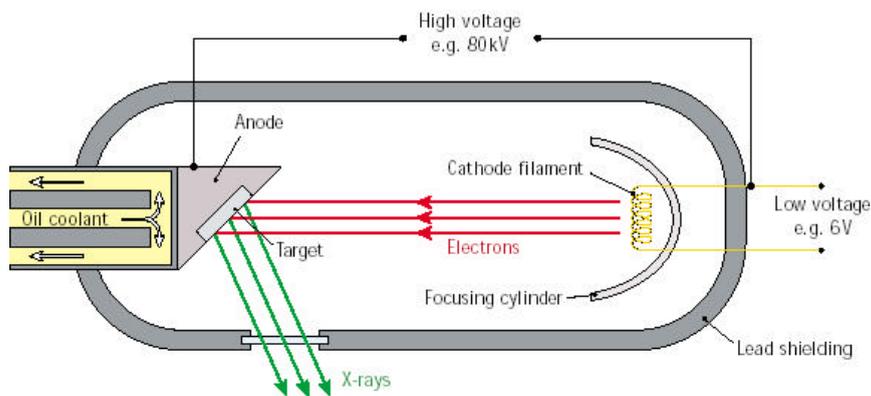


Question 9.

- Explain with the aid of a labeled diagram how X-rays are produced
- Justify the statement “X-ray production may be considered as the inverse of the photoelectric effect.”
- Describe an experiment to demonstrate the photoelectric effect.
- Outline Einstein’s explanation of the photoelectric effect.
- Give two applications of a photocell.

Explain with the aid of a labeled diagram how X-rays are produced

In an X-ray tube electrons are accelerated from a hot cathode across an evacuated tube by means of a very large voltage. They strike, and are brought to rest by a tungsten target. Most of the kinetic energy of the electrons is converted to heat, but a small percentage is converted to X-rays.

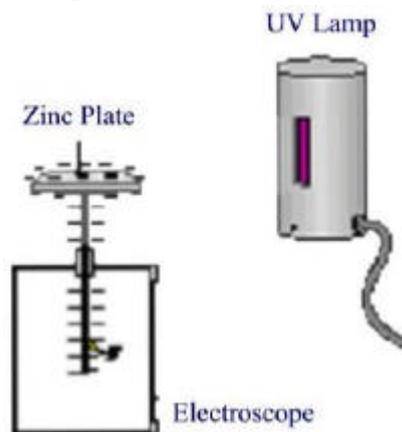


Justify the statement “X-ray production may be considered as the inverse of the photoelectric effect.”

In the photoelectric effect electrons are emitted from the surface of a metal when sufficiently energetic photons strike it. In X-ray production high-energy electrons strike a metal and cause the emission of photons.

Describe an experiment to demonstrate the photoelectric effect

If UV radiation is shone upon a negatively charged Zinc plate placed on top of an electroscopes the leaves of the electroscopes will be seen to collapse as the electrons are emitted from the zinc surface



Outline Einstein's explanation of the photoelectric effect.

Einstein explained the photoelectric effect with his photoelectric law

$$\frac{1}{2}mv_{\max}^2 = hf - \boldsymbol{f}$$

The electrons are emitted from the surface of any metal with a maximum kinetic energy that depends upon the energy of the incident radiation,  $hf$ , which is taken to consist of discrete packets (quanta) of energy referred to as photons. An electron, in removing itself from the surface absorbs the energy of the photon, and any residual energy becomes the kinetic energy of the electron. The minimum energy the photon must have to remove an electron from the metals surface is known as work function of the metal,  $\phi$

Give two applications of a photocell.

- I. Light meter on a camera
- II. Detecting a broken beam of light in a burglar alarm