DPP – 4 [Photoelectric Effect]

Chapter: Structure of Atom

"Ek question solve karo. Phir next. Isi tarah ordinary log extraordinary ban jaate hain."

TYPE 1 : Kinetic Energy of electron

Q.1 **Photoelectrons are liberated by ultraviolet light of wavelength 2000 Å from a metallic surface for which the photoelectric threshold is 4000 Å. The maximum kinetic energy of the emitted electrons is**

(1) 4.969×10^{-19} J
(2) 6.626×10^{-20} J
(3) 3.313×10^{-19} J
(4) 9.938×10^{-19} J

Q.2 **Calculate the maximum kinetic energy of photoelectrons emitted when light of frequency 2×10^{16} Hz is irradiated on a metal surface with threshold frequency $\nu_0 = 8.68 \times 10^{15}$ Hz.**
($h = 6.626 \times 10^{-34}$ J s)

(1) 7.5×10^{-18} J (2) 5.0×10^{-18} J (3) 6.2×10^{-18} J (4) 9.0×10^{-18} J

Q.3 **Threshold frequency of a metal is 5×10^{13} sec^{-1}. Upon this metal, 1×10^{14} sec^{-1} frequency light is focused. The maximum kinetic energy of the emitted electron is**

(1) 3.3×10^{-21} J (2) 3.3×10^{-20} J (3) 6.6×10^{-21} J (4) 6.6×10^{-20} J

TYPE 2 : Work Function and Thresold frequency

Q.4 **What is the work function (W_0) of the metal whose threshold frequency (ν_0) is 5.2×10^{14} s^{-1}?**
($h = 6.626 \times 10^{-34}$ J s)

(1) 3.44×10^{-19} J (2) 2.44×10^{-19} J (3) 4.44×10^{-19} J (4) 5.44×10^{-19} J

Q.5 **If threshold wavelength (λ°) for ejection of electron from metal is 330 nm, then work function for the photoelectric emission is**

(1) 6×10^{-10} J (2) 1.2×10^{-18} J (3) 3×10^{-19} J (4) 6×10^{-19} J

Q.6 **What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity 6×10^5 ms^{-1} from it?**
($m_e = 9 \times 10^{-31}$ kg, $c = 3 \times 10^8$ ms^{-1}, $h = 6.626 \times 10^{-34}$ J s, $e = 1.6 \times 10^{-19}$ J eV^{-1}) **[JEE Main (Jan.) 2019]**

(1) 2.1 eV (2) 3.1 eV (3) 0.9 eV (4) 4.0 eV

Q.7 When a certain metal was irradiated with light of frequency 0.4×10^{13} Hz, the photoelectrons emitted had twice the kinetic energy as did photoelectrons emitted when the same metal was irradiated with light of frequency 1.0×10^{13} Hz. The threshold frequency (ν_0) of the metal is

(1) 1.6×10^{13} Hz (2) 0.8×10^{13} Hz (3) 1.2×10^{13} Hz (4) 2.0×10^{13} Hz

TYPE 3 :Energy of Photon

Q.8 A photon of wavelength 3000 Å strikes a metal surface. The work function of the metal is 2.20 eV. Which of the following correctly gives (i) the energy of the photon in eV, (ii) the kinetic energy of the emitted photoelectron, and (iii) the velocity of the photoelectron?
($h = 6.6 \times 10^{-34}$ J s, $c = 3 \times 10^{8}$ m s^{-1}, $m_e = 9.1 \times 10^{-31}$ kg, 1 eV $= 1.6 \times 10^{-19}$ J)

(1) 4.1235 eV; 3.08×10^{-19} J; 8.22×10^{5} ms^{-1}
(2) 4.00 eV; 2.50×10^{-19} J; 7.50×10^{5} ms^{-1}
(3) 3.50 eV; 2.10×10^{-19} J; 6.80×10^{5} ms^{-1}
(4) 4.1235 eV; 1.60×10^{-19} J; 5.93×10^{5} ms^{-1}

Q.9 The work function for a metal is 4 eV. To emit a photo-electron of zero velocity from the surface of the metal, the wavelength of incident light should be

(1) 2700 Å (2) 1700 Å (3) 5900 Å (4) 3100 Å

Q.10 The energy required to remove an electron from metal X is 3.31×10^{-20} J. The maximum wavelength of light that can photo-eject an electron from metal X is

(1) 40 μm (2) 60 μm (3) 7 μm (4) 5 mm

TYPE 4 : Miscellaneous

Q.11 If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength λ, then for $1.5\,p$ momentum of the photoelectron, the wavelength of the light should be
(Assume kinetic energy of ejected photoelectron to be very high in comparison to work function)[JEE Main (April) 2019]

(1) $\frac{3}{4}\lambda$ (2) $\frac{4}{9}\lambda$ (3) $\frac{1}{2}\lambda$ (4) $\frac{2}{3}\lambda$

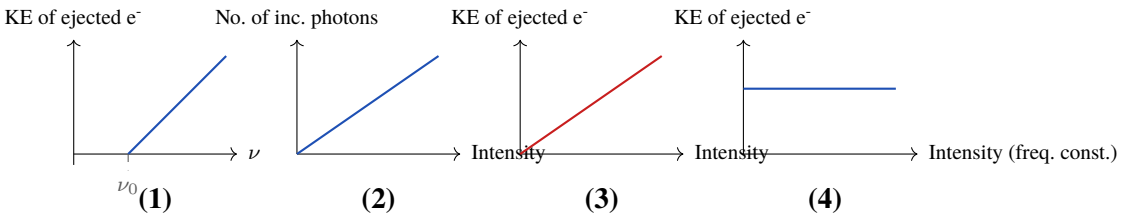
Q.12 An incident UV light having wavelength λ_1 is incident on a metal surface and the ejected electron has velocity V_1. Another UV light having wavelength λ_2 is incident on the same metal surface and ejects an electron having velocity V_2. Then $V_2^2 - V_1^2$ is

(1) $\frac{2hc}{m_e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right]$ (2) $\frac{2hc}{m_e}\left[\frac{1}{\lambda_2} - \frac{1}{\lambda_1}\right]^2$

(3) $\frac{2hc}{m_e}[\lambda_2 - \lambda_1]$ (4) $\frac{2hc}{m_e}[\lambda_2 - \lambda_1]^2$

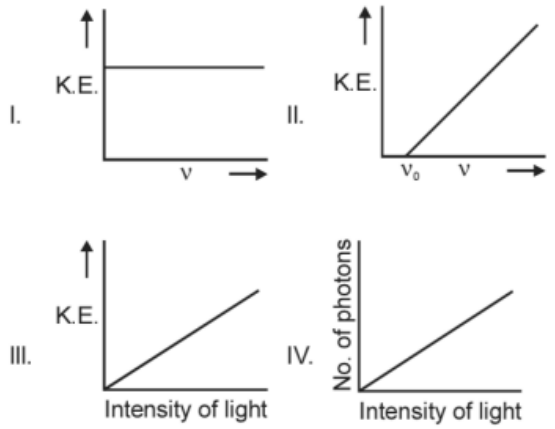
TYPE 5: Grapgh based questions

Q.13 Which of the following is an incorrect graphical representation based on the photoelectric effect? [NCERT Pg. 41]



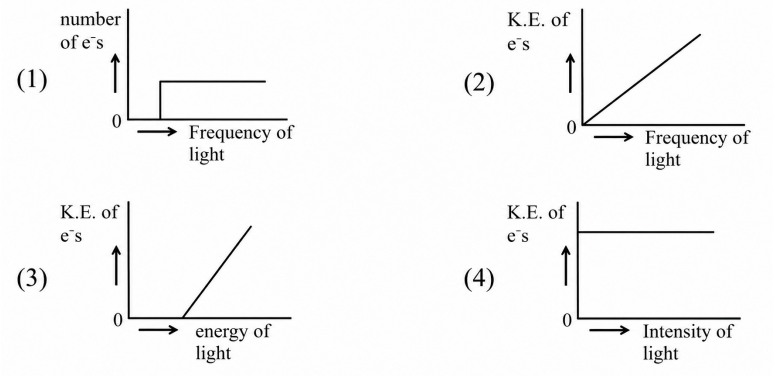
(1) Graph (1) (2) Graph (2) (3) Graph (3) (4) Graph (4)

Q.14 Which is the correct graphical representation based on the photoelectric effect?



(1) I & II (2) II & III (3) III & IV (4) II & IV

Q.15 Which of the graphs shown below does not represent the relationship between incident light and the electron ejected from the metal surface? [JEE Main (Jan.) 2019]



(1) Graph (1) (2) Graph (2) (3) Graph (3) (4) Graph (4)

TYPE 6: Theortical questions

Q.16 The number of electrons ejected from the metal surface after a light wave of certain minimum frequency strikes the metal surface is proportional to the [NCERT Pg. 41]

(1) Frequency of light (2) Brightness of light (3) Velocity of light (4) Wavelength of light

Q.17 "Kinetic energy (energy content of beam of light) should depend upon the intensity of light" is a statement related with [NCERT Pg. 41]

(1) Classical mechanics
(2) Photoelectric effect
(3) Black body radiation
(4) Both (2) & (3)