Dual Nature of Radiation and Matter

CHAPTER 11

TRY YOURSELF **ANSWERS**

1. The minimum amount of energy necessary to eject an electron out of a metal surface against the attractive forces of surrounding positive ions.

2. If E = energy of incident light (photons).
Then,
$E < \phi$, no photoelectric effect will take place.
$E = \phi$, photoelectric effect will just take place but K.E. of ejected photoelectrons is zero.
$E > \phi$, photoelectric effect will take place along with possession of K.E. by ejected photoelectrons.

3. Work function of platinum is highest, $\phi_0 = 5.65$ eV.
Work function of caesium is lowest, $\phi_0 = 2.14$ eV

4. Photoelectric effect shows the quantum nature of electromagnetic radiation.

5. Work function $= h\upsilon = \dfrac{hc}{\lambda}$

$\therefore$ The ratio, $\dfrac{\phi_A}{\phi_B} = \dfrac{hc}{\lambda_A} \times \dfrac{\lambda_B}{hc} = \dfrac{\lambda_B}{\lambda_A}$

6. Not all the electrons that absorb a photon come out as photoelectrons because most of electrons get scattered into the metal. Only those electrons come out as photoelectrons whose energy becomes greater than work function of metal.

7. $n = \dfrac{P}{h\upsilon}$

8. Einstein first explained the photoelectric effect.

9. As, $\phi = h\upsilon_0 \Rightarrow \phi = \dfrac{hc}{\lambda_0} \Rightarrow \lambda_0 = \dfrac{(6.63\times10^{-34})(3\times10^{8})}{(3.3)\times(1.6\times10^{-19})}$

$= 3770$ Å

10. $E = \dfrac{hc}{\lambda} = \dfrac{6.6\times10^{-34}\times3\times10^{8}}{1}\text{ J} = \dfrac{19.8\times10^{-26}}{1.6\times10^{-19}}\text{ eV}$

$= 1.24 \times 10^{-6}$ eV

11. In case of stable material, this is not possible because, to absorb a photon of larger wavelength and emit a photon of shorter wavelength, energy has to be supplied by the material.

12. $p = \dfrac{E}{c} = \dfrac{h\upsilon}{c}$

13. Device which converts light energy into electrical energy.

14. (i) Photo emissive cell.
(ii) Photo voltaic cell
(iii) Photo conductive cell

15. $\lambda = \dfrac{h}{p} = \dfrac{h}{mv}$

16. The wave associated with moving particles is called matter wave.

17. Yes, de-Broglie equation is applicable to photons of radiation.

18. Electron microscope is the application of de-Broglie waves designed to study minute things.

19. It verifies the wave nature of electron.