

X-ray Production

Multiple Choice

Identify the choice that best completes the statement or answers the question.

- ___ 1. Projectile electrons travel from _____.
a. anode to cathode
b. cathode to anode
c. target to patient
d. inner shell to outer shell
- ___ 2. During an exposure, most of the _____ energy of the projectile electrons is converted to _____.
a. kinetic, x-rays
b. x-ray, kinetic
c. kinetic, heat
d. heat, kinetic
- ___ 3. At the target, the projectile electrons interact with _____.
a. outer-shell electrons
b. inner-shell electrons
c. atomic nuclei
d. both A and B
- ___ 4. The production of heat at the anode is directly proportional to _____.
a. rotor speed
b. filament current
c. kVp
d. tube current
- ___ 5. The _____ is the portion of the x-ray tube that contains the filament.
a. Cathode
b. Anode
c. Rotor
d. Rotating disk
- ___ 6. The filament is made of:
a. Tungsten
b. Rhenium
c. Molybdenum
d. Lead
- ___ 7. _____ 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
- ___ 8. The positive side of the x-ray tube is the:
a. Anode

- b. Cathode
 - c. Window
 - d. Stream of electrons
- _____ 9. What is the name of the exact area on the anode that is struck by the electron stream?
- a. Focal spot
 - b. Focal point
 - c. Focal range
 - d. Any of the above
- _____ 10. 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
- _____ 11. _____ is the boiling off of electrons from the filament when current is applied.
- a. Saturation emission
 - b. Thermionic emission
 - c. Filament transport
 - d. Proton emission
- _____ 12. The actual flow of electrons from cathode to anode within the x-ray tube is known as:
- a. Tube current
 - b. Filament current
 - c. Anode current
 - d. A and C
- _____ 13. mA is a measure of _____ that flows from cathode to anode.
- a. Filament current
 - b. Tube current
 - c. Space charge
 - d. Thermionic emission
- _____ 14. Increasing the kVp will do which of the following?
- a. Decrease the tube current
 - b. Increase the speed of the electrons
 - c. Increase the penetrability of the beam
 - d. B and C
- _____ 15. The x-ray tube inside the protective housing is made of:
- a. lead.
 - b. steel.
 - c. aluminum.
 - d. Pyrex glass.
- _____ 16. What are the four essential elements required for x-ray production?
- a. A target, a vacuum, an electron source, and a high potential difference
 - b. A target, a source of electrons, an inert gas environment, and a high potential difference
 - c. A source of electrons, a magnetic field, a resistance-free path, and a target
 - d. A source of electrons, an electric field, a circuit, and a target

- ___ 17. The “electron cloud” that surrounds the hot cathode is referred to as a:
- focusing cup.
 - photon.
 - filament.
 - space charge.
- ___ 18. Free electrons at the cathode that are used for x-ray production come from the:
- filament.
 - target.
 - anode.
 - kilovoltage.
- ___ 19. When tungsten atoms are heated, their outermost electrons are moved out of the atom in space. This principle is called:
- electromagnetic induction.
 - variable resistance.
 - quantum theory.
 - thermionic emission.
- ___ 20. The anode, or target, of the x-ray tube is _____ charged.
- positively
 - negatively
 - neutrally
 - radioactively
- ___ 21. The cathode end of the x-ray tube is _____ charged.
- positively
 - negatively
 - neutrally
 - radioactively
- ___ 22. Most x-ray tubes in use today have a standard rotation speed of _____ rpm.
- 1,500
 - 2,000
 - 3,600
 - 10,000
- ___ 23. What is the principal advantage of a high-speed rotating anode?
- More efficient production of x-rays
 - Increased amount of characteristic radiation produced
 - Increased amount of bremsstrahlung radiation produced
 - More efficient heat dissipation
- ___ 24. What is required to move the electron stream rapidly across the x-ray tube?
- Magnetic field
 - High potential difference
 - Focusing cups
 - Copper mass in the target

- ____ 25. More than 99% of the energy applied to an x-ray tube is converted into:
- bremstrahlung radiation.
 - characteristic radiation.
 - secondary radiation.
 - heat.
- ____ 26. What percentage of the total energy applied to an x-ray tube target is converted into x-rays?
- 1%
 - 50%
 - 75%
 - 99%
- ____ 27. The purpose of rotating the x-ray tube target is to:
- create a space charge.
 - speed up the electrons in the electron stream.
 - remove long wavelength photons from the x-ray beam.
 - increase the heat capacity of the anode.
- ____ 28. A smaller effective focal spot produces:
- greater tube heat capacity.
 - lower patient dose.
 - more characteristic radiation.
 - greater image sharpness.
- ____ 29. A larger actual focal spot produces:
- greater image sharpness.
 - greater tube heat capacity.
 - lower patient dose.
 - more characteristic radiation.
- ____ 30. Which of the following can be found on a dual-focus x-ray tube?
- Two filaments
 - Two focal spot sizes
 - Two anodes
- 1 and 2 only
 - 1 and 3 only
 - 2 and 3 only
 - 1, 2, and 3

X-ray Production Answer Section

MULTIPLE CHOICE

1. ANS: B

Projectile electrons travel from filament to target.

PTS: 1 DIF: Moderate REF: page 124

OBJ: Discuss the interactions between projectile electrons and the x-ray tube target.

2. ANS: C

During an exposure, most of the kinetic energy of the projectile electrons is converted to heat.

PTS: 1 DIF: Moderate REF: page 125

OBJ: Discuss the interactions between projectile electrons and the x-ray tube target.

3. ANS: D

The projectile electrons interact with both outer-shell and inner-shell electrons in the target.

PTS: 1 DIF: Moderate REF: page 125

OBJ: Discuss the interactions between projectile electrons and the x-ray tube target.

4. ANS: D

The production of heat at the anode is directly proportional to tube current.

PTS: 1 DIF: Moderate REF: page 125

OBJ: Discuss the interactions between projectile electrons and the x-ray tube target.

5. ANS: A

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

PTS: 1 OBJ: 3

6. ANS: A

The cathode filament is made of tungsten.

PTS: 1 OBJ: 3

7. 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.

PTS: 1 OBJ: 5

8. ANS: A

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

PTS: 1 OBJ: 3

9. ANS: A

The focal spot is the exact area on the focal track of the anode target where electrons strike.

PTS: 1 OBJ: 3

10. ANS: A

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

