

INTERNATIONAL INDIAN SCHOOL BURAIDAH

CLASS:XII SUBJECT: PHYSICS

LESSON : DUAL NATURE OF RADIATION AND MATTER

1. A photon of wavelength 663 nm is incident on a metal surface. The work function of the metal is 1.50 eV. The maximum kinetic energy of the emitted photon electrons is (CBSE 2023)

(a)  $3.0 \times 10^{-20}$  J

(b)  $6.0 \times 10^{-20}$  J

(c)  $45 \times 10^{-20}$  J

(d)  $9.0 \times 10^{-20}$  J

2. A proton and an alpha particle have the same kinetic energy. The ratio of de-Broglie wavelengths associated with the proton to that with the alpha particle is (CBSE 2023)

(a) 1

(b) 2

(c)  $2/\sqrt{2}$

(d)  $1/2$

3. Photons of energy 3.2 eV are incident on a photosensitive surface. If the stopping potential for the emitted electrons is 1.5 V, the work function for the surface is (CBSE 2023)

(a) 1.5 eV

(b) 1.7 eV

(c) 3.2 eV

(d) 4.7 eV

4. (i) State two important features of Einstein's photoelectric equation.

5. (1) Write the important properties of photons which are used to establish Einstein's photoelectric equation.

(ii) Use this equation to explain the concept of

(a) threshold frequency and

(b) stopping potential.

6. What are matter waves ? A proton and an alpha particle are accelerated through the same potential difference. Find the ratio of the de-Broglie wavelength associated with the proton to that with the alpha particle.
7. The wavelength of the waves associated with a particle having kinetic energy  $E$ , is  $\lambda$ . How and by what factor should its kinetic energy be changed, so that the wavelength becomes half? Also, find the ratio of the final to the initial velocity of the particle.
8. Define the terms cut-off voltage and threshold frequency in relation to the phenomenon of photoelectric effect. Using Einstein's photoelectric equation, show how the cut-off voltage and threshold frequency for a given photosensitive material can be determined with the help of a suitable plot/graph.
9. Calculate the de-Broglie wavelength of the electron orbiting in the  $n = 2$  state of hydrogen atom.
10. Plot a graph showing the variation of photoelectric current with intensity of light. The work function for the following metals is given: Na: 2.75 eV and Mo: 4.175 eV. Which of these will not give photoelectron emission from a radiation of wavelength 3300 Å from a laser beam ?