MULTIPLE CHOICE

1. The fundamental unit of matter is the
   a. proton.
   b. neutron.
   c. electron.
   d. atom.

   ANS: D
   A proton is a subatomic particle; the fundamental unit of matter is the atom. A neutron is a subatomic particle; the fundamental unit of matter is the atom. An electron is a subatomic particle; the fundamental unit of matter is the atom. The fundamental unit of matter is the atom.

   DIF: Recall REF: Page 8 OBJ: 1
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

2. The nucleus of an atom contains
   a. protons.
   b. neutrons.
   c. protons and neutrons.
   d. electrons.

   ANS: C
   The nucleus of an atom contains neutrons as well as protons. The nucleus of an atom contains protons as well as neutrons. The nucleus of an atom contains protons and neutrons. The nucleus of an atom does not contain electrons; it contains protons and neutrons.

   DIF: Recall REF: Page 8 OBJ: 2
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

3. Which subatomic particle carries a negative electrical charge?
   a. A neutron
   b. A proton
   c. An electron
   d. A nucleon

   ANS: C
   A neutron does not carry an electrical charge. A proton carries a positive electrical charge. An electron carries a negative electrical charge. A nucleon carries a positive (proton) or no (neutron) electrical charge.

   DIF: Comprehension REF: Page 8 OBJ: 2
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation

MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

4. Which of the following elements is the simplest atom?
   a. Hydrogen (H #1)
   b. Helium (He #2)
   c. Nitrogen (N #7)
   d. Oxygen (O #8)

   ANS: A
   Atomic numbers are assigned from simplest to most complex. Hydrogen is the simplest atom; with a single proton, it has an atomic number of 1. Helium has an atomic number of 2. Nitrogen has an atomic number of 7. Oxygen has an atomic number of 8.

   DIF: Comprehension REF: Page 8 OBJ: 2
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

5. Which of the following statements is *true* of orbits or shells in the atom?
   a. Protons travel around the nucleus in well-defined shells.
   b. An atom contains innumerable shells.
   c. The energy level within each shell is the same.
   d. The orbiting shell closest to the nucleus has the highest energy level.

   ANS: D
   Electrons travel around the nucleus in well-defined shells. An atom contains a maximum of seven shells. Each of the maximum seven shells within an atom represents a different energy level. The orbiting shell closest to the nucleus has the highest energy level. The K shell is the orbiting shell closest to the nucleus.

   DIF: Comprehension REF: Page 8 OBJ: 2
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

6. The binding energy or binding force of an electron is
   a. determined by the distance between the neutrons and protons within the nucleus.
   b. determined by the distance between the orbiting electrons and the nucleus.
   c. weaker for electrons located in inner shells than in outer shells.
   d. determined by the atomic number.

   ANS: B
   The binding energy or binding force of an electron is determined by the distance between the nucleus and the orbiting electron. The binding energy or binding force of an electron is determined by the distance between the orbiting electron and the nucleus, not the distance between the orbiting electrons. The binding energy or binding force of an electron is stronger for electrons located in inner shells than for outer shells.

   DIF: Recall REF: Page 8 OBJ: 2 TOP: CDA, N/A
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

7. Which of the following statements is *true* of ionization?
   a. An atom that gains an electron will have a negative charge.
   b. An atom that loses an electron will have a negative charge.
   c. An atom that loses an electron will have a positive charge.
   d. An atom that gains an electron has a negative charge, and an atom that loses an electron has a positive charge.

   ANS: D
   This answer is not the best answer. An atom that gains an electron has a negative charge; however, an atom that loses an electron has a positive charge. An atom that loses an electron will have a positive charge. An atom that loses an electron has a positive charge; however, an atom that gains an electron has a negative charge. An atom that gains an electron will have a negative charge, and an atom that loses an electron will have a positive charge.

   DIF: Comprehension REF: Page 10 OBJ: 3
   TOP: CDA, N/A
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

8. An ion pair results when
   a. a proton is removed from an atom.
   b. an electron is removed from an atom.
   c. a neutron is removed from an atom.
   d. two atoms share a pair of electrons.

   ANS: B
   An ion pair results when an electron is removed from an atom rather than a proton; a neutron.

   DIF: Recall REF: Page 10 OBJ: 3
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

9. (1) *Radiation* is the emission and propagation of energy through space or a substance in the form of waves or particles. (2) *Radioactivity* can be defined as the process by which certain unstable atoms or elements undergo spontaneous disintegration, or decay, in an effort to attain a more balanced nuclear state.
   a. Both statements are true.
   b. Both statements are false.
   c. The first statement is true; the second statement is false.
   d. The first statement is false; the second statement is true.

   ANS: A
   Radiation is the emission and propagation of energy through space or a substance in the form of waves or particles. *Radioactivity* can be defined as the process by which certain unstable atoms or elements undergo spontaneous disintegration, or decay, in an effort to attain a more balanced nuclear state.

   DIF: Recall REF: Page 10 OBJ: 4
   TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
   MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics

and radiobiology

10. The spontaneous emission of radiation from the disintegration of unstable atomic nuclei is
    a. beta particle decay.
    b. radiation.
    c. radioactivity.
    d. alpha particle decay.

    ANS: C
    Beta particles are fast-moving electrons emitted from the nucleus of radioactive atoms. Radioactivity is the process by which certain unstable atoms or elements undergo spontaneous disintegration, or decay, in an effort to attain a more balanced nuclear state. Radiation is the emission and propagation of energy through space or a substance in the form of waves or particles. Radioactivity is the process by which certain unstable atoms or elements undergo spontaneous disintegration, or decay, in an effort to attain a more balanced nuclear state. Alpha particles are emitted from the nuclei of heavy metals and exist as two protons and neutrons, without electrons. Radioactivity is the process by which certain unstable atoms or elements undergo spontaneous disintegration, or decay, in an effort to attain a more balanced nuclear state.

    DIF: Comprehension REF: Page 10 OBJ: 4
    TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

11. Which of the following statements is *true* of ionizing radiation?
    a. It is radiation that is capable of producing ions by removing or adding an electron to an atom.
    b. It is strictly an electromagnetic radiation and does not involve particles that have mass.
    c. It is strictly particulate radiation and cannot travel as waves.
    d. It can only travel at the speed of light.

    ANS: A
    It is radiation that is capable of producing ions by removing or adding an electron to an atom. Ionizing radiation involves both particulate and electromagnetic radiation. There are two groups of ionizing radiation: particulate radiation and electromagnetic radiation. Electromagnetic radiation, a type of ionizing radiation, travels at the speed of light. Particulate radiation travels at varying speeds.

    DIF: Comprehension REF: Page 10 OBJ: 3
    TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

12. Cathode rays are derived from which of the following types of particulate radiation?
    a. Electrons
    b. Alpha particles
    c. Protons
    d. Neutrons

    ANS: A

Cathode rays are derived from electrons. Alpha particles are emitted from the nuclei of heavy metals. Protons are accelerated particles with a mass of 1 and a charge of +1. Neutrons are accelerated particles with a mass of 1 and no electrical charge.

DIF: Recall REF: Page 10 OBJ: 5
TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

13. Electromagnetic radiations
    a. are entirely human-made.
    b. include x-rays and visible light.
    c. are a form of particulate radiation.
    d. have mass.

ANS: B
Electromagnetic radiations are human-made or occur naturally. Electromagnetic radiations include x-rays and visible light. Electromagnetic radiations are not a form of particulate radiation. Electromagnetic radiations do not have mass.

DIF: Recall REF: Page 11 OBJ: 6
TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

14. Which of the following forms of electromagnetic radiation are capable of ionization?
    a. Radio waves
    b. Visible light
    c. Ultraviolet light
    d. X-rays

ANS: D
Radio waves are not capable of ionization. Visible light is not capable of ionization. Ultraviolet light is not capable of ionization. Of the forms of electromagnetic radiation listed, only x-rays are capable of ionization.

DIF: Recall REF: Page 11 OBJ: 6
TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

15. Photons are
    a. bundles of energy with mass and weight.
    b. bundles of energy that travel at the speed of sound.
    c. a component of the particle concept of electromagnetic radiation.
    d. a component of the wave concept of electromagnetic radiation.

ANS: C
Photons are bundles of energy without mass or weight; that travel at the speed of light. Photons are a component of the particle concept of electromagnetic radiation.

DIF: Comprehension REF: Page 11 OBJ: 6

TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

16. Which of the following statements is *true* of the wave concept of electromagnetic radiation?
    a. *Wavelength* refers to the speed of the wave.
    b. *Velocity* refers to the number of wavelengths that pass a given point in a certain amount of time.
    c. *Frequency* is defined as the distance between the crest of one wave and the crest of the next.
    d. Frequency and wavelength are inversely related.

    ANS: D
    Velocity refers to the speed of the wave. Frequency refers to the number of wavelengths that pass a given point in a certain amount of time. Wavelength is defined as the distance between the crest of one wave and the crest of the next. Frequency and wavelength are inversely related: if the frequency of the wave is high, the wavelength will be short, and if the frequency is low, the wavelength will be long.

    DIF: Recall REF: Page 12 OBJ: 6
    TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

17. Which of the following forms of electromagnetic radiation has the shortest wavelength?
    a. Radio wave
    b. Television wave
    c. Radar wave
    d. Dental x-ray wave

    ANS: D
    A radio wave has a wavelength as long as 100 meters. A television wave has a wavelength of approximately 1 meter. A radar wave has a wavelength of 1/100 of a meter. The dental x-ray wave has a wavelength of 0.1 nanometer, or 0.00000000001 meter.

    DIF: Comprehension REF: Page 12 OBJ: 6
    TOP: CDA, RHS, III.B.2. Describe the characteristics of x-radiation
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

18. Which of the following components of the x-ray machine would have two indicator lights?
    a. X-ray tube
    b. X-ray tubehead
    c. The control panel
    d. The extension arm

    ANS: C
    The x-ray tube is inside the tubehead; it does not have indicator lights. The x-ray tubehead contains the x-ray tube; it does not have indicator lights. The control panel has an indicator light for the on-off switch and an indicator light for the exposure button. The extension arm is used to position the tubehead; it does not have indicator lights.

DIF: Comprehension REF: Page 12 OBJ: 8
TOP: CDA, RHS, III.B.3. Demonstrate understanding of x-ray machine factors that influence radiation safety
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

19. Heat is a byproduct of x-ray production. Which component of the x-ray tubehead dissipates the heat created by the production of x-rays?
    a. Metal housing
    b. Insulating oil
    c. Aluminum discs
    d. Lead collimator

    ANS: B
    The metal housing protects the x-ray tube and grounds the high-voltage components. Insulating oil absorbs heat created by the production of x-rays. Aluminum discs filter out nonpenetrating, longer-wavelength x-rays. The lead collimator restricts the size of the x-ray beam.

    DIF: Comprehension REF: Page 13 OBJ: 8
    TOP: CDA, N/A
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

20. Your patient had x-rays taken in her previous dental office. She notices that the long metal tube at the end of the x-ray head is longer than it was at the other office. What explanation would you give for the purpose of the tube, or cone, attached to the x-ray head?
    a. It surrounds the x-ray tube, protects the x-ray tube, and grounds the high-voltage components.
    b. It seals the oil in the tubehead and acts as a filter to the x-ray beam.
    c. It filters out the nonpenetrating, longer-wavelength x-rays.
    d. It aims and shapes the x-ray beam.

    ANS: D
    The metal housing surrounds and protects the x-ray tube and grounds the high-voltage components. The tubehead seals the oil in the tubehead and acts as a filter to the x-ray beam. Aluminum discs filter out the nonpenetrating, longer-wavelength x-rays. The position-indicating device aims and shapes the x-ray beam.

    DIF: Application REF: Page 14 OBJ: 8
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

21. Within the x-ray tube, electrons are generated by the
    a. tungsten filament in the cathode.
    b. tungsten filament in the anode.
    c. molybdenum cup.
    d. copper stem.

    ANS: A

Within the x-ray tube, electrons are generated by the tungsten filament in the cathode. The molybdenum cup focuses the electrons into a narrow beam and directs the beam across the tube toward the tungsten target of the anode. The copper stem functions to dissipate heat away from the tungsten target.

DIF: Comprehension REF: Page 15 OBJ: 8
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

22. The purpose of the anode is to
    a. produce electrons when heated.
    b. convert electrons into x-ray photons.
    c. absorb heat created by the production of x-rays.
    d. filter out nonpenetrating, longer-wavelength x-rays.

    ANS: B
    The purpose of the cathode is to produce electrons when heated. The purpose of the anode is to convert electrons into x-ray photons. The purpose of insulating oil is to absorb heat created by the production of x-rays. The purpose of aluminum discs is to filter out nonpenetrating, longer-wavelength x-rays.

    DIF: Recall REF: Page 15 OBJ: 10
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

23. In the dental x-ray tube, the number of electrons created is controlled by
    a. alternating current.
    b. direct current.
    c. milliamperage.
    d. kilovoltage.

    ANS: C
    Alternating current describes a current in which the electrons flow in two opposite directions. Direct current describes a current in which the electrons flow in one direction through a conductor. Milliamperage in the dental x-ray tube controls the number of electrons created that will move through a conductor. Kilovoltage in the dental x-ray tube controls the electrical force or speed that moves electrons from a negative pole (cathode) to a positive one (anode).

    DIF: Comprehension REF: Page 15 OBJ: 8
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

24. Your x-ray machine runs off 110 volts. Theoretically what would occur if there was no step-down transformer in the x-ray control panel?
    a. Too few electrons would be produced for the purpose of dental x-rays. 65,000 to 100,000 volts are required to heat the tungsten filament.

b. Too few electrons would be produced for the purpose of dental x-rays. 50,000 to 75,000 volts are required to heat the tungsten filament.
c. Too many electrons would be produced for the purpose of dental x-rays. Only 3-5 volts are required to heat the tungsten filament.
d. There would be no interruption in function of the machine.

ANS: C
The step-up transformer is used to increase the voltage to the 65,000 to 100,000 volts required. 65,000 to 100,000 volts are needed to activate the high-voltage circuit to accelerate the electrons to the anode. A step-down transformer is used to decrease the voltage from the incoming 110- or 220-line voltage to the 3 to 5 volts required. The step-up transformer is used to increase the voltage to the 65,000 to 100,000 volts required. Too many electrons would be produced for the purpose of dental x-rays. Only 3-5 volts are required to heat the tungsten filament. A step-down transformer is used to decrease the volts from 110-220 volts to the required 3-5 volts. Too many electrons would be produced for the purpose of dental x-rays.

DIF: Application REF: Page 16 OBJ: 8
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

25. Thermionic emission of electrons occurs at the
a. tungsten filament in the anode.
b. tungsten filament in the cathode.
c. copper stem.
d. molybdenum cup.

ANS: B
Thermionic emission of electrons occurs at the tungsten filament in the cathode; the copper stem functions as a heat sink for the tungsten target; the molybdenum cup focuses the electrons into a narrow beam.

DIF: Comprehension REF: Page 16 OBJ: 10
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

26. Approximately what percentage of the kinetic energy of the electrons is converted to x-rays at the anode?
a. Less than 1%
b. 25%
c. 50%
d. 100%

ANS: A
Less than 1% of the kinetic energy of the electrons is converted to x-rays at the anode. 25% is incorrect; less than 1% of the kinetic energy of the electrons is converted to x-rays at the anode. 50% is incorrect; less than 1% of the kinetic energy of the electrons is converted to x-rays at the anode. 100% is incorrect; less than 1% of the kinetic energy of the electrons is converted to x-rays at the anode.

DIF: Recall REF: Page 16 OBJ: 10
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

27. The lead collimator
    a. carries away the heat produced during the production of x-rays.
    b. permits a small number of x-rays to exit from the x-ray tube.
    c. filters the longer-wavelength x-rays from the beam.
    d. restricts the size of the x-ray beam.

    ANS: D
    The copper stem carries away the heat produced during the production of x-rays. The unleaded glass window portion of the tube permits a small number of x-rays to exit from the x-ray tube. The aluminum disc filters the longer-wavelength x-rays from the beam. The lead collimator restricts the size of the x-ray beam.

    DIF: Recall REF: Page 14 OBJ: 10
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

28. Which of the following statements is *true* of characteristic radiation?
    a. It is also known as braking (bremsstrahlung) radiation.
    b. It only occurs at 70 kV and above.
    c. It is the source of the majority of x-rays that are produced.
    d. The high-speed electron passes close to the nucleus or hits the nucleus of the tungsten atom.

    ANS: B
    General radiation is known as braking, or bremsstrahlung, radiation. Characteristic radiation is not the same as general radiation. Characteristic radiation occurs at 70 kV and above. General radiation is the source of the majority of the x-rays that are produced. The speeding electron passes close to the nucleus or hits the nucleus of the tungsten atom in general radiation.

    DIF: Recall REF: Page 17 OBJ: 10
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

29. Which form of the x-ray beam is most detrimental to the patient and operator?
    a. Primary radiation
    b. Secondary radiation
    c. Scatter radiation
    d. Useful beam

    ANS: C

Primary radiation is the penetrating x-ray beam produced at the target of the anode. Secondary radiation is created when the primary beam interacts with matter. Scatter radiation is the most detrimental to the patient and operator. The useful beam is another term for primary radiation.

DIF: Recall REF: Page 18 OBJ: 11
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

30. Which is the most common possibility when an x-ray photon interacts with matter?
    a. No interaction
    b. Absorption or photoelectric effect
    c. Compton scatter
    d. Coherent scatter

ANS: C
No interaction means the photon passed through matter without any interaction. Absorption (photoelectric effect) accounts for 30% of the interactions with matter from the dental x-ray beam. Compton scatter accounts for 62% of the interactions with matter that occur in diagnostic radiography. Coherent scatter accounts for only 8% of the interactions with matter from the dental x-ray beam.

DIF: Recall REF: Page 19 OBJ: 11
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

31. Which of the following four possibilities that can occur when an x-ray photon interacts with matter is responsible for producing densities on a dental receptor that make dental radiography possible?
    a. No interaction
    b. Absorption or photoelectric effect
    c. Compton scatter
    d. Coherent scatter

ANS: A
X-ray photons that pass through a patient without interaction are responsible for producing the densities on a dental receptor that make dental radiography possible. Absorption or photoelectric effect is incorrect; x-ray photons that pass through a patient without interaction are responsible for producing densities on a dental receptor that make dental radiography possible. Compton scatter is incorrect; x-ray photons that pass through a patient without interaction are responsible for producing densities on a dental receptor that make dental radiography possible. Coherent scatter is incorrect; x-ray photons that pass through a patient without interaction are responsible for producing densities on a dental receptor that make dental radiography possible.

DIF: Recall REF: Page 18 OBJ: 11
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics

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32. (1) X-ray photon production occurs as a result of both general and characteristic radiation. (2) General radiation accounts for a small number of x-ray photons produced because it takes high kV to dislodge the electrons from the K shell.
    a. Both statements are true.
    b. Both statements are false.
    c. The first statement is true; the second statement is false.
    d. The first statement is false; the second statement is true.

    ANS: C
    The first statement is true; the second statement is false. X-ray photon production occurs as a result of both general and characteristic radiation; however, it is characteristic radiation that accounts for a small number of x-ray photons produced because it is through characteristic radiation that electrons are ejected from the K shell, which results in the production of x-ray photons.

    DIF: Comprehension REF: Page 17 OBJ: 10
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

33. Interaction with the x-ray photon as a result of the photoelectric effect is harmful to the patient because ionization occurs.
    a. The statement is true.
    b. The statement is false.
    c. The first part of the statement is true, but the second part of the statement is false.
    d. The first part of the statement is false, but the second part of the statement is true.

    ANS: A
    Both statements are true. Absorption, one of the types of interactions with the x-ray photon, occurs as a result of the photoelectric effect. It is harmful to the patient because ionization occurs.

    DIF: Comprehension REF: Pages 18-19 OBJ: 11
    TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
    MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

34. Which would you adjust if you wanted to create a larger electron cloud?
    a. Milliamperage
    b. Kilovoltage
    c. Step-up transformer
    d. Step-down transformer

    ANS: A

Milliamperage controls the number of electrons produced in the electron cloud. Kilovoltage controls the speed or force with which the electron cloud is propelled to the anode. The step-up transformer increases the incoming voltage from 110-220 volts to 65,000 to 100,000 volts. The step-down transformer decreases the incoming voltage from 110-220 volts to 3-5 volts.

DIF: Application REF: Page 15 OBJ: 10
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

35. Which would you adjust if you wanted to produce characteristic radiation?
    a. Milliamperage
    b. Kilovoltage
    c. Step-up transformer
    d. Step-down transformer

ANS: B
Milliamperage controls the number of electrons produced in the electron cloud; the number of electrons does not affect the production of characteristic radiation. The kilovoltage control would be adjusted. Kilovoltage controls the speed or force with which the electron cloud is propelled to the anode. Characteristic radiation occurs at 70 kV or higher. The step-up transformer increases the incoming voltage from 110-220 volts to 65,000 to 100,000 volts. The step-down transformer decreases the incoming voltage from 110-220 volts to 3-5 volts.

DIF: Application REF: Page 15 OBJ: 10
TOP: CDA, RHS, III.B. Apply the principles of radiation protection and hazards in the operation of radiographic equipment
MSC: NBDHE, 2.0 Obtaining and Interpreting Radiographs | NBDHE, 2.1 Principles of radiophysics and radiobiology

36. Which property of x-rays allows for the image on the receptor?
    a. Fluorescence
    b. Penetrating power
    c. Focusing capability
    d. Effect on living tissue

ANS: B
X-rays have fluorescence capability, and they can cause substances to fluoresce. However, this is not a property that produces an image on a receptor. The penetrating power of the x-ray determines the x-ray's ability to penetrate matter. The amount of x-rays that pass through or are that are absorbed creates the image on the receptor. The focusing ability, which means an x-ray cannot be focused to a point, does not affect the production of an image on the receptor. X-rays cause biologic changes to living cells; this does not affect the production of an image on the receptor.

DIF: Comprehension REF: Page 12 OBJ: 7
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