1945
 - 1947
 - 1948
114. To limit patient dose, relatively small amounts of activity are usually injected, typically ranging from _____ to 1,000 MBq.
- 10
 - 50
 - 75
 - 100
115. What is the second most important physical factor affecting emission tomography?
- Photon attenuation
 - Noisy data
 - Blurry data
 - Long exposure time

116. True or false. Compton scatter is not very important for emission tomography.
- a. True
 - b. False
117. What year was the gamma camera invented?
- a. 1955
 - b. 1956
 - c. 1957
 - d. 1958
118. Which of the following is not a component of a gamma camera?
- a. Anode
 - b. Collimator
 - c. Scintillator
 - d. Photomultiplier tubes
119. What is the most commonly used collimator for SPECT imaging?
- a. Geometric bores
 - b. Linear bores
 - c. Special bores
 - d. Parallel bores
120. The decay process that forms the basis of PET produces _____ photons that travel in opposing directions away from each other.
- a. Two
 - b. Four
 - c. Six
 - d. Eight

Chapter 11

121. Acoustic waves with frequencies between 16 Hz and _____ can be sensed by the human ear.
- a. 18 kHz
 - b. 20 kHz
 - c. 22 kHz
 - d. 24 kHz
122. If greater than _____ you are talking about ultrasound.
- a. 20 kHz
 - b. 24 kHz
 - c. 26 kHz
 - d. 28 kHz
123. What year was the first ultrasound device in clinical use?
- a. 1949
 - b. 1952
 - c. 1955
 - d. 1958
124. Sound waves are mainly characterized by which of the following?
- a. Frequency
 - b. Velocity
 - c. Wavelength and intensity
 - d. All the above
125. True or false. Frequency is measured in Hertz (Hz).
- a. True
 - b. False

126. The _____ states that the angle of incidence equals the angle of reflection.
- Law of reflection
 - Law of refraction
 - Law of relationship
 - Law of reduction
127. What involves a change in direction of the sound waves?
- Dissolvment
 - Diffraction
 - Differentiation
 - Distinction
128. An ultrasound transducer functions as both a _____ and a detector of ultrasonic waves.
- Transformer
 - Transferer
 - Generator
 - Energizer
129. Which of the following is the most common ultrasound imaging mode?
- A-mode
 - B-mode
 - M- mode
 - All the above

Chapter 12

130. Optical coherency tomography is similar to ultrasound but uses _____ instead of ultrasound.
- Tracers
 - Radioactivity
 - Light
 - Scintillation
131. Optical coherence tomography has become a standard modality in _____.
- Ophthalmology
 - Cardiology
 - Urology
 - Endocrinology
132. Light exhibits properties of particle and _____.
- Pixels
 - Shadows
 - Waves
 - Pigments
133. What describes the width of the spectrum that a light source emits?
- Wave
 - Particle
 - Pixel
 - Bandwidth

Part Two

Chapter 13 Fluoroscopic Imaging Systems

134. The major difference between radiographic and fluoroscopic equipment is the_____.
- a. Amount of radiation
 - b. Type of generator
 - c. Image receptor
 - d. Imaging chain
135. The development of the_____ was essential to the success of modern fluoroscopic imaging.
- a. X-ray image intensifier
 - b. Photomultiplier tube
 - c. Power generator
 - d. High heat capacity x-ray tube
136. What is the most commonly used input phosphor material?
- a. Fluoride
 - b. Zinc selenide
 - c. Terphenyl
 - d. Cesium iodide
137. Intensification occurs through two mechanisms, flux gain and_____.
- a. Opposition gain
 - b. Simple gain
 - c. Minification gain
 - d. Electronic gain
138. Brightness gain ranges from 2500 to_____, depending on the FOV.
- a. 3000
 - b. 5000
 - c. 6500
 - d. 7000
139. Video cameras are selected based on which of the following fundamental characteristics?
- a. Lag
 - b. Signal to noise ratio (SNL)
 - c. Speed
 - d. A & B
140. Which of the following is an advantage of flat panel image receptors?
- a. Large size
 - b. Less bulky profile
 - c. Absence of image distortions
 - d. All the above
141. What refers to the use of a focusing electrode to deminify the fluoroscopic image?
- a. Electronic magnification
 - b. Expansion
 - c. Enlargement
 - d. Macro display
142. True or false. Contrast is inherently poor in fluoroscopic imaging, especially at the high kV values used to maintain patient dose at an acceptable level.
- a. True
 - b. False

143. The sharpness of a fluoroscopic image is influenced by which of the following factors?
- Display matrix
 - FOV
 - Video camera matrix
 - All the above
144. What is an optical distortion that produces a falloff in light intensity or darkening near the edges of an image called?
- Blooming
 - Vignetting
 - Glare
 - Distortion
145. _____ distortion causes straight objects to appear curved.
- P
 - D
 - T
 - S
146. What refers to a mode of operation where high-quality images are recorded and stored for analysis?
- Digital subtraction imaging
 - Digital acquisition imaging
 - Digital archiving
 - Digital storage

Chapter 14 Mammography

147. How many women were diagnosed with breast cancer internationally in 2008?
- 1.25 million
 - 1.30 million
 - 1.38 million
 - 1.40 million
148. Which of the following is a common view in a typical screening mammogram?
- Lateral view
 - Cranial-caudal view
 - Mediolateral oblique
 - B & C
149. The nominal focal spot size for mammography is_____.
- 0.3 mm
 - 0.4 mm
 - 0.5 mm
 - 0.6 mm
150. For mammography, it is suggested the optimum energy for film imaging is between_____and_____keV.
- 15, 20
 - 18, 23
 - 20, 23
 - 22, 27

151. What is the typical focused linear grid ratio used in mammography?
- 3:1 to 3.5:1
 - 3.5:1 to 5:1
 - 4:1 to 5:1
 - 5:1 to 5.5:1
152. What is the benefit of magnification mammography?
- Increased SNR
 - Improved spatial resolution
 - Dose efficient scatter rejection
 - All the above
153. What year was digital mammography introduced?
- 1995
 - 1997
 - 2000
 - 2002
154. True or false. In digital mammography, image acquisition, processing, display, and storage are performed independently, allowing optimization of each.
- True
 - False
155. At the time the text was written, what type of monitors were recommended to view digital mammograms?
- One 5 megapixel monitor
 - Two 5 megapixel monitors
 - Two 7 megapixel monitors
 - Two 9 megapixel monitors
156. Which of the following **is not** a potential benefit of CAD systems?
- Potential to reduce the cancer miss rate
 - Reduce the variability among radiologists
 - Improve the consistency of a single radiologist
 - Make the radiologist less productive
157. Stereotactic biopsy systems use _____ digital detectors.
- 3 cm × 5 cm
 - 3.5 cm × 5 cm
 - 4.5 cm × 5 cm
 - 5 cm × 5 cm
158. Which of the following is the primary interest regarding the risk of radiation-induced cancer in breast imaging?
- Incident air kerma
 - Entrance surface air kerma
 - Mean glandular dose
 - A & B

Chapter 15 Image Post-Processing and Analysis

159. What is the most important limitation of image processing?
- Processing is only as fast as the computer
 - Processing cannot increase the amount of information available in the input image
 - Image noise is a continual problem
 - Applying mathematical process is very difficult

160. What is an operation that changes the observable quality of an image in terms of resolution, contrast, and noise?
- Resampling
 - Edge detection
 - Filtering
 - Processing
161. Mean filtering is an example of an image_____operation.
- Smoothing
 - Enhancing
 - Brightening
 - Shaping
162. What filter is a low pass filter that is not affected by the ringing artifact?
- Median filter
 - Gaussian filter
 - Mean filtering
 - Digital filtering

Chapter 16 Radiation Biology

163. What is the study of the action of radiation on living matter called?
- Diagnostic biology
 - Genetic biology
 - Radiobiology
 - Cellular biology
164. What contains the genetic information of the cell?
- DNA
 - Molecules
 - Nucleotides
 - Cytosine
165. What is the primary cause of cell death induced by radiation?
- Free radicals
 - DNA damage
 - Low linear energy transfer
 - Radiosensitivity
166. Which of the following are DNA repair mechanisms?
- Excision repair
 - Mismatch repair
 - Nucleotide excision repair
 - All the above
167. What is found in the nucleus of the cell?
- Molecules
 - Chromosomes
 - Protein
 - Water

168. Measuring the radiosensitivity of a cell is the ability of the cell to undergo more than 5 or 6 cell division and produce a viable colony containing at least_____cells.
- 20
 - 30
 - 40
 - 50
169. True or false. Cells are regarded as having been “killed” by radiation if they have lost reproductive integrity.
- True
 - False
170. Which of the following **is not** a phase in the development of cancer in tissue?
- Hypoblastic phase
 - Neoplastic initiation phase
 - Promotion phase
 - Conversion phase
171. After irradiation, Leukemia has a minimum latency period of about_____years.
- 2
 - 3
 - 4
 - 5
172. The International Commission of Radiological Protection (ICRP) recommendations for radiation protection purposes are based on the_____study and other epidemiological studies.
- German
 - Australian
 - Japanese
 - Italian
173. Tissues and organs in the human body are composed of many different_____.
- Molecules
 - Cells
 - Nuclei
 - Atoms
174. The detailed knowledge about radiation-induced normal tissue effects comes primarily from which of the following?
- Experience with patients receiving radiotherapy
 - Radiation accidents
 - Laboratory studies
 - All the above
175. Acute radiation response may manifest clinical symptoms with a few_____of radiation exposure.
- Minutes
 - Hours
 - Days
 - Weeks
176. The epidermis of the skin renews rapidly within_____days.
- 3 -5
 - 10 -12
 - 15 – 3
 - 45 – 60

177. Transient erythema or skin reddening occurs after a single dose greater than_____.
a. 2 Gy
b. 3 Gy
c. 5 Gy
d. 6 Gy
178. What is the incident rate to develop cataracts for individuals exposed to a single dose of 2Gy or higher?
a. 85%
b. 90%
c. 95%
d. 100%

Chapter 17 Radiation Protection

179. What type of exposure is defined by the ICRP as radiation exposures incurred by workers as a result of their work?
a. Public exposure
b. Occupational exposure
c. Medical exposure
d. Planned exposure
180. What modality is by far the greatest contributor in the significant rise of medical exposure?
a. PET
b. Nuclear Medicine
c. CT
d. Radiography
181. True or false. Radiation protection in a hospital must not be seen as something imposed from the 'outside' and separate from the real business of providing medical services and patient care.
a. True
b. False
182. The_____provide specialist expertise concerning radiation protection of patients.
a. Radiological medical practitioner
b. Medical physicist
c. Medical radiologic technologist
d. Radiation protection officer
183. Within a radiology facility, who has the responsibility to oversee and implement radiation protection in the facility?
a. Radiological medical practitioner
b. Medical physicist
c. Radiation protection officer
d. Medical radiologic technologist
184. What underpins much of the practice of radiation protection?
a. Education
b. Practice
c. Training
d. A & C
185. CT examination of the pelvic region with and without contrast can lead to a fetal absorbed dose of about_____.
a. 25 mGy
b. 35 mGy
c. 50 mGy
d. 60 mGy

186. The recommended effective dose for people 16-18 years old is _____ in a year.
- 4 mSv
 - 6 mSv
 - 8 mSv
 - 10 mSv
187. Pregnant workers must be monitored and the dose to the embryo should not exceed _____.
- 1 mSv
 - 2 mSv
 - 3 mSv
 - 4 mSv
188. Which of the following is a basic principle to reduce occupational exposure?
- Restrict the time a person is exposed to radiation as much as possible
 - Ensure the distance between a person and the x-ray source is kept as large as practical
 - Employ appropriate measures to ensure the person is shielded from the source of radiation
 - All the above
189. Wearing protective eyewear, especially with side protection, can reduce the dose to the eye by what percentage?
- 50 – 60%
 - 65 – 75%
 - 80 – 90%
 - > 90%
190. Unauthorized access by the public to functioning X-ray rooms must be _____.
- Monitored
 - Restricted
 - Protected
 - Prohibited
191. The design of radiation shielding for diagnostic installations are based on _____ common approaches used internationally.
- Two
 - Three
 - Four
 - Five
192. When determining shielding, the occupancy factor, the fraction of an _____ day a particular area may be occupied must be taken into consideration.
- 8-hour
 - 10-hour
 - 12- hour
 - 16-hour