Chapter 1

1. What is the most sensitive weight-bearing bone?
   a. Talus
   b. Calcaneus
   c. Navicular
   d. Cuboid

2. What does the central skeletal site include?
   a. Thoracic and lumbar spine
   b. Pelvis
   c. Proximal femur
   d. A & C

3. X-ray densitometry reports which of the following quantities during the scan?
   a. Bone mineral density (BMD)
   b. Bone mineral content (BMC)
   c. Area
   d. All the above

4. BMD with quantitative computed tomography (QCT) are 3-dimensional or volumetric.
   a. True
   b. False

5. How are bone density measurements of a PA lumbar spine reported?
   a. L1 - L4 BMD
   b. L2 - L4 BMD
   c. L1, L2, L3, L4 BMD
   d. A & B

6. Quantitative ultrasound (QUS) measures what parameters?
   a. Bone mineral density
   b. Speed of sound
   c. Broadband ultrasound attenuation
   d. B & C

7. The expression of a patient’s densitometry value as a percentage of average peak for a young adult of the same sex is called what?
   a. % young adult
   b. % young reference
   c. % your range
   d. A & B

8. What year did the International Committee for Standards in Bone Measurement approve the standardized BMD for the total femur?
   a. 1996
   b. 1997
   c. 1998
   d. 1999
9. What percentage of bone density loss must occur before it can be visualized on a radiograph?
   a. 20%
   b. 30%
   c. 40%
   d. 50%

10. What method of radiogrammetry has been used for almost 50 years?
    a. Metatarsal
    b. Calcaneus
    c. Metacarpal
    d. Carpal

11. A radiologic osteoporosis score of ______ or less indicates peripheral osteoporosis.
    a. 58
    b. 68
    c. 78
    d. 88

12. Who performed studies on the effects of weightlessness on the skeleton of astronauts in the Gemini and Apollo missions?
    a. George Voss
    b. Pauline Beery Mack
    c. Barneet and Nordin
    d. KG Faulkner

13. What is referred to as a reduction in the number and energy of photons in the x-ray beam?
    a. Absorption
    b. Refraction
    c. Attenuation
    d. Scatter

14. The difference in the patterns of transmitted or attenuate photons create the ______ necessary to discern images on an x-ray.
    a. Contrast
    b. Sharpness
    c. Detail
    d. Level

15. Accuracy of single-photon absorptiometry (SPA) measurements of the mid-radius range from _____ to ______ percent.
    a. 1, 2
    b. 3, 5
    c. 4, 6
    d. 5, 7

16. In the United States, what was the most utilized isotope for dual-photon absorptiometry?
    a. Cesium – 131
    b. Cobalt 60
    c. Chromium – 51
    d. Gadolinium – 153
17. What is the advantage of an x-ray tube over the use of a radioactive isotope for dual-energy x-ray absorptiometry (DXA)?
   a. No source decay
   b. Less dose overlap
   c. Faster scans
   d. All the above

Chapter 3

18. The pedicles, lamina, spinous process, transverse process and the inferior and superior articulating surfaces are considered what part of a vertebrae?
   a. Body
   b. Posterior elements
   c. Foramen
   d. None of the above
19. The posterior elements of L1, L2, and L3 have what shaped appearance?
   a. U
   b. Y
   c. H
   d. A and B
20. What area is extensively used in densitometry, but also is the most affected by structural change and artifact?
   a. Metacarpals
   b. Femur
   c. Lumbar spine
   d. Forearm
21. Vertebral fractures in osteoporosis frequently occur at what level?
   a. T7 – T9
   b. T12 – L2
   c. L3 – L5
   d. A & B
22. What is the likelihood of degenerative changes in a 55-year-old woman?
   a. 10%
   b. 30%
   c. 40%
   d. 50%
23. Unlike aortic calcification, what can have a profound effect on measured BMD in the AP and PA lumbar spine?
   a. Facet sclerosis
   b. Osteophytes
   c. Scoliosis
   d. Fracture
24. Which of the following is an artifact that can occur in a PA lumbar spine study?
   a. Renal stones
   b. Gallstones
   c. Contrast agents
   d. All the above
25. Ward’s triangle is a calculated region of high density in the femoral neck.
   a. True
   b. False

26. Which of the following is not a commonly measured site of the forearm?
   a. 10% site
   b. 33% site
   c. 50% site
   d. 75% site

Chapter 4

27. What is the purpose of elevating a patient’s legs for a scan?
   a. Flatten the lumbar spine against the table
   b. Increase the separation between the lumbar vertebrae
   c. Decrease movement
   d. A & B

28. The term rotoscoliosis is rotation of the vertebrae accompanying scoliosis.
   a. True
   b. False

29. Which of the following is an anatomic positioning limitation that a technologist cannot overcome?
   a. Disc space collapse
   b. Severe thoracic kyphosis
   c. Arthritic changes
   d. All the above

30. What is the goal when positioning a patient for a proximal femur study?
   a. Reduced movement
   b. Properly rotated proximal femur
   c. Straight femoral shaft
   d. B & C

31. Precision is not improved when the mean of the right and left region of interest (ROI) is used instead of the BMD for either single ROI.
   a. True
   b. False

32. When positioning a forearm, the scan should include the radial styloid and the ______ region of interest.
   a. 10%
   b. 33%
   c. 50%
   d. 75%

33. What is the major obstacle to correct positioning for a forearm on a central DXA device?
   a. Patient size
   b. Rotation of the arm
   c. Design of the scan table
   d. Patient movement

34. A forearm scan should contain the lower 2/3 of which bone?
   a. Capitate
   b. Hamate
   c. Trapezoid
   d. Scaphoid
35. When energy is released and then transmitted through a substance, it is called __________.
   a. Infrared  
   b. Radiation  
   c. Microwave  
   d. Radio waves
36. What is used to describe a quantity of radiation exposure?
   a. Curie  
   b. Millicurie  
   c. Microcurie  
   d. Roentgen
37. Radon is a gas formed by the decay of __________.
   a. Uranium  
   b. Cesium  
   c. Cobalt  
   d. Helium
38. GI death occurs as a result of what level of radiation dose?
   a. 100 – 150 rads  
   b. 200 – 1,000 rads  
   c. 1,000 – 5,000 rads  
   d. >5000 rads
39. Reddening of the skin can occur with what size dose?
   a. <300 rads  
   b. 300 -1,000 rads  
   c. 2,000 – 5,000 rads  
   d. >5,000 rads
40. What dose to the ovaries can cause permanent sterility?
   a. 100 rads  
   b. 200 rads  
   c. 500 rads  
   d. 600 rads
41. Which is the most sensitive to irradiation?
   a. Red blood cells  
   b. White blood cells  
   c. Platelets  
   d. Plasma
42. What is the amount of natural background radiation exposure each year?
   a. 120 mrem/year  
   b. 180 mrem/year  
   c. 210 mrem/year  
   d. 240 mrem/year
43. What is the annual dose limit for a radiation worker?
   a. 4 rem/year  
   b. 5 rem/year  
   c. 6 rem/year  
   d. 7 rem/year
44. What is the maximum permissible dose to a fetus?
   a. 100 mrem
   b. 250 mrem
   c. 500 mrem
   d. 700 mrem

Chapter 6

45. What are quality control anthropomorphic phantoms made of?
   a. Hydroxyapatite
   b. Aluminum
   c. Plexiglass
   d. A & B

46. Which phantom is intended to replicate the lower half of T12 to the upper half of L5?
   a. European spine phantom
   b. Bona Fida Spine phantom
   c. Hologic spine phantom
   d. Lunar spine phantom

47. Manufacturers generally recommend scanning the phantom how many times on the same day without repositioning it?
   a. 6
   b. 8
   c. 10
   d. 12

48. Two of the most commonly used methods for tracking machine performance are the Shewhart rules and the CUSUM chart.
   a. True
   b. False

49. Shewart rules have been used in analytical chemistry since ________.
   a. 1940’s
   b. 1950’s
   c. 1960’s
   d. 1970’s

50. A machine failure has occurred if which of the following Shewhart rules have been violated?
   a. A phantom BMD value exceeding the average ±3SD
   b. Two consecutive phantom BMD values on the same side of the average exceeding the average by ±2SD
   c. Two consecutive phantom BMD values differing by more than 4SD
   d. All the above

51. Which of the following is not an International Society for Clinical Densitometry quality control requirement for DXA facilities?
   a. Follow manufacture’s guidelines for system maintenance
   b. Perform monthly phantom scans
   c. Maintain all service logs
   d. Comply with government inspection, radiation surveys and regulation requirements
Chapter 7

52. What is it called when quantitative measurement techniques can reproduce the same numerical results in the same setting?
   a. Explicit
   b. Precision
   c. Accuracy
   d. Definition

53. The only way to know that a biologic change has occurred is to know if the ______ of the technique has been exceeded.
   a. Reproducibility
   b. Integrity
   c. Precision
   d. Standard deviation

54. Precision is expressed by which of the following?
   a. Root-mean-square standard (RMS-SD)
   b. Root-mean-square % coefficient (RMS-%CV)
   c. Least significant change (LSC)
   d. A & B

Chapter 8

55. What is one of the most important uses of the bone density measurement?
   a. Determine medication to reduce bone loss
   b. Outline exercises to build bone
   c. Predict patient fracture risk
   d. A & B

56. How should a patient’s fracture risk be expressed in clinical practice?
   a. Relative risk
   b. Clinical risk
   c. Baseline risk
   d. Absolute risk

57. Absolute risk predictions usually cover a period of how many years?
   a. 3 years
   b. 5 years
   c. 7 years
   d. 10 years

58. Which of the following is not an absolute fracture risk prediction tool?
   a. FRAX
   b. FORE FRC
   c. CAROC
   d. Primary Fracture Risk Prediction Tool

59. Where was the FRAX risk algorithm developed?
   a. World Health Organization
   b. National Academy of Science
   c. National Institute of Health
   d. Association of Science and Technology
60. What tool is the predominant method for the prediction of fracture risk?
   a. FORE FRC  
   b. Garvan Fracture Risk Prediction Tool  
   c. CAROC  
   d. FRAX  

61. FRAX is intended to be used with BMD or T-scores obtained at skeletal sites other than the femoral neck or with other technologies.
   a. True  
   b. False  

62. What is the acceptable age for FORE-FRC to begin?
   a. 40  
   b. 45  
   c. 50  
   d. 55  

63. The original CAROC assessment tool was found to ______ fracture risk in Canadian men and women.
   a. Overestimate  
   b. Accurately predict  
   c. Underestimate  
   d. Miscalculate  

64. The Garvan fracture risk calculator is widely used in what country?
   a. United States  
   b. Spain  
   c. Australia  
   d. Germany  

Chapter 9

65. Prior to 1991, osteoporosis was described as what kind of disorder?
   a. Systemic skeletal disorder  
   b. Microarchitectural deterioration of bone  
   c. Age-related  
   d. Bone fragility  

66. What year was the World Health Organization (WHO) criteria for the diagnosis of osteoporosis based on bone density published?
   a. 1992  
   b. 1994  
   c. 1996  
   d. 1998  

67. The WHO stated a bone density that was _____ standard deviations or more below the average peak of the young adult was sufficiently low to be called osteoporosis.
   a. 1.5  
   b. 2.0  
   c. 2.5  
   d. 3.0
68. In 2002, the National Osteoporosis Foundation estimated how many men and women in the United States over the age of 50 had osteoporosis and osteopenia?
   a. 20 million
   b. 27 million
   c. 38 million
   d. 44 million

69. What is the lifetime risk of hip fracture for a 50-year-old Caucasian woman?
   a. 15.2%
   b. 17.5%
   c. 23.2%
   d. 26.5%

70. How many fractures are attributed to osteoporosis each year?
   a. 1 million
   b. 2 million
   c. 3 million
   d. 4 million

71. Kyphosis is a commonly known as what?
   a. Morbidity
   b. Widow’s hump
   c. Dowager’s hump
   d. B & C

72. What percentage of women who fracture their hip cannot walk independently one year later?
   a. 30%
   b. 40%
   c. 50%
   d. 60%

73. What refers to the maximum bone mass or density that is attained in life?
   a. Peak bone measurement
   b. Peak bone level
   c. Peak bone density
   d. Peak bone equivalent

74. Peak bone density is reached by what age?
   a. 20
   b. 25
   c. 30
   d. 35

75. Which of the following is a factor in the failure to achieve an average peak bone density?
   a. Calcium deficiency
   b. Lack of exercise
   c. Genetics
   d. A & B

76. What forms new bone to replace removed old bone?
   a. Osteoblast
   b. Osteoclast
   c. Osteocytes
   d. Cartilage
77. The diagnosis of osteoporosis should be based on bone measurement from what site?
   a. PA lumbar spine
   b. Forearm
   c. Proximal femur
   d. A & C

78. How often will Medicare pay for a bone density test?
   a. 12 months
   b. 18 months
   c. 23 months
   d. 36 months

79. Pharmacologic intervention should be considered when a patient has a T-score equal to or poorer than _____ at the lumbar spine or femoral neck.
   a. -1.0
   b. -1.5
   c. -2.0
   d. -2.5

80. How much calcium does the National Osteoporosis Foundation recommend per day?
   a. 800 mg
   b. 1,000 mg
   c. 1,200 mg
   d. 1,400 mg

Chapter 10

81. The results from bone densitometry can be categorized into which of the following?
   a. The skeletal image
   b. Age-regression graph
   c. Patient orientation
   d. A & B

82. When calculating bone density parameters, what is the default region of interest in the PA lumbar spine?
   a. T11 – L4
   b. T11 – L5
   c. T12 – L5
   d. L1 – L4

83. What is the preferred site of the forearm to scan for a patient being evaluated for hyperparathyroidism?
   a. 10% site
   b. 33% site
   c. 50% site
   d. 5 mm site

84. In clinical practice the standard score comparisons have been given more importance than the % comparison in diagnosis of fracture risk.
   a. True
   b. False
85. Which of the following should never be used in the interpretation of serial bone mass?
   a. T-score
   b. Z-score
   c. % comparisons
   d. All the above

Chapter 11

86. Even with perfect positioning study results may not be ideal due to which factors?
   a. Artifacts
   b. Structured changes in patient anatomy
   c. Patient movement
   d. A & B

Chapter 12

87. Which of the following is not true of the pediatric skeleton?
   a. Ossification centers fuse in different bones at different ages
   b. Chronological age does reflect their bone age
   c. Puberty has a profound effect on the development of the skeleton
   d. Radiation safety issues are not the same as adults

88. As low as reasonably achievable (ALARA) is the guiding principle in pediatric densitometry radiation safety.
   a. True
   b. False

89. What are secondary ossifications centers at the end of the long bone that are responsible for longitudinal growth?
   a. Epiphyses
   b. Osteoblasts
   c. Osteocytes
   d. Osteoclasts

90. Ring like epiphysis on the upper and low surfaces of the vertebral bone do not fuse with the rest of the vertebral body until what age?
   a. 16
   b. 18
   c. 20
   d. 25

91. What technique is used to determine bone age in the hand?
   a. Greulich and Pyle method
   b. Jensen method
   c. Tanner and Whitehouse method
   d. A & C

92. What is used to determine the level of sexual development of a child?
   a. Hobart Stage
   b. Jensen Stage
   c. Tanner Stage
   d. Miller Stage
93. In girls, the peak rate of linear growth is seen in which Tanner Stage?
   a. Stage 1  
   b. Stage 2  
   c. Stage 3  
   d. Stage 4  

94. The ________ is the standard score comparison to bone density that is predicted for the patient’s age.
   a. T-score  
   b. Z-score  
   c. C-score  
   d. L-score  

95. Using the T-score in children is always appropriate.
   a. True  
   b. False  

96. In the study from Gafni and Baron, the second most common error in interpretation of pediatric densitometry results was the use of a reference database that did not reflect what?
   a. Patient’s sex  
   b. Patient’s height  
   c. Patient’s ethnicity  
   d. A & C  

97. In the study from Bachrach, how much greater was the BMD for black females?
   a. 3%  
   b. 5%  
   c. 7%  
   d. 10%  

98. What is osteogenesis imperfecta often called?
   a. “failure to thrive disease”  
   b. “long bone disease”  
   c. “brittle bone disease”  
   d. “malabsorption disease”  

99. Which of the following is not a secondary cause of low bone mass in childhood?
   a. Cushing’s syndrome  
   b. Rotavirus  
   c. Hyperthyroidism  
   d. Rheumatoid arthritis  

100. What is the greatest problem faced in pediatric densitometry?
   a. Underutilization  
   b. Misinterpretation  
   c. Machine design  
   d. Inconsistent results  

Chapter 13

101. What percentage of vertebral fractures are symptomatic?
   a. 17%  
   b. 26%  
   c. 33%  
   d. 40%
102. Quantitative techniques rely heavily on the accuracy of what?
   a. Computer techniques
   b. Point placement
   c. Comparison to reference databases
   d. B & C

103. Fan-array DXA imaging largely avoids the problem created by ________.
   a. Scan time
   b. Patient positioning
   c. Parallax
   d. Patient movement

104. In Rea’s evaluation of post-menopausal women using VFA imaging, what percentage of unfractured vertebras were identified?
   a. 96.4%
   b. 97.4%
   c. 98.4%
   d. 99.4%

105. What is the most common location for vertebral fractures?
   a. T4 – T6
   b. T7 – T8
   c. T9 – T12
   d. T11 – L1

106. In a study by Schousboe, what percentage of women over 60 with osteopenic bone density had a vertebral fracture?
   a. 27.4%
   b. 29.2%
   c. 31.4%
   d. 33.6%

107. Which of the following is not a clinical guideline for VFA?
   a. Postmenopausal women with osteopenia
   b. Age ≥ to 50 years
   c. Height loss >2 cm
   d. Self-reported vertebral fracture

108. Due to abdominal aortic calcification, what location is better to diagnosis osteoporosis in older women using BMD?
   a. Forearm
   b. Proximal femur
   c. PA lumbar spine
   d. A & C

109. On the AAC-8 scale, what score is a calcification length of > 3 vertebras?
   a. 1
   b. 2
   c. 3
   d. 4
Chapter 14

110. The assessment of body composition is concerned with the percentage and distribution of ____ and ____ in the body.
   a. Fat, muscle
   b. Fat, lean tissue
   c. Lean tissue, muscle
   d. Height, weight

111. What is the measurement that relates to a patient’s weight to their height?
   a. Body composition
   b. Muscle mass index
   c. Body mass index
   d. Lean tissue index

112. A body mass index of 30.00 – 34.99 is what obesity class?
   a. Preobese
   b. Obese class 1
   c. Obese class 2
   d. Obese class 3

113. The fat-free compartment of the body is divided into which of the following?
   a. Water
   b. Protein
   c. Mineral
   d. All the above

114. What is the “gold standard” for measuring body composition?
   a. Measurement of skin fold thickness
   b. Bioelectric impedance
   c. Air displacement plethysmography
   d. Underwater weighing

115. Fat mass has a density of _____.
   a. 0.9/gcm³
   b. 1.1/gcm³
   c. 1.2/gcm³
   d. 1.3/gcm³

116. Skin fold measurements is considered a ______ compartment method to determine body fat.
   a. One
   b. Two
   c. Three
   d. Four

117. Bioelectric impedance analysis is often found in health clubs.
   a. True
   b. False

118. What is one technique using air displacement called?
   a. BOD POD
   b. POD BOD
   c. AIR POD
   d. BOD CAP
119. According to the American Heart Association, what waist circumference for men is criteria for metabolic syndrome?
   a. ≥ 30”
   b. ≥ 35”
   c. ≥ 40”
   d. ≥ 45”

120. Increased visceral or adipose tissue is strongly associated with metabolic and cardiovascular disease risk.
   a. True
   b. False