

## Basic Physics for Radiography (Simple Breakdown)

### Matter & Structure of the Atom

- All matter is made of atoms
- Atom parts:
  - Proton = positive charge (+)
  - Electron = negative charge (-)
  - Neutron = no charge (neutral)
- The atomic number = number of protons
- The mass number = protons + neutrons

### Electricity Basics

- Electric current = flow of electrons
- Voltage (kVp) = pushing electrons through the tube
- Amperage (mA) = number of electrons flowing
- Exposure time (s) = how long the current flows

$\text{mA} \times \text{time} = \text{mAs}$  (total radiation produced)

### X-Ray Production

Occurs inside the x-ray tube:

- Cathode = negative side (produces electrons)
- Anode = positive side (target for electrons)

Steps:

1. Electrons boil off filament (thermionic emission)
2. High speed electrons hit target
3. X-rays are produced

### Types of Radiation

- Primary radiation = useful beam
- Scatter radiation = unwanted, causes fog
- Remnant radiation = exits patient to image receptor

### Beam Properties

- X-rays travel in straight lines
- They have no mass and no charge
- They move at the speed of light

### Image Quality Factors

- Density = darkness of image (controlled by mAs)
- Contrast = difference between black & white (controlled by kVp)
- Detail (resolution) = sharpness
- Distortion = shape error

## **Inverse Square Law**

Radiation intensity changes with distance:

$$I_1 / I_2 = D_2^2 / D_1^2$$

- As distance increases, intensity decreases
- Important for positioning and safety

## **Radiation Protection**

- Time ↓ = less exposure
- Distance ↑ = less exposure
- Shielding (lead aprons, barriers)

### Atom Basics

1. All matter is made up of \_\_\_\_\_.
2. The positively charged particle is the \_\_\_\_\_.
3. The negatively charged particle is the \_\_\_\_\_.
4. The neutral particle is the \_\_\_\_\_.
5. The atomic number equals the number of \_\_\_\_\_.

### Electricity

6. The flow of electrons is called \_\_\_\_\_.
7. \_\_\_\_\_ (kVp) controls the energy of x-rays.
8. \_\_\_\_\_ (mA) controls the number of electrons.
9.  $\text{mA} \times \text{time} =$  \_\_\_\_\_.
10. Exposure time is measured in \_\_\_\_\_.

### X-Ray Tube

11. The negative side of the tube is the \_\_\_\_\_.
12. The positive side of the tube is the \_\_\_\_\_.
13. Electrons are produced at the \_\_\_\_\_.
14. X-rays are produced when electrons hit the \_\_\_\_\_.

### Radiation Types

15. The useful beam is called \_\_\_\_\_ radiation.
16. Unwanted radiation that causes fog is \_\_\_\_\_ radiation.
17. Radiation that reaches the image receptor is \_\_\_\_\_ radiation.

### Beam Properties

18. X-rays travel in \_\_\_\_\_ lines.
19. X-rays have no \_\_\_\_\_ and no \_\_\_\_\_.
20. X-rays travel at the speed of \_\_\_\_\_.

### Image Quality

21. Image darkness is called \_\_\_\_\_.
22. \_\_\_\_\_ controls density.
23. \_\_\_\_\_ controls contrast.
24. Sharpness is also called \_\_\_\_\_.
25. Shape distortion is called \_\_\_\_\_.

### Radiation Protection

26. Reducing \_\_\_\_\_ reduces exposure.
27. Increasing \_\_\_\_\_ reduces exposure.
28. Wearing lead aprons provides \_\_\_\_\_.