Test Bank - Chapter 01

Q1: When were x-rays discovered?

A. October 8, 1985
B. November 8, 1895 (Correct)
C. January 23, 1896
D. August 15, 1902

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

Q2: What type of tube was Roentgen working with in his lab when x-rays were discovered?

A. Crookes tube (Correct)
B. Fluorescent tube
C. High-vacuum tube
D. Wurzburg tube

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

Q3: 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 (Correct)

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

Q4: 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. (Correct)

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

Q5: 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. (Correct)

D. 150 min.

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

Q6: The letter x in x-ray is the symbol for:

A. electricity.
B. the unknown. (Correct)
C. penetrating.
D. discovery.

Rationale: The letter x represents the mathematical symbol of the unknown.

Q7: The first Nobel Prize for physics was received in 1901 by:

A. Marie Curie.
B. William Crookes.
C. Wilhelm Roentgen. (Correct)
D. Albert Einstein.

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

Q8: X-rays were at one time called:

A. Becquerel rays.
B. Roentgen rays. (Correct)
C. Z-rays.
D. gamma rays.

Rationale: X-rays were at one time called Roentgen rays.

Q9: Erythema, an early sign of biologic damage due to x-ray exposure, is:

A. reddening of the skin. (Correct)
B. a malignant tumor.
C. a chromosomal change.
D. one of the most serious effects of x-ray exposure.

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

Q10: X-rays have which of the following properties?

A. Electrical and magnetic (Correct)
B. Electrical and chemical
C. Magnetic and chemical
D. All options are correct.

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

Q11: 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 (Correct)

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

Q12: X-rays used in radiography have wavelengths that are measured in:

A. angstroms. (Correct)
B. millimeters.
C. centimeters.
D. hertz.

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

Q13: 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. (Correct)
C. inches.
D. eV.

Rationale: The unit of frequency is hertz. The frequency of x-rays in the radiography range varies from about 3 × 1019 to 3 × 1018 Hz.

Q14: 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. (Correct)
D. Wavelength and frequency have no relationship to each other.

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

Q15: A _____ is a small, discrete bundle of energy.

A. phaser
B. quark
C. photon (Correct)

D. mesion

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

Q16: The speed of light is:

A. 3 x 108 meters per second and 3 x 108 miles per second
B. 3 x 108 meters per second and 186,000 miles per second (Correct)
C. 3 x 108 miles per second and 186,000 miles per second
D. All options are correct.

Rationale: The speed of light can be described as either 3 × 108 meters per second or 186,000 miles per second.

Q17: When first developed, the branch of medicine using x-rays was called:

A. radiology.
B. radiography.
C. roentgenology. (Correct)
D. imaging sciences.

Rationale: What we now call radiology was first called roentgenology.

Q18: The electrical energy applied to an x-ray tube will be transformed to:

A. heat and x-rays (Correct)
B. heat and light
C. x-rays and light
D. All options are correct.

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

Q19: The Greek symbol lambda (λ) represents the x-ray's:

A. wavelength. (Correct)
B. speed.
C. frequency.
D. quantity.

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

Q20: An angstrom (A■) is equal to:

A. 10-1 meter
B. 10-10 meter (Correct)
C. 10-1 foot
D. 10-10 foot

Rationale: One angstrom is equal to 10-10 meter.

Q21: X-rays used in radiography have wavelengths ranging from 0.1 to:

A. 0.01 A■.
B. 1 A■. (Correct)
C. 10 A■.
D. 100 A■.

Rationale: X-rays used in radiography have wavelengths ranging from 0.1 to 1 A■.

Q22: X-rays used in radiography have wavelengths ranging from 3 × 1019 to:

A. 3 × 108 Hz.
B. 3 × 10-10 Hz.
C. 3 × 1010 Hz.
D. 3 × 1018 Hz. (Correct)

Rationale: X-rays used in radiography have wavelengths ranging from 3 × 1019 to 3 × 1018 Hz.

Q23: In the formula c = λv, c represents:

A. frequency.
B. the speed of light. (Correct)
C. wavelength.
D. kinetic energy.

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

Q24: In the formula c = λv, v represents:

A. frequency. (Correct)
B. the speed of light.
C. wavelength.
D. kinetic energy.

Rationale: In this formula, v represents frequency.

Q25: The energy of an individual x-ray photon is measured in:

A. frequency.
B. wavelength.
C. kilovolts peak (kVp).
D. electron volts (eV). (Correct)

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

Q26: An x-ray beam that has photons with many different energies is:

A. homogenous.
B. monoenergetic.
C. heterogeneous. (Correct)
D. never found.

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

Q27: 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. (Correct)

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

Q28: Which of the following units is derived by multiplying a radiation weighting (Wr) for the type of ionizing radiation by the units of absorbed dose?

A. exposure
B. radioactivity
C. equivalent dose (Correct)
D. effective dose

Rationale: Equivalent dose is derived by multiplying a quality factor, radiation weighting factor (Wr) for the type of ionizing radiation by the units of absorbed exposure, rads or grays.

Q29: What radiation unit is defined as an expression of the relative risk to humans of exposure to ionizing radiation?

A. exposure
B. radioactivity
C. equivalent dose
D. effective dose (Correct)

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

Q30: X-rays are invisible.

A. True (Correct)
B. False

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

Q31: X-rays carry a negative charge that causes ionization.

A. True
B. False (Correct)

Rationale: X-rays are electrically neutral.

Q32: X-ray photons travel at the speed of light in a vacuum.

A. True (Correct)
B. False

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

Q33: X-ray photons are capable of traveling around corners.

A. True
B. False (Correct)

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

Q34: X-rays can cause certain substances to fluoresce.

A. True (Correct)
B. False

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

Q35: X-rays will change direction in the presence of a strong magnetic field.

A. True
B. False (Correct)

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

Q36: X-rays produce a slight tingling sensation when they enter the body.

A. True
B. False (Correct)

Rationale: X-rays cannot be felt.

Q37: X-rays cannot be focused with a lens.

A. True (Correct)
B. False

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

Q38: The joule is the SI unit for the transfer of energy into matter (absorbed dose).

A. True (Correct)
B. False

Rationale: 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.

Q39: It is impossible for x-rays to interact with matter and produce secondary radiation.

A. True
B. False (Correct)

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

Q40: X-rays can produce ionization of atoms making up cells, causing damage.

A. True (Correct)
B. False

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

Q41: Since Roentgen's discovery in the late nineteenth century, we have learned an enormous amount about the properties of x-rays.

A. True
B. False (Correct)

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

Q42: It is the radiographer's responsibility to optimize for radiological protection when imaging patients.

A. True (Correct)
B. False

Rationale: It is the radiographer's responsibility to ensure the radiation dose should be appropriate to the imaging procedure and avoid unnecessary exposure to the patient while producing quality images for diagnostic interpretation.

Q43: Screening for pregnancy is an important task for minimizing unnecessary exposure to a developing fetus.

A. True (Correct)
B. False

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