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MULTIPLE CHOICE

1. If the useful beam is not centered on the film in the patient's mouth, the result will be:
   a. elongation.
   b. overlapping.
   c. foreshortening.
   d. collimator cutoff.

   ANS: D
   The useful beam occurs after the primary beam has been filtered and collimated. If the useful beam is not centered on the film, the result will be collimator cutoff because the collimating device restricts the size and shape of the x-ray beam. Elongation is caused by inadequate vertical angulation. Overlapping is the result of the central beam not being perpendicular to the film and teeth in the horizontal plane. Foreshortening is caused by excessive vertical angulation.

   DIF: Challenging: Application REF: p. 22 OBJ: #13
   MSC: CDA: Expose and Evaluate: B1b | CDA: Expose and Evaluate: C1a | CDA: Expose and Evaluate: C1b
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.3 Technique and 2.4 Recognition of normalities and abnormalities

2. A diagnostic film is made at 10 mA and 4 impulses. The exposure that would produce the same image at 5 mA would be:
   a. 5 impulses.
   b. 8 impulses.
   c. 10 impulses.
   d. 45 impulses.

   ANS: B
   10 mA × 4 impulses = 40 to produce the same image at 5 mA you would need 8 impulses: 5 mA × 8 impulses = 40.

   DIF: Challenging: Application REF: p. 20 OBJ: #4 | #10
   MSC: CDA: Radiation Safety for Patients and Operators: B1
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

3. All of the following are on the control panel of the dental x-ray machine EXCEPT one. Which one is the EXCEPTION?
   a. Transformer
   b. mA selector
   c. Indicator light
   d. Exposure button

   ANS: A

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The control panel of the dental x-ray machine contains an on-off switch and indicator light, an exposure button and indicator light, timer dial and kVp, and mA selectors. It does not contain a transformer on the panel.

DIF: Easy: Recall REF: p. 17 OBJ: #6
MSC: CDA: Radiation Safety for Patients and Operators: B2 | CDA: Radiation Safety for Patients and Operators: B3
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

4. If a radiograph is described as "underpenetrated," then the error must be:
   a. too little mA.
   b. excessive mA.
   c. too little kVp.
   d. excessive kVp.

ANS: C
The quality, or penetrating power of the x-ray beam is controlled by the kilovoltage. Low kilovoltage, in the 45 to 65 range, produces a diagnostic radiograph that should not be used because the radiation produced many long, nonpenetrating wavelengths. Excessive kVp causes overpenetration. The mA range is usually 5 to 15 mA. Milliamperage lower than 5 will not produce enough x-rays because not enough heat would be available to produce enough electrons at the cathode of the tube. Excessive mA (mA higher than 15) produces too many electrons and thus too much heat.

DIF: Challenging: Application REF: p. 20 OBJ: #10
MSC: CDA: Radiation Safety for Patients and Operators: B1
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

5. Which of the following is used in the high-voltage circuit?
   a. A fuse
   b. A rectifier
   c. A step-up transformer
   d. A step-down transformer

ANS: C
The high-voltage circuit in the dental x-ray machine requires voltage in the range of 65,000 to 100,000 V. This increase in voltage is achieved by the use of a step-up transformer. The filament circuit uses 2 to 5 V, so the 110 V line current is reduced by a step down transformer. A fuse or rectifier is both not involved in a high-voltage circuit.

DIF: Average: Comprehension REF: p. 17 OBJ: #7
MSC: CDA: Radiation Safety for Patients and Operators: B2
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

6. Position-indicating device (PID) should be lead-lined to prevent the escape of scatter radiation. PIDs are always 16-inches long.
   a. Both statements are true.
   b. Both statements are false.
   c. The first statement is true, the second is false.

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d. The first statement is false, the second is true.

ANS: C
Position-indicating device (PID) should always be lead-lined to prevent scatter radiation. PIDs can be 8-, 12-, or 16-inches long.

DIF: Average: Comprehension REF: p. 18 OBJ: #9
MSC: CDA: Radiation Safety for Patients and Operators: B3
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

7. All of the following are parameters of the dental x-ray beam that are adjusted from the control panel EXCEPT one. Which one is the EXCEPTION?
   a. The collimation of the x-ray beam
   b. The energy or penetrating power (quality)
   c. The number of x-rays produced (quantity)
   d. The length of time x-rays will be produced

   ANS: A
   The collimation of the x-ray beam is not one of the three parameters of the dental x-ray beam that are adjusted from the control panel. Collimation occurs within the x-ray tube.

   DIF: Challenging: Application REF: p. 19 OBJ: #5 | #6
   MSC: CDA: Radiation Safety for Patients and Operators: B1
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

8. When a current flows in one direction and then reverses and flows in the opposite direction in the circuit, it is referred to as:
   a. direct current.
   b. electric current.
   c. alternating current.
   d. ratification of current.

   ANS: C
   Alternating current (AC) flows in one direction and then reverses and flows in the opposite direction in the circuit. Direct current (DC) flows in one direction in an electric circuit. Electric current is the flow of electricity through a circuit; it can be either AC or DC. Ratification is the blocking of the current from traveling across the tube.

   DIF: Average: Comprehension REF: p. 15 OBJ: #2
   MSC: CDA: Radiation Safety for Patients and Operators: B2
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

9. The standard of care in radiation risk prevention calls for open-ended, lead-lined PIDs. Radiation protection codes in almost all states have required the use of open-ended PIDs.
   a. Both statements are true.
   b. Both statements are false.
   c. The first statement is true, the second is false.
   d. The first statement is false, the second is true.

   ANS: A

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Both statements are true.

DIF: Average: Comprehension REF: p. 19 OBJ: #9
MSC: CDA: Radiation Safety for Patients and Operators: B3
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

10. Which of the following is true regarding a collimated rectangular beam?
    a. Covers greater facial area.
    b. Exposes patient to more primary radiation.
    c. Can be accomplished without an increase in cone cutting.
    d. Cannot be accomplished without an increase in cone cutting.

ANS: C
Rectangular collimation exposes the patient to less primary radiation and can be accomplished without an increase in cone cutting. Circular collimation covers greater facial area, and exposes the patient to more primary radiation.

DIF: Challenging: Application REF: p. 22 OBJ: #14
MSC: CDA: Radiation Safety for Patients and Operators: B3
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

11. Which of the following removes the long, nonpenetrating wavelength x-rays from the primary beam?
    a. Transformer
    b. Rectification
    c. Direct current
    d. Aluminum filter

ANS: D
The function of the aluminum filter is to remove the long, nonpenetrating wavelength x-rays from the primary beam. A transformer is a device that can either increase or decrease the voltage in an electric circuit. Ratification is the blocking of the current from traveling across the tube. Direct current is when the electrons flow in one direction.

DIF: Average: Comprehension REF: p. 22 OBJ: #13
MSC: CDA: Radiation Safety for Patients and Operators: B3
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

12. Pointed, plastic cones are not used in dental radiology because:
    a. the cones are difficult for the practitioner to line up correct anatomic structures.
    b. the cones cause the production of excess secondary and scatter radiation.
    c. the cones require a higher kVp setting on the control panel.
    d. the cones require an increase in the time setting.

ANS: B
Pointed, plastic cones are not used in dental radiology because of the secondary radiation and scatter radiation that is produced by the interaction of the primary beam of x-ray photons with the plastic cone.

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DIF: Average: Comprehension REF: p. 18 OBJ: #9
MSC: CDA: Radiation Safety for Patients and Operators: B3 | CDA: Radiation Safety for Patients and Operators: B4 | CDA: Radiation Safety for Patients and Operators: E1 | CDA: Radiation Safety for Patients and Operators: E2
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

13. During phase 1 of x-ray production, the step-up transformer increases the 110V (or 220V) to the 65,000 to 100,000 volts which is necessary to accelerate the movement across the tube. During phase 2, the current activates the filament circuit and the step-down transformer 110V (or 220V) is then reduced to 3 to 5V by the step-down transformer.
    a. Both statements are true.
    b. Both statements are false.
    c. The first statement is true, the second is false.
    d. The first statement is false, the second is true.

    ANS: B
    During phase 1, the current activates the filament circuit and the step-down transformer 110V (or 220V) is then reduced to 3-5V by the step-down transformer. During phase 2 of x-ray production, the step-up transformer increases the 110V (or 220V) to the 65,000 to 100,000 volts which is necessary to accelerate the movement across the tube.

    DIF: Challenging: Application REF: p. 17 OBJ: #7
    MSC: CDA: Radiation Safety for Patients and Operators: B2
    NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

14. The thickness of aluminum that will reduce the intensity of the x-ray beam by 50% is termed:
    a. filtration.
    b. collimation.
    c. half-value layer.
    d. penetrating power.

    ANS: C
    Half-value layer is the thickness of aluminum (measured in millimeters) that will reduce the intensity of the x-ray beam by 50%. Filtration removes the primary beam the long, nonpenetrating wavelength x-rays. Collimation is a device that restricts the size and shape of the x-ray beam as it leave the tube head. Penetrating power is represented by the beam intensity.

    DIF: Average: Comprehension REF: p. 20 OBJ: #11
    MSC: CDA: Radiation Safety for Patients and Operators: B2
    NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

15. When the alternating current is supplied to the x-ray tube, it is considered to be which of the following?
    a. Cycle
    b. Voltage
    c. Impulses
    d. Self-rectified

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ANS: D
If the dental x-ray machine is operating on alternating current, the polarity is reversed 60 times per second. The blocking of this reversal process is called rectification, and because the x-ray tube is designed to produce this reversal process it is called self-rectified. Impulses take place only during one half of the alternating current cycle. Voltage is the term used to describe the electric potential or force that drives an electric current through a circuit.

DIF: Average: Comprehension REF: p. 15 OBJ: #3
MSC: CDA: Radiation Safety for Patients and Operators: B2
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

TRUE/FALSE

1. X-rays are produced by impulses and not by a steady stream.

   ANS: T
   X-rays are produced in spurts or impulses, and not produced in a steady stream.

   DIF: Average: Comprehension REF: p. 15 OBJ: #3
   MSC: CDA: Radiation Safety for Patients and Operators: B2
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

2. The unit of measurement used to describe the amount of electric current flowing through a circuit is called ampere.

   ANS: T
   The ampere is the unit of measurement used to describe the amount of electric current flowing through a circuit.

   DIF: Easy: Knowledge REF: p. 16 OBJ: #3
   MSC: CDA: Radiation Safety for Patients and Operators: B2
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

3. The determination of the size and shape of the x-ray beam is called collimation.

   ANS: T
   A collimating device restricts the size and shape of the x-ray beam as it leaves the tube head.

   DIF: Average: Comprehension REF: p. 22 OBJ: #9
   MSC: CDA: Radiation Safety for Patients and Operators: B3
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology and 2.3 Technique

4. The quantity of x-ray photons produced is determined by the kilovolt setting.

   ANS: F

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The milliamperage dial determines the number of x-rays produced in a given exposure period by controlling the heating of the tungsten filament to produce electrons at the cathode of the tube. The kilovolt determines the quality of the x-ray.

DIF: Challenging: Application REF: p. 20 OBJ: #10
MSC: CDA: Radiation Safety for Patients and Operators: B1
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

5. The quality of the x-ray photons is determined by the milliamperage.

ANS: F
The quality, wavelength or penetrating power, of the x-ray beam is controlled by the kilovoltage. The milliamperage determines the number of x-rays produced in a given exposure period.

DIF: Challenging: Application REF: p. 20 OBJ: #10
MSC: CDA: Radiation Safety for Patients and Operators: B1
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