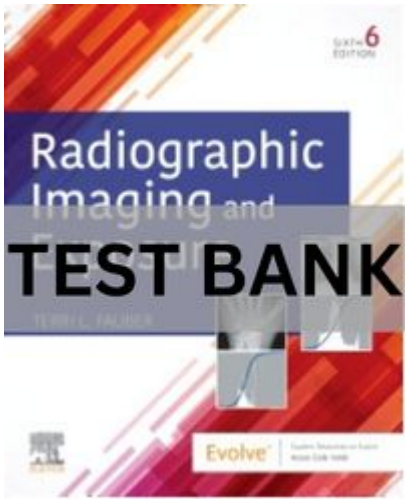
Radiographic Imaging and Exposure 6th Edition Test Bank

Chapter 01: Radiation and Its Discovery
Fauber: Radiographic Imaging and Exposure, 6th Edition



MULTIPLE CHOICE

1. When were x-rays discovered?
   a.
   b. November 8, 1895
   c. January 23, 1896
   d. August 15, 1902

   ANS: B
   X-rays were discovered by Wilhelm Conrad Roentgen on November 8, 1895.

2. What type of tube was Roentgen working with in his lab when x-rays were discovered?
   a. Crookes tube
   b. Fluorescent tube
   c. High-vacuum tube
   d. Wurzburg tube

   ANS: A
   Roentgen was working with a low-vacuum tube known as a Crookes tube.

3. Which of the following terms could be defined as the instantaneous production of light only during an interaction between a type of energy and some element or compound?
   a. Phosphorescence
   b. Afterglow
   c. Glowing
   d. Fluorescence

   ANS: D
   Fluorescence is the instantaneous emission of light from a material due to the interaction with some type of energy.

4. Barium platinocyanide was the:
   a. type of dark paper Roentgen used to darken his laboratory.
   b. material Roentgen used to produce the first radiograph of his wife's hand.
   c. metal used to produce the low-vacuum tube.
   d. fluorescent material that glowed when the tube was energized.

ANS: D
A piece of paper coated with barium platinocyanide glowed each time Roentgen energized his tube.

5. The first radiograph produced by Roentgen, of his wife's hand, required an exposure time of:
   a. 15 s.
   b. 150 s.
   c. 15 min.
   d. 150 min.

   ANS: C
   It took a 15-min exposure time to produce the first radiograph.

6. The letter *x* in *x-ray* is the symbol for:
   a. electricity.
   b. the unknown.
   c. penetrating.
   d. discovery.

   ANS: B
   The letter *x* represents the mathematical symbol of the unknown.

7. The first Nobel Prize for physics was received in 1901 by:
   a. Marie Curie.
   b. William Crookes.
   c. Wilhelm Roentgen.
   d. Albert Einstein.

   ANS: C
   Wilhelm Roentgen received the first Nobel Prize for physics in 1901.

8. X-rays were at one time called:
   a. Becquerel rays.
   b. Roentgen rays.
   c. Z-rays.
   d. gamma rays.

   ANS: B
   X-rays were at one time called Roentgen rays.

9. Erythema, an early sign of biologic damage due to x-ray exposure, is:
   a. reddening of the skin.
   b. a malignant tumor.
   c. a chromosomal change.
   d. one of the most serious effects of x-ray exposure.

   ANS: A
   Erythema is reddening and burning of the skin, an early and less serious effect of exposure to large doses of x-radiation.

10. X-rays have which of the following properties?
    a. Electrical and magnetic
    b. Electrical and chemical

c. Magnetic and chemical
d. All options are correct.

ANS: A
X-rays, a type of electromagnetic radiation, have both electrical and magnetic properties.

11. The distance between two successive crests of a sine wave is known as:
a. an angstrom.
b. frequency.
c. the Greek letter *nu.*
d. wavelength

ANS: D
The distance between two successive crests or troughs of a sine wave is the measure of its wavelength.

12. X-rays used in radiography have wavelengths that are measured in:
a. angstroms.
b. millimeters.
c. centimeters.
d. hertz.

ANS: A
X-rays in the range used in radiography have wavelengths that are so short that they are measured in angstroms.

13. The frequency of a wave is the number of waves passing a given point per given unit of time. Frequency is measured in:
a. angstroms.
b. hertz.
c. inches.
d. eV.

ANS: B
The unit of frequency is hertz. The frequency of x-rays in the radiography range varies from about 3×10^{19} to 3×10^{18} Hz.

14. Which of the following is a correct description of the relationship between the wavelength and frequency of the x-ray photon?
a. Wavelength and frequency are directly proportional.
b. Wavelength and frequency are inversely related by the square root of lambda.
c. Frequency and wavelength are inversely related.
d. Wavelength and frequency have no relationship to each other.

ANS: C
Wavelength and frequency are inversely related; as one increases, the other decreases.

15. A _____ is a small, discrete bundle of energy.
a. phaser
b. quark
c. photon
d. mesion

ANS: C

A photon, or quantum, is a small, discrete bundle of energy.

16. The speed of light is:
    a. 3 a. 3 x 10^8 meters per second and 3×10^8 miles per second
    b. 3×10^8 meters per second and 186,000 miles per second
    c. 3×10^8 miles per second and 186,000 miles per second
    d. All options are correct.

    ANS: B
    The speed of light can be described as either 3×10^8 meters per second or 186,000 miles per second.

17. When first developed, the branch of medicine using x-rays was called:
    a. radiology.
    b. radiography.
    c. roentgenology.
    d. imaging sciences.

    ANS: C
    What we now call *radiology* was first called *roentgenology.*

18. The electrical energy applied to an x-ray tube will be transformed to:
    a. heat and x-rays
    b. heat and light
    c. x-rays and light
    d. All options are correct.

    ANS: A
    The electrical energy applied to the x-ray tube will be transformed into heat (primarily) and x-rays.

19. The Greek symbol lambda (λ) represents the x-ray's:
    a. wavelength.
    b. speed.
    c. frequency.
    d. quantity.

    ANS: A
    Lambda (λ) is the Greek symbol that represents wavelength.

20. An angstrom (Å) is equal to:
    a. 10^{-1} meter
    b. 10^{-10} meter
    c. 10^{-1} foot
    d. 10^{-10} foot

    ANS: B
    One angstrom is equal to 10^{-10} meter.

21. X-rays used in radiography have wavelengths ranging from 0.1 to:
    a. 0.01 Å.
    b. 1 Å.
    c. 10 Å.

d. 100 Å.

ANS: B
X-rays used in radiography have wavelengths ranging from 0.1 to 1 Å.

22. X-rays used in radiography have wavelengths ranging from 3×10^{19} to:
a. 3×10^{8} Hz.
b. 3×10^{-10} Hz.
c. 3×10^{10} Hz.
d. 3×10^{18} Hz.

ANS: D
X-rays used in radiography have wavelengths ranging from 3×10^{19} to 3×10^{18} Hz.

23. In the formula $c = \lambda v$, c represents:
a. frequency.
b. the speed of light.
c. wavelength.
d. kinetic energy.

ANS: B
In this formula, c represents the speed of light.

24. In the formula $c = \lambda v$, v represents:
a. frequency.
b. the speed of light.
c. wavelength.
d. kinetic energy.

ANS: A
In this formula, v represents frequency.

25. The energy of an individual x-ray photon is measured in:
a. frequency.
b. wavelength.
c. kilovolts peak (kVp).
d. electron volts (eV).

ANS: D
X-ray photon energy is measured in electron volts (eV).

26. An x-ray beam that has photons with many different energies is:
a. homogenous.
b. monoenergetic.
c. heterogeneous.
d. never found.

ANS: C
A heterogeneous x-ray beam consists of photons with many different energies.

27. X-rays can:
a. penetrate the human body and be absorbed in the human body
b. penetrate the human body and change direction in the human body

c. be absorbed in the human body and change direction in the human body
d. All options are correct.

ANS: D
X-rays can penetrate, be absorbed in, or change direction (due to scattering) in the human body.

28. Which of the following units is used to measure occupational radiation exposure?
a. exposure
b. radioactivity
c. dose equivalent
d. effective dose

ANS: C
The units used in measuring occupational radiation exposure dose equivalent.

29. What radiation unit is defined as an expression of the relative risk to humans of exposure to ionizing radiation?
a. exposure
b. radioactivity
c. dose equivalent
d. effective dose

ANS: D
Effective dose is an expression of the *relative risk to humans* (whole body exposure) of exposure to ionizing radiation.

TRUE/FALSE

1. X-rays are invisible.

ANS: T
A characteristic of x-rays is that they are invisible.

2. X-rays carry a negative charge that causes ionization.

ANS: F
X-rays are electrically neutral.

3. X-ray photons travel at the speed of light in a vacuum.

ANS: T
In a vacuum, x-rays will travel at the speed of light.

4. X-ray photons are capable of traveling around corners.

ANS: F
X-rays travel in straight lines, so they are unable to travel around corners.

5. X-rays can cause certain substances to fluoresce.

ANS: T

X-rays can cause certain substances to fluoresce. When x-rays strike certain substances, those substances produce light.

6. X-rays will change direction in the presence of a strong magnetic field.

   ANS: F
   X-rays do not respond to a magnetic field.

7. X-rays produce a slight tingling sensation when they enter the body.

   ANS: F
   X-rays cannot be felt.

8. X-rays cannot be focused with a lens.

   ANS: T
   Unlike visible light, it is not possible to focus x-rays with a lens.

9. The joule is the SI unit for the transfer of energy into matter (absorbed dose).

   ANS: T
   The joule is the SI unit for the transfer of energy into matter and more commonly used today, 100 ergs per gram is equal to 0.01 joule per kilogram of irradiated matter.

10. It is impossible for x-rays to interact with matter and produce secondary radiation.

    ANS: F
    Secondary radiation is often produced as a result of x-rays interacting with matter.

11. X-rays can produce ionization of atoms making up cells, causing damage.

    ANS: T
    A major reason that unnecessary exposure must be avoided is that x-rays can ionize atoms and cause damage.

12. Since Roentgen's discovery in the late nineteenth century, we have learned an enormous amount about the properties of x-rays.

    ANS: F
    Roentgen's original work on the characteristics of x-rays was so thorough that very little has been learned about their properties since.

13. It is the radiographer's responsibility to minimize the radiation dose to the patient, to themselves, and to others in accordance with the **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA) principle.

    ANS: T
    It is the radiographer's responsibility to minimize the radiation dose to the patient, to themselves, and to others in accordance with the **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA) principle.

14. Screening for pregnancy is an important task for minimizing unnecessary exposure to a developing fetus.

    ANS: T
    Screening for pregnancy is an important task for minimizing unnecessary exposure to a developing fetus.

Chapter 02: The X-ray Beam
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MULTIPLE CHOICE

1. The _____ is the portion of the x-ray tube that contains the filament.
   a. cathode
   b. anode
   c. rotor
   d. rotating disk

   ANS: A
   The filament, the source of electrons during x-ray production, is located in the cathode.

2. The cathode filament is made of:
   a. tungsten.
   b. rhenium.
   c. molybdenum.
   d. lead.
   e. nickel.

   ANS: A
   The cathode filament is made of tungsten.

3. The focusing cup:
   a. surrounds the anode.
   b. has a positive charge.
   c. has a negative charge.
   d. focuses the x-ray beam.

   ANS: C
   The focusing cup, surrounding the filament on three sides, has a negative charge, keeping the negatively charged electrons focused.

4. In a dual-focus tube, how many filaments are energized at any one-time during x-ray production?
   a. One
   b. Two
   c. Four
   d. An infinite number

   ANS: A
   Only one filament is energized at any one-time during x-ray production.

5. The focusing cup is made of:
   a. tungsten.

b. rhenium.
c. molybdenum.
d. lead.
e. nickel.

ANS: E
The focusing cup is made of nickel.

6. _____ is the phenomenon that occurs around the filament during thermionic emission and prevents the further escape of electrons from the filament.
   a. Saturation current
   b. Space charge effect
   c. mA rectification
   d. Line focus principle

   ANS: B
   The space charge effect limits the number of electrons in the space charge by preventing additional electrons from being boiled off the filament.

7. The positive side of the x-ray tube is the:
   a. anode.
   b. cathode.
   c. window.
   d. stream of electrons.

   ANS: A
   The anode is the positive side of the x-ray tube, and the cathode is the negative.

8. The maximum speed the rotating anode will typically achieve is _____ rpm.
   a. 3200
   b. 5000
   c. 10,000
   d. 20,000

   ANS: C
   Rotating anodes rotate at a set speed ranging from 3000 to 10,000 revolutions per minute (rpm).

9. What is the base material of the anode disk?
   a. Tungsten and molybdenum
   b. Tungsten and graphite
   c. Molybdenum and graphite
   d. All options are correct.

   ANS: C
   The base of the rotating anode disk is made of molybdenum with a graphite layer.

10. What is the name of the fixed physical area on the anode target that is struck by the electron stream?
    a. Focal spot
    b. Focal point
    c. Focal range
    d. Focal radius

ANS: A
The focal spot is the fixed physical area on the focal track of the anode target where electrons strike.

11. What is the name of the device in a rotating anode x-ray tube that turns the rotor?
    a. Stator
    b. Rotor
    c. Focusing cup
    d. Rheostat

    ANS: A
    Located outside the envelope of the x-ray tube, the stator is an electric motor that turns the rotor.

12. Effective compensation for the anode heel effect would involve positioning:
    a. the thinnest portion of the part under the anode and the thickest portion of the part under the cathode
    b. the thinnest portion of the part under the anode and the thinnest portion of the part under the cathode
    c. the thickest portion of the part under the cathode and the thickest portion of the part under the anode
    d. the thinnest portion of the part under the cathode and the thickest portion of the part under the anode

    ANS: A
    The thinnest portion of a part should be placed under the anode, because the more intense x-rays are emitted toward the cathode end of the tube, where the thickest part should be placed.

13. What is an acceptable level of leakage from the tube housing?
    a. 100 mGy_a per hour, measured 6 feet away
    b. 10 mGy_a per hour, measured 1 foot away
    c. 10 Gy per hour, measured at a distance of 4 meters
    d. 1 mGy_a per hour, measured at a distance of 1 meter

    ANS: D
    The maximum amount of leakage radiation from an x-ray tube is 100 mR (1 mGy_a) per hour when measured at a distance of 1 meter.

14. Which of the following could be defined as the production of an x-ray photon by the electrostatic attraction between the incident electron and the nucleus of the tungsten atom?
    a. Photoelectric interaction
    b. Bremsstrahlung interaction
    c. Characteristic interaction
    d. Pair production interaction

    ANS: B
    Production of an x-ray photon as a result of a slowing down of the incoming electron due to the electrostatic force of the nucleus is due to a bremsstrahlung interaction.

15. If a projectile electron enters an atom with 100 keV of energy, passes very close to the nucleus, and exits with 30 keV of energy. The x-ray photon produced is:
    a. 13.3 keV
    b. 70 keV