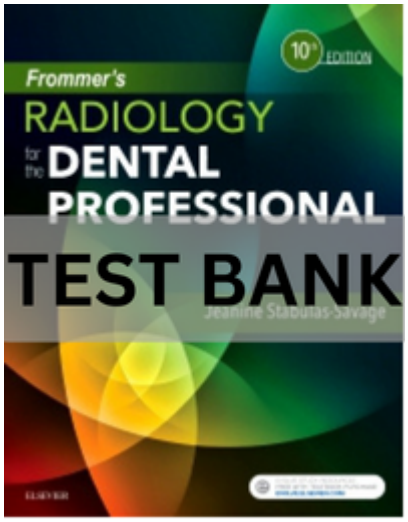
Frommer's Radiology for the Dental Professional 10th Edition Test Bank

Chapter 01: The History of Ionizing Radiation and Basic Principles of X-Ray Generation
Stabulas-Savage: Frommer's Radiology for the Dental Professional, 10th Edition



MULTIPLE CHOICE

1. The duty rating refers to the number of consecutive seconds a machine can be operated before it overheats, and the duty cycle refers to the portion of every minute that the dental machine can be used without overheating.

   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
   Both statements are true.

   DIF: Average: Comprehension REF: p. 9 OBJ: #8
   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. Too many electrons can hit the target causing too much heat production when the milliampere (mA) setting of the x-ray machine is more than:
   a. 5.
   b. 8.
   c. 11.
   d. 15.

   ANS: A
   Heat production at the target is the limiting factor of the milliampere (mA) setting of a dental x-ray machine and an mA of more than 15 more electrons hit the target causing an increase in heat production.

   DIF: Challenging: Application REF: p. 8 OBJ: #8
   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. Ultrasonic radiation is part of the electromagnetic spectrum, and has no effect on tissue.
   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: D
Ultrasonic radiation is not part of the electromagnetic spectrum, so the first statement is false. It is non-ionizing radiation and therefore has no effect on tissue, so the second statement is true.

DIF: Average: Comprehension REF: p. 5 OBJ: #4
MSC: CDA: Radiation Safety for Patients and Operators: B2
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

4. Federal regulations require that all dental x-ray machines have which of the following?
   a. An audible signal in addition to the signal lights in the control panel when an exposure is being made.
   b. A light in the control panel that signals when an exposure is being made.
   c. An audible signal when an exposure is being made.
   d. There are no federal regulations in this area.

   ANS: A
   Federal regulations require that all dental x-ray machines must have an audible signal in addition to the signal lights in the control panel when an exposure is being made.

   DIF: Challenging: Application REF: p. 10 OBJ: #9
   MSC: CDA: Radiation Safety for Patients and Operators: E2
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.5 Principles of radiophysics and radiobiology

5. In a stable atom the number of orbiting electrons (–) equals the number of protons (+) in the nucleus. Therefore, the atom is electrically neutral.
   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
   Both statements are true.

   DIF: Average: Comprehension REF: p. 7 OBJ: #6
   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. Ionization occurs:
   a. when an atom loses a proton.
   b. when the atom has no charge.
   c. when an atom gains a neutron.
   d. when an atom loses an electron.

   ANS: D
   When an orbiting electron is ejected from its shell in an electrically stable or neutral atom, the process is called ionization.

DIF: Average: Comprehension REF: p. 7 OBJ: #6
MSC: CDA: Radiation Safety for Patients and Operators: B2
NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

7. All of the following are the basic elements of an x-ray tube needed to produce x-rays EXCEPT one. Which one is the EXCEPTION?
   a. High voltage
   b. The production of heat
   c. A target to stop the electrons
   d. A source of electrons within the tube.

   ANS: B
   The three basic elements of an x-ray tube needed to produce x-rays are: high voltage to accelerate electrons across the tube, a source of electrons within the tube, and a target to stop the electrons. Heat production at the target is the limiting factor of the milliampere.

   DIF: Average: Comprehension REF: p. 8 OBJ: #9
   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. Each of the following are examples of particulate radiation EXCEPT one. Which one is the EXCEPTION?
   a. Neutrons
   b. Electrons
   c. Alpha particles
   d. Gamma particles

   ANS: C
   Particulate radiation consists of atoms or subatomic particles that travel at high speeds to transmit their kinetic energy. Examples of particulate include electron (sometimes called beta particles), protons, neutrons, and alpha particles. Gamma particles are not particulate radiation.

   DIF: Average: Comprehension REF: p. 4 OBJ: #3
   MSC: CDA: Radiation Safety for Patients and Operators: B4
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

9. The difference in the electromagnetic spectrum between x-rays and visible light lies in the:
   a. energy.
   b. wavelength.
   c. subatomic particles.
   d. weightlessness of the waves.

   ANS: B
   The individual radiations of the electromagnetic spectrum differ in their wavelengths and frequencies and thus in many of their properties including their ability to penetrate objects. The weightlessness of the waves is what they have in common.

   DIF: Average: Comprehension REF: p. 4 OBJ: #4
   MSC: CDA: Radiation Safety for Patients and Operators: B2

NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

10. Each of the following are properties of x-rays EXCEPT one. Which one is the EXCEPTION?
    a. x-rays are invisible.
    b. x-rays travel in wavy lines.
    c. x-rays can penetrate structures.
    d. x-rays can adversely affect human tissues.

    ANS: B
    X-rays travel in straight lines not in wavy lines. All the other answers are correct properties of x-rays.

    DIF: Easy: Knowledge (Recall) REF: p. 6 OBJ: #5
    MSC: CDA: Radiation Safety for Patients and Operators: B2
    NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

11. Identify the particles that compose the nucleus of an atom:
    a. electrons and photons.
    b. electrons and protons.
    c. protons and neutrons.
    d. neutrons.

    ANS: C
    The nucleus of an atom is composed of positively charged subatomic particles, called protons, and particles that have no charge, called neutrons. Electrons are negatively charged subatomic particles that orbit around the nucleus.

    DIF: Average: Comprehension REF: p. 7 OBJ: #6
    MSC: CDA: Radiation Safety for Patients and Operators: B2
    NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

12. The target or focal spot in the x-ray tube can be found at the:
    a. positively charged anode.
    b. negatively charged anode.
    c. positively charged cathode.
    d. negatively charged cathode.

    ANS: A
    The target or focal spot of the x-ray is found at the anode side of the tube, and when the circuit is complete, it has a positive (+) charge. The negative side of the x-ray tube is called the cathode.

    DIF: Challenging: Application REF: p. 8 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

13. Identify the metal used in the focal spot of the x-ray tube:
    a. iron.
    b. copper.

c. tungsten.
d. molybdenum.

ANS: C
The x-ray tube is made of tungsten and measures about 0.8 × 1.8 mm.

DIF: Challenging: Application REF: p. 8 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 total x-ray energy produced by the collision of the electrons with the target inside the x-ray tube is approximately:
a. less than 1%.
b. 10%-20%.
c. 50%.
d. 99%.

ANS: A
Of the total energy produced at the anode by the collision of the electrons with the target, less than 1% is x-ray energy, the remaining 99% is in the form of heat.

DIF: Challenging: Application REF: p. 8 OBJ: #6
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. The distance from the crest of one wave to the crest of another wave is called the frequency. The wavelength of a wave is the number of oscillations per unit of time.
a. Both statements are true.
b. Both statements are false.
c. First statement is true, second is false.
d. First statement is false, second is true.

ANS: B
The distance from the crest of one wave to the crest of another wave is called the wavelength. The frequency of a wave is the number of oscillations per unit of time.

DIF: Average: Comprehension REF: p. 4 OBJ: #5
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. The amount of heat produced in the x-ray tube is less than the amount of radiation produced.

ANS: F
Of the total energy produced at the anode by the collision of the electrons with the target, less than 1% is x-ray energy, the remaining 99% is in the form of heat.

DIF: Average: Comprehension REF: p. 8 OBJ: #8
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 release of electrons from the hot tungsten filament at the cathode is called the thermionic emission effect.

   ANS: T
   The hotter the tungsten filament becomes, the more electrons are produced at the cathode. This release of electrons for the hot tungsten filament is called thermionic emission effect.

   DIF: Easy: Knowledge (Recall) REF: p. 8 OBJ: #6
   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 tungsten filament in the x-ray tube is found at the cathode.

   ANS: T
   The main source of electrons in the x-ray tube is the tungsten filament found at the cathode.

   DIF: Easy: Knowledge (Recall) REF: p. 8 OBJ: #9
   MSC: CDA: Radiation Safety for Patients and Operators: B2
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

4. Particulate radiations are most commonly emitted from radionuclides.

   ANS: T
   Radionuclides are radioactive substances that commonly emit particulate radiations.

   DIF: Average: Comprehension REF: p. 4 OBJ: #3
   MSC: CDA: Radiation Safety for Patients and Operators: B4
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

5. Electromagnetic spectrum is a grouping of electrons.

   ANS: F
   Electromagnetic spectrum is a grouping of energy waves that has in common the weightlessness of the waves and the speed at which they travel (186,000 miles per second, the speed of light).

   DIF: Average: Comprehension REF: p. 4 OBJ: #4
   MSC: CDA: Radiation Safety for Patients and Operators: B2
   NOT: NBDHE: 2.0 Obtaining and Interpreting Radiographs: 2.1 Principles of radiophysics and radiobiology

Chapter 02: The Dental X-Ray Machine
Stabulas-Savage: Frommer's Radiology for the Dental Professional, 10th Edition

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
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.
   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
   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.

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.