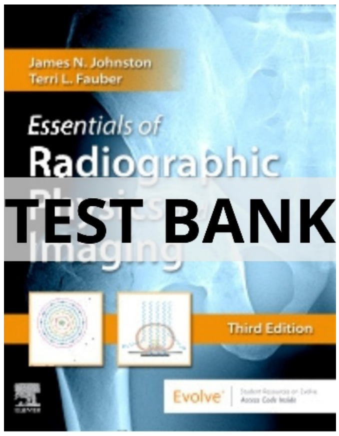
Chapter 01: Introduction to the Imaging Sciences
Johnston/Fauber: Essentials of Radiographic Physics and Imaging, 3rd Edition



MULTIPLE CHOICE

1. X-rays were discovered
   a. November 8, 1805
   b. November 8, 1875
   c. November 8, 1895
   d. November 8, 1985

   ANS: C
   X-rays were discovered November 8, 1895.

2. Barium platinocyanide was the material in Dr. Roentgen's laboratory that
   a. covered the cathode ray tube
   b. fluoresced when the cathode ray tube was energized
   c. was used to produce the radiograph of Bertha Roentgen's hand
   d. protected the people in the room from the x-rays

   ANS: B
   A piece of cardboard covered with barium platinocyanide fluoresced when the tube was energized, leading to further investigation.

3. Wilhelm Roentgen's lab was located in
   a. Wurzburg
   b. Zurich
   c. Paris
   d. Boston

   ANS: A
   Dr. Roentgen's lab was located at the University of Wurzburg in Wurzburg, Germany.

4. The first radiograph produced by Dr. Roentgen was of
   a. his own hand
   b. his daughter's hand
   c. his son's hand
   d. his wife's hand

   ANS: D
   The first radiograph was taken December 22, 1895, of his wife, Bertha's, hand.

5. Exposure times for very early radiographs ranged from
   a. 1 second to 5 seconds
   b. 1 minute to 15 minutes
   c. 20 minutes to 2 hours
   d. 2 hours to 5 hours

   ANS: C
   Exposure times for early radiographs took from 20 minutes to 2 hours to produce an image.

6. Acute radiodermatitis was
   a. the radiation burn resulting from excessive exposure to x-rays
   b. common among early patients and operators of x-ray equipment
   c. a delayed reaction to excessive x-ray exposure
   d. all of these

   ANS: D
   Early on, the excessive radiation exposure to many operators and patients resulted in radiation burns, a delayed response to the exposure.

7. Who brought attention to the dangers of x-rays?
   a. Wilhelm Roentgen.
   b. Bertha Roentgen.
   c. Crookes.
   d. Thomas Edison.

   ANS: D
   Thomas Edison, the famous American inventor, suffered a radiation burn and brought attention to the dangers of x-rays.

8. An example of how x-rays were used for entertainment or business gain in a dangerous manner was the
   a. fluoroscopic shoe fitter
   b. x-ray stove polish
   c. x-ray headache tablets
   d. x-ray golf balls

   ANS: A
   Although the stove polish, headache tablets, and golf balls used "x-ray" in their names, the shoe fitter actually exposed shoppers to radiation.

9. Mass, length, and time are considered
   a. fundamental quantities
   b. derived quantities
   c. radiologic quantities
   d. none of these

   ANS: A
   Mass, length, and time are the most basic or fundamental quantities.

10. Velocity, acceleration, and work are
    a. fundamental quantities
    b. derived quantities
    c. radiologic quantities
    d. none of these

    ANS: B
    Along with force, momentum and power, velocity, acceleration, and work are derived from the fundamental quantities.

11. Exposure, dose, and dose equivalent are

a. fundamental quantities
b. derived quantities
c. radiologic quantities
d. none of these

ANS: C
Along with the measure of radioactivity, dose, dose equivalent, and exposure are radiologic quantities.

12. The metric system is also known as the
a. British system
b. System International (SI)
c. System of Units (SU)
d. French system

ANS: B
The metric system is also known as the System International (SI).

13. In the SI system the unit of measure for mass is
a. pound
b. gram
c. kilogram
d. ton

ANS: C
The SI system uses kilogram to quantify mass.

14. In the SI system the unit of measure for length is
a. meter
b. kilometer
c. foot
d. mile

ANS: A
The SI system uses meter to quantify length.

15. In the SI system the unit of measure for time is
a. minute
b. second
c. hour
d. day

ANS: B
The SI system uses second to quantify time.

16. In the British system the unit of measure for mass is
a. pound
b. gram
c. kilogram
d. ton

ANS: A
The British system uses pound to quantify mass.

17. In the British system the unit of measure for length is
    a. meter
    b. kilometer
    c. foot
    d. mile

    ANS: C
    The British system uses *foot* to quantify length.

18. In the British system the unit of measure for time is
    a. minute
    b. second
    c. hour
    d. day

    ANS: B
    The British system uses *second* to quantify time.

19. _______________ is equal to distance traveled divided by the time needed to cover that distance.
    a. Work
    b. Momentum
    c. Velocity
    d. Acceleration

    ANS: C
    Distance traveled divided by the time needed to cover that distance is the formula to derive velocity.

20. Meters per second squared (m/s2) is the unit of measure of
    a. velocity
    b. momentum
    c. force
    d. acceleration

    ANS: D
    Meters per second squared (m/s2) is the unit of measure of acceleration.

21. Newton is the unit of measure of
    a. velocity
    b. momentum
    c. force
    d. acceleration

    ANS: C
    Force is measured in Newtons.

22. Kilograms-meters per second (kg-m/s) is the unit of measure of
    a. velocity
    b. momentum
    c. force

d. acceleration

ANS: B
Kilograms-meters per second (kg-m/s) is the unit of measure of momentum.

23. Joule is the unit of measure of
a. power
b. force
c. work
d. momentum

ANS: C
Joule is the unit of measure of work.

24. Watt is the unit of measure of
a. power
b. force
c. work
d. momentum

ANS: A
Watt is the unit of measure of power.

25. Fd (force × distance) is the formula to determine
a. power
b. force
c. work
d. momentum

ANS: C
Fd (force × distance) is the formula to determine work.

26. Work/time is the formula to determine
a. power
b. force
c. work
d. momentum

ANS: A
Work divided by the time over which it is done (work/t) is the formula for power.

27. The formula mv (mass × velocity) is used to determine
a. power
b. force
c. work
d. momentum

ANS: D
Mass × velocity (mv) is the formula to determine momentum.

28. The formula ma (mass × acceleration) is for
a. power

b. force
c. work
d. momentum

ANS: B
Mass × acceleration (ma) is the formula to determine force.

29. What is the velocity of a javelin that travels 45 meters in 3 seconds?
a. 0.067 m/s.
b. 15 m/s.
c. 67 m/s.
d. 135 m/s.

ANS: B
Velocity is determined by dividing the distance traveled (45 meters) by the time necessary to cover the distance (3 s); therefore 45 m/3 s or 15 m/s.

30. What is the acceleration of the javelin if the initial velocity is 0, the final velocity is 15 m/s and the time of travel is 3 seconds?
a. 1 m/s2.
b. 5 m/s2.
c. 10 m/s2.
d. 15 m/s2.

ANS: B
Acceleration is determined by subtracting the initial velocity (0 m/s) from the final velocity (15 m/s) and then dividing that amount by the time it took (3 seconds), resulting in 5 m/s2.

31. How much force is needed to move a 30-kg piece of equipment at a rate of 3 m/s2?
a. 10 N.
b. 30 N.
c. 60 N.
d. 90 N.

ANS: D
Force is determined by multiplying mass (30 kg) by acceleration (3 m/s2) and is measured in Newtons. 30 kg × 3 m/s2 = 90 N.

32. What is the momentum of a 30-kg object traveling at 2.5 m/s?
a. 12 kg-m/s.
b. 75 kg-m/s.
c. 150 kg-m/s.
d. 187.5 kg-m/s.

ANS: B
Momentum is determined by multiplying mass (30 kg) by its velocity (2.5 m/s), resulting in 75 kg-m/s.

33. How much work is done if a force of 20 N is applied to move a patient 100 meters?
a. 0.5 J.
b. 5 J.
c. 200 J.

d. 2000 J.

ANS: D
Work = Fd, in this case 20 (force) multiplied by 100 (distance) over which it's moved, resulting in 2000 Joules.

34. If it takes 2 minutes to perform 360 J of work, what is the power?
a. 3 W.
b. 9 W.
c. 180 W.
d. 720 W.

ANS: A
Power is determined by dividing the work done (360 J) by the time it takes to do the work (2 minutes or 120 seconds). 360/120 = 3 Watts.

35. What is the velocity of a baseball that travels 15 meters in 2 seconds?
a. 7.5 N.
b. 7.5 m/s2.
c. 7.5 J.
d. 7.5 m/s.

ANS: D
Velocity is determined by dividing the distance traveled (15 meters) by the time necessary to cover the distance (2 s); therefore 15 m/2 s or 7.5 m/s. The unit of measurement for velocity is meter/second (m/s).

36. If a basketball goes from being stationary to a velocity of 18 m/s in 3 seconds, what is its acceleration?
a. 6 N.
b. 6 m/s2.
c. 6 m/s.
d. 6 W.

ANS: B
Acceleration is determined by subtracting the initial velocity (0 m/s) from the final velocity (18 m/s) and then dividing that amount by the time it took (3 seconds), resulting in 6 m/s2. The unit of measurement of acceleration is m/s2.

37. How much force is needed to move a 20-kg box whose acceleration is 5 m/s2?
a. 100 N.
b. 100 W.
c. 100 m/s2.
d. 100 m/s.

ANS: A
Force is determined by multiplying mass (20 kg) by acceleration (5 m/s2) and is measured in Newtons. 20 kg × 5 m/s2 = 100 N. The unit of measurement of force is the Newton (N).

38. What is the momentum of the 20 kg box that is traveling 10 m/s?
a. 200 m/s2.
b. 200 W.

c. 200 kg-m/s.
d. 200 J.

ANS: C
Momentum is determined by multiplying mass (20 kg) by its velocity (10 m/s), resulting in 200 kg-m/s. Momentum is measured in kg-m/s.

39. How much work is done if 5 N of force is used to lift a box 3 meters high?
a. 15 W.
b. 15 kg-m/s.
c. 15 N/s.
d. 15 J.

ANS: D
Work is determined by multiplying force (5 N) by distance (3 m) over which it's moved, resulting in 15 Joules. The Joule (J) is the unit of measurement of work.

40. If 240 J of work is done in 1 minute, how much power is consumed?
a. 4 J.
b. 4 W.
c. 4 kg-m/s.
d. 4 m/s.

ANS: B
Power is determined by dividing the work done (240 J) by the time it takes to do the work (1 minutes or 60 seconds). 240/60 = 4 watts. The unit of measurement of power is the watt (W).

41. The property of an object with mass that resists a change in its state of motion is
a. momentum
b. power
c. energy
d. inertia

ANS: D
Inertia is the property of an object with mass that resists a change in its state of motion.

42. The principle of inertia was first described by
a. Wilhelm Conrad Roentgen
b. Sir Isaac Newton
c. Thomas Alva Edison
d. Crookes

ANS: B
The principle of inertia was first described by Sir Isaac Newton in the 17th century.

43. Newton's first law of motion states that, unless acted on by an external force, an object at rest
a. will stay at rest
b. will move very slowly
c. will accelerate very quickly
d. none of these

ANS: A

Newton's first law of motion was that a body at rest will remain at rest unless an external force is applied.

44. The ability to do work is
    a. power
    b. energy
    c. inertia
    d. momentum

    ANS: B
    Energy is the ability to do work.

45. Energy in a stored state is
    a. kinetic energy
    b. energy of motion
    c. potential energy
    d. power

    ANS: C
    Potential energy is energy in a stored state; it can do work by virtue of position.

46. Kinetic energy is
    a. stored energy
    b. energy being expended
    c. the same as potential energy
    d. power

    ANS: B
    Kinetic energy is energy being used or expended.

47. Electromagnetic, chemical, electrical, and thermal are all types of
    a. waves
    b. equipment
    c. force
    d. energy

    ANS: D
    Energy comes in many types, including electromagnetic, chemical, electrical, and thermal.

48. Einstein's formula, E = MC2, demonstrates the relationship between
    a. matter and energy
    b. energy and electricity
    c. electricity and mass
    d. mass and electromagnetic energy

    ANS: A
    E = MC2 demonstrates the relationship between matter (M) and energy (E).

49. The standard radiologic unit that quantifies radiation intensity is the
    a. rem
    b. Becquerel
    c. gray

d. roentgen

ANS: D
The roentgen quantifies radiation intensity.

50. The standard radiologic unit that quantifies the biological effect of radiation on humans and animals is the
a. Becquerel
b. rad
c. roentgen
d. sievert

ANS: B
The rad quantifies the biological effect of radiation on humans and animals.

51. The standard radiologic unit that quantifies occupational exposure or dose equivalent is the
a. rem
b. rad
c. roentgen
d. Becquerel

ANS: A
The rem quantifies occupational exposure or dose equivalent.

52. The ____________ is the SI unit equivalent to the rad.
a. rem
b. roentgen
c. gray
d. Becquerel

ANS: C
The gray (Gy) is the SI unit equivalent to the rad.

53. 1 rad = ______________.
a. 10-2 Gy
b. 10-1 Gy
c. 10 Gy
d. 102 Gy

ANS: A
One rad is equal to 10-2 Gy or 1/100 Gy.

54. 1 rem = ______________.
a. 10-2 Sv
b. 10-1 Sv
c. 10 Sv
d. 102 Sv

ANS: A
One rem is equal to 10-2 Sv or 1/100 Sv.

55. The ____________ is the SI unit equivalent to the rem.
a. rad