

PHYSICS · JEE MAIN

# Dual Nature of Radiation & Matter

Chapter-wise previous year questions, with answer key

**127**

PYQS

**2020–2025**

PAPERS

**4**

TOPICS

de Broglie Wavelength

Photoelectric Effect

Davisson-Germer Experiment

Work Function and Threshold Frequency

- 1 Attempt each question on paper first — they're grouped by topic, newest papers first.
- 2 Check yourself against the answer key at the end.
- 3 Got one wrong? Tap “Step-by-step solution” under it for the full working.

## Stuck on a question?

Every question has a free step-by-step solution on PrepWiser — tap “Step-by-step solution” under it.

Practise this chapter online with instant answer checking: [prepwiser.in/learn](https://prepwiser.in/learn) · No signup needed to browse

## de Broglie Wavelength · 59 PYQs

**Q1** JEE Main 2025 · 8 Apr · Shift 2

An electron is released from rest near an infinite non-conducting sheet of uniform charge density ' $-\sigma$ '. The rate of change of de-Broglie wave length associated with the electron varies inversely as  $n^{\text{th}}$  power of time. The numerical value of  $n$  is \_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/R8vmFI2vAm](https://www.prepwiser.in/questions/R8vmFI2vAm)

**Q2** JEE Main 2025 · 2 Apr · Shift 2

An electron with mass ' $m$ ' with an initial velocity ( $t = 0$ )  $\vec{v} = v_0 \hat{i}$  ( $v_0 > 0$ ) enters a magnetic field  $\vec{B} = B_0 \hat{j}$ . If the initial de-Broglie wavelength at  $t = 0$  is  $\lambda_0$  then its value after time ' $t$ ' would be :

- (A)  $\frac{\lambda_0}{\sqrt{1 - \frac{e^2 B_0^2 t^2}{m^2}}}$   
(B)  $\lambda_0$   
(C)  $\lambda_0 \sqrt{1 + \frac{e^2 B_0^2 t^2}{m^2}}$   
(D)  $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 B_0^2 t^2}{m^2}}}$

[Step-by-step solution ► prepwiser.in/questions/wYobAXpgRa](https://www.prepwiser.in/questions/wYobAXpgRa)

**Q3** JEE Main 2025 · 28 Jan · Shift 1

A proton of mass ' $m_P$ ' has same energy as that of a photon of wavelength ' $\lambda$ '. If the proton is moving at non-relativistic speed, then ratio of its de Broglie wavelength to the wavelength of photon is.

- (A)  $\frac{1}{c} \sqrt{\frac{E}{m_p}}$   
(B)  $\frac{1}{c} \sqrt{\frac{2E}{m_p}}$   
(C)  $\frac{1}{2c} \sqrt{\frac{E}{m_p}}$   
(D)  $\frac{1}{c} \sqrt{\frac{E}{2m_p}}$

[Step-by-step solution ► prepwiser.in/questions/fOZrNIGp6K](https://www.prepwiser.in/questions/fOZrNIGp6K)

**Q4** JEE Main 2025 · 24 Jan · Shift 1

An electron of mass ' $m$ ' with an initial velocity  $\vec{v} = v_0 \hat{i}$  ( $v_0 > 0$ ) enters an electric field  $\vec{E} = -E_0 \hat{k}$ . If the initial de Broglie wavelength is  $\lambda_0$ , the value after time  $t$  would be

- (A)  $\frac{\lambda_0}{\sqrt{1 - \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$   
(B)  $\lambda_0$   
(C)  $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$   
(D)  $\lambda_0 \sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}$

[Step-by-step solution ► prepwiser.in/questions/AI2Nv3ex2L](https://www.prepwiser.in/questions/AI2Nv3ex2L)

**Q5** JEE Main 2025 · 24 Jan · Shift 2

The energy  $E$  and momentum  $p$  of a moving body of mass  $m$  are related by some equation. Given that  $c$  represents the speed of light, identify the correct equation

- (A)  $E^2 = pc^2 + m^2c^4$
- (B)  $E^2 = pc^2 + m^2c^2$
- (C)  $E^2 = p^2c^2 + m^2c^4$
- (D)  $E^2 = p^2c^2 + m^2c^2$

[Step-by-step solution ► prepwiser.in/questions/NmRF\\_rw\\_LM](https://www.prepwiser.in/questions/NmRF_rw_LM)

**Q6** JEE Main 2025 · 23 Jan · Shift 1

A sub-atomic particle of mass  $10^{-30}\text{kg}$  is moving with a velocity  $2.21 \times 10^6\text{m/s}$ . Under the matter wave consideration, the particle will behave closely like ( $h = 6.63 \times 10^{-34}\text{J.s}$ )

- (A) X-rays
- (B) Infra-red radiation
- (C) Gamma rays
- (D) Visible radiation

[Step-by-step solution ► prepwiser.in/questions/tsQjttoelO](https://www.prepwiser.in/questions/tsQjttoelO)

**Q7** JEE Main 2025 · 22 Jan · Shift 1

An electron in the ground state of the hydrogen atom has the orbital radius of  $5.3 \times 10^{-11}\text{m}$  while that for the electron in third excited state is  $8.48 \times 10^{-10}\text{m}$ . The ratio of the de Broglie wavelengths of electron in the ground state to that in the excited state is

- (A) 4
- (B) 3
- (C) 9
- (D) 16

[Step-by-step solution ► prepwiser.in/questions/1ZSFYzUpAz](https://www.prepwiser.in/questions/1ZSFYzUpAz)

**Q8** JEE Main 2024 · 9 Apr · Shift 1

A proton, an electron and an alpha particle have the same energies. Their de-Broglie wavelengths will be compared as :

- (A)  $\lambda_p > \lambda_e > \lambda_\alpha$
- (B)  $\lambda_\alpha < \lambda_p < \lambda_e$
- (C)  $\lambda_e > \lambda_\alpha > \lambda_p$
- (D)  $\lambda_p < \lambda_e < \lambda_\alpha$

[Step-by-step solution ► prepwiser.in/questions/I6SRQFnu94](https://www.prepwiser.in/questions/I6SRQFnu94)

**Q9** JEE Main 2024 · 8 Apr · Shift 2

A proton and an electron have the same de Broglie wavelength. If  $K_p$  and  $K_e$  be the kinetic energies of proton and electron respectively, then choose the correct relation :

- (A)  $K_p > K_e$
- (B)  $K_p = K_e$
- (C)  $K_p < K_e$
- (D)  $K_p = K_e^2$

[Step-by-step solution ► prepwiser.in/questions/LLhoD1R2-T](https://www.prepwiser.in/questions/LLhoD1R2-T)

**Q10** JEE Main 2024 · 8 Apr · Shift 1

A proton and an electron are associated with same de-Broglie wavelength. The ratio of their kinetic energies is:

(Assume  $h = 6.63$

$$\times 10^{-34} \text{Js}, m_e = 9.0 \times 10^{-31} \text{kg}$$

and  $m_p = 1836$  times  $m_e$  )

(A)  $1 : \frac{1}{1836}$

(B)  $1 : \sqrt{1836}$

(C)  $1 : 1836$

(D)  $1 : \frac{1}{\sqrt{1836}}$

[Step-by-step solution ► prepwisar.in/questions/IcnCUZcQ3W](https://www.prepwisar.in/questions/IcnCUZcQ3W)

**Q11** JEE Main 2024 · 1 Feb · Shift 1

The de Broglie wavelengths of a proton and an  $\alpha$  particle are  $\lambda$  and  $2\lambda$  respectively. The ratio of the velocities of proton and  $\alpha$  particle will be :

(A)  $8 : 1$

(B)  $1 : 2$

(C)  $1 : 8$

(D)  $4 : 1$

[Step-by-step solution ► prepwisar.in/questions/ROca7xfysl](https://www.prepwisar.in/questions/ROca7xfysl)

**Q12** JEE Main 2024 · 29 Jan · Shift 1

The de-Broglie wavelength of an electron is the same as that of a photon. If velocity of electron is 25% of the velocity of light, then the ratio of K.E. of electron and K.E. of photon will be:

(A)  $\frac{1}{4}$

(B)  $\frac{8}{1}$

(C)  $\frac{1}{8}$

(D)  $\frac{1}{1}$

[Step-by-step solution ► prepwisar.in/questions/jSODHEFTMc](https://www.prepwisar.in/questions/jSODHEFTMc)

**Q13** JEE Main 2023 · 15 Apr · Shift 1

The de Broglie wavelength of an electron having kinetic energy  $E$  is  $\lambda$ . If the kinetic energy of electron becomes  $\frac{E}{4}$ , then its de-Broglie wavelength will be :

(A)  $\sqrt{2}\lambda$

(B)  $2\lambda$

(C)  $\frac{\lambda}{2}$

(D)  $\frac{\lambda}{\sqrt{2}}$

[Step-by-step solution ► prepwisar.in/questions/MmHilHCpvm](https://www.prepwisar.in/questions/MmHilHCpvm)

**Q14** JEE Main 2023 · 12 Apr · Shift 1

A proton and an  $\alpha$ -particle are accelerated from rest by 2V and 4V potentials, respectively. The ratio of their de-Broglie wavelength is :

(A)  $4 : 1$

(B)  $2 : 1$

(C)  $8 : 1$

(D)  $16 : 1$

[Step-by-step solution ► prepwisar.in/questions/xHZdaUYsq6](https://www.prepwisar.in/questions/xHZdaUYsq6)

**Q15** JEE Main 2023 · 11 Apr · Shift 2

The ratio of the de-Broglie wavelengths of proton and electron having same Kinetic energy :

(Assume  $m_p = m_e \times 1849$  )

- (A) 1:43 (B) 1:62  
(C) 2:43 (D) 1:30

[Step-by-step solution ► prepwiser.in/questions/EP175IngHP](https://www.prepwiser.in/questions/EP175IngHP)

**Q16** JEE Main 2023 · 10 Apr · Shift 1

The de Broglie wavelength of a molecule in a gas at room temperature (300 K) is  $\lambda_1$ . If the temperature of the gas is increased to 600 K, then the de Broglie wavelength of the same gas molecule becomes

- (A)  $2 \lambda_1$   
(B)  $\frac{1}{2} \lambda_1$   
(C)  $\frac{1}{\sqrt{2}} \lambda_1$   
(D)  $\sqrt{2} \lambda_1$

[Step-by-step solution ► prepwiser.in/questions/qQ6meBwykV](https://www.prepwiser.in/questions/qQ6meBwykV)

**Q17** JEE Main 2023 · 8 Apr · Shift 1

Proton (P) and electron (e) will have same de-Broglie wavelength when the ratio of their momentum is (assume,  $m_p = 1849m_e$  ):

- (A) 1 : 1 (B) 1 : 43  
(C) 1 : 1849 (D) 43 : 1

[Step-by-step solution ► prepwiser.in/questions/pRJYFVV4bQ](https://www.prepwiser.in/questions/pRJYFVV4bQ)

**Q18** JEE Main 2023 · 6 Apr · Shift 1

The kinetic energy of an electron,  $\alpha$ -particle and a proton are given as  $4K$ ,  $2K$  and  $K$  respectively. The de-Broglie wavelength associated with electron ( $\lambda_e$ ),  $\alpha$ -particle ( $\lambda_\alpha$ ) and the proton ( $\lambda_p$ ) are as follows:

- (A)  $\lambda_\alpha < \lambda_p < \lambda_e$   
(B)  $\lambda_\alpha > \lambda_p > \lambda_e$   
(C)  $\lambda_\alpha = \lambda_p < \lambda_e$   
(D)  $\lambda_\alpha = \lambda_p > \lambda_e$

[Step-by-step solution ► prepwiser.in/questions/DZWZwM3BMK](https://www.prepwiser.in/questions/DZWZwM3BMK)

**Q19** JEE Main 2023 · 1 Feb · Shift 1

A proton moving with one tenth of velocity of light has a certain de Broglie wavelength of  $\lambda$ . An alpha particle having certain kinetic energy has the same de-Broglie wavelength  $\lambda$ . The ratio of kinetic energy of proton and that of alpha particle is:

- (A) 1 : 4 (B) 2 : 1  
(C) 4 : 1 (D) 1 : 2

[Step-by-step solution ► prepwiser.in/questions/dA2\\_kMj-Kr](https://www.prepwiser.in/questions/dA2_kMj-Kr)

**Q20** JEE Main 2023 · 30 Jan · Shift 1

A small object at rest, absorbs a light pulse of power  $20\text{mW}$  and duration  $300\text{ns}$ . Assuming speed of light as  $3 \times 10^8\text{m/s}$ , the momentum of the object becomes equal to :

- (A)  $1 \times 10^{-17}\text{kgm/s}$
- (B)  $0.5 \times 10^{-17}\text{kgm/s}$
- (C)  $3 \times 10^{-17}\text{kgm/s}$
- (D)  $2 \times 10^{-17}\text{kgm/s}$

[Step-by-step solution ► prepwisser.in/questions/mdWYnEZV7O](https://www.prepwisser.in/questions/mdWYnEZV7O)

**Q21** JEE Main 2023 · 30 Jan · Shift 2

An electron accelerated through a potential difference  $V_1$  has a de-Broglie wavelength of  $\lambda$ . When the potential is changed to  $V_2$ , its de-Broglie wavelength increases by 50%. The value of  $\left(\frac{V_1}{V_2}\right)$  is equal to

- (A)  $\frac{3}{2}$
- (B) 4
- (C) 3
- (D)  $\frac{9}{4}$

[Step-by-step solution ► prepwisser.in/questions/RmRK55gjdp](https://www.prepwisser.in/questions/RmRK55gjdp)

**Q22** JEE Main 2023 · 29 Jan · Shift 2

The ratio of de-Broglie wavelength of an  $\alpha$  particle and a proton accelerated from rest by the same potential is  $\frac{1}{\sqrt{m}}$ , the value of  $m$  is -

- (A) 2
- (B) 16
- (C) 8
- (D) 4

[Step-by-step solution ► prepwisser.in/questions/L-LhQ0w-lG](https://www.prepwisser.in/questions/L-LhQ0w-lG)

**Q23** JEE Main 2023 · 25 Jan · Shift 1

Electron beam used in an electron microscope, when accelerated by a voltage of  $20\text{ kV}$ , has a de-Broglie wavelength of  $\lambda_0$ . IF the voltage is increased to  $40\text{ kV}$ , then the de-Broglie wavelength associated with the electron beam would be :

- (A)  $3 \lambda_0$
- (B)  $9 \lambda_0$
- (C)  $\frac{\lambda_0}{\sqrt{2}}$
- (D)  $\frac{\lambda_0}{2}$

[Step-by-step solution ► prepwisser.in/questions/MdBeV\\_bEps](https://www.prepwisser.in/questions/MdBeV_bEps)

**Q24** JEE Main 2023 · 24 Jan · Shift 2

An  $\alpha$ -particle, a proton and an electron have the same kinetic energy. Which one of the following is correct in case of their de-Broglie wavelength:

- (A)  $\lambda_\alpha > \lambda_p < \lambda_e$
- (B)  $\lambda_\alpha > \lambda_p > \lambda_e$
- (C)  $\lambda_\alpha = \lambda_p = \lambda_e$
- (D)  $\lambda_\alpha < \lambda_p < \lambda_e$

[Step-by-step solution ► prepwisser.in/questions/-NIQ\\_CQdmx](https://www.prepwisser.in/questions/-NIQ_CQdmx)

**Q25** JEE Main 2022 · 29 Jul · Shift 2

An  $\alpha$  particle and a proton are accelerated from rest through the same potential difference. The ratio of linear momenta acquired by above two particles will be:

- (A)  $\sqrt{2} : 1$  (B)  $2\sqrt{2} : 1$   
(C)  $4\sqrt{2} : 1$  (D)  $8 : 1$

[Step-by-step solution ► prepwisar.in/questions/Agvt90GGIx](https://www.prepwisar.in/questions/Agvt90GGIx)

**Q26** JEE Main 2022 · 28 Jul · Shift 1

The equation  $\lambda = \frac{1.227}{x} \text{ nm}$  can be used to find the de-Broglie wavelength of an electron. In this equation  $x$  stands for :

Where

$m$  = mass of electron

$P$  = momentum of electron

$K$  = Kinetic energy of electron

$V$  = Accelerating potential in volts for electron

- (A)  $\sqrt{mK}$  (B)  $\sqrt{P}$   
(C)  $\sqrt{K}$  (D)  $\sqrt{V}$

[Step-by-step solution ► prepwisar.in/questions/Om2-K2pQEk](https://www.prepwisar.in/questions/Om2-K2pQEk)

**Q27** JEE Main 2022 · 27 Jul · Shift 1

An electron (mass  $m$ ) with an initial velocity  $\vec{v} = v_0 \hat{i}$  ( $v_0 > 0$ ) is moving in an electric field  $\vec{E} = -E_0 \hat{i}$  ( $E_0 > 0$ ) where  $E_0$  is constant. If at  $t = 0$  de Broglie wavelength is  $\lambda_0 = \frac{h}{mv_0}$ , then its de Broglie wavelength after time  $t$  is given by

- (A)  $\lambda_0$   
(B)  $\lambda_0 \left(1 + \frac{eE_0 t}{mv_0}\right)$   
(C)  $\lambda_0 t$   
(D)  $\frac{\lambda_0}{\left(1 + \frac{eE_0 t}{mv_0}\right)}$

[Step-by-step solution ► prepwisar.in/questions/Ak755w9QO6](https://www.prepwisar.in/questions/Ak755w9QO6)

**Q28** JEE Main 2022 · 25 Jul · Shift 2

The ratio of wavelengths of proton and deuteron accelerated by potential  $V_p$  and  $V_d$  is  $1 : \sqrt{2}$ . Then the ratio of  $V_p$  to  $V_d$  will be :

- (A)  $1 : 1$  (B)  $\sqrt{2} : 1$   
(C)  $2 : 1$  (D)  $4 : 1$

[Step-by-step solution ► prepwisar.in/questions/JgqxmMUoYg](https://www.prepwisar.in/questions/JgqxmMUoYg)

**Q29** JEE Main 2022 · 28 Jun · Shift 1

The de Broglie wavelengths for an electron and a photon are  $\lambda_e$  and  $\lambda_p$  respectively. For the same kinetic energy of electron and photon, which of the following presents the correct relation between the de Broglie wavelengths of two ?

- (A)  $\lambda_p \propto \lambda_e^2$
- (B)  $\lambda_p \propto \lambda_e$
- (C)  $\lambda_p \propto \sqrt{\lambda_e}$
- (D)  $\lambda_p \propto \sqrt{\frac{1}{\lambda_e}}$

Step-by-step solution ► [prepwiser.in/questions/\\_5GTOzUaem](https://www.prepwiser.in/questions/_5GTOzUaem)

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**Q30** JEE Main 2022 · 27 Jun · Shift 1

An  $\alpha$  particle and a carbon 12 atom has same kinetic energy K. The ratio of their de-Broglie wavelengths ( $\lambda_\alpha : \lambda_{C12}$ ) is :

- (A)  $1 : \sqrt{3}$
- (B)  $\sqrt{3} : 1$
- (C)  $3 : 1$
- (D)  $2 : \sqrt{3}$

Step-by-step solution ► [prepwiser.in/questions/CxLFYwrutY](https://www.prepwiser.in/questions/CxLFYwrutY)

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**Q31** JEE Main 2022 · 26 Jun · Shift 1

An electron with speed  $v$  and a photon with speed  $c$  have the same de-Broglie wavelength. If the kinetic energy and momentum of electron are  $E_e$  and  $p_e$  and that of photon are  $E_{ph}$  and  $p_{ph}$  respectively. Which of the following is correct?

- (A)  $\frac{E_e}{E_{ph}} = \frac{2c}{v}$
- (B)  $\frac{E_e}{E_{ph}} = \frac{v}{2c}$
- (C)  $\frac{p_e}{p_{ph}} = \frac{2c}{v}$
- (D)  $\frac{p_e}{p_{ph}} = \frac{v}{2c}$

Step-by-step solution ► [prepwiser.in/questions/mjGaPqBRDB](https://www.prepwiser.in/questions/mjGaPqBRDB)

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**Q32** JEE Main 2022 · 25 Jun · Shift 2

A proton, a neutron, an electron and an  $\alpha$  particle have same energy. If  $\lambda_p$ ,  $\lambda_n$ ,  $\lambda_e$  and  $\lambda_a$  are the de Broglie's wavelengths of proton, neutron, electron and  $\alpha$  particle respectively, then choose the correct relation from the following :

- (A)  $\lambda_p = \lambda_n > \lambda_e > \lambda_a$
- (B)  $\lambda_a < \lambda_n < \lambda_p < \lambda_e$
- (C)  $\lambda_e < \lambda_p = \lambda_n > \lambda_a$
- (D)  $\lambda_e = \lambda_p = \lambda_n = \lambda_a$

Step-by-step solution ► [prepwiser.in/questions/HRf--uBs8J](https://www.prepwiser.in/questions/HRf--uBs8J)

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**Q33** JEE Main 2021 · 1 Sep · Shift 2

The temperature of an ideal gas in 3-dimensions is 300 K. The corresponding de-Broglie wavelength of the electron approximately at 300 K, is :

[ $m_e$  = mass of electron =  $9 \times 10^{-31}$  kg,  $h$  = Planck constant =  $6.6 \times 6.6 \times 10^{-34}$  Js,  $k_B$  = Boltzmann constant =  $1.38 \times 10^{-23}$  JK $^{-1}$ ]

- (A) 6.26 nm (B) 8.46 nm  
(C) 2.26 nm (D) 3.25 nm

[Step-by-step solution ► prepwiser.in/questions/jOyVoskCFi](https://www.prepwiser.in/questions/jOyVoskCFi)

**Q34** JEE Main 2021 · 31 Aug · Shift 2

Consider two separate ideal gases of electrons and protons having same number of particles. The temperature of both the gases are same. The ratio of the uncertainty in determining the position of an electron to that of a proton is proportional to :-

- (A)  $\left(\frac{m_p}{m_e}\right)^{3/2}$   
(B)  $\sqrt{\frac{m_e}{m_p}}$   
(C)  $\sqrt{\frac{m_p}{m_e}}$   
(D)  $\frac{m_p}{m_e}$

[Step-by-step solution ► prepwiser.in/questions/MWpqL3s6NK](https://www.prepwiser.in/questions/MWpqL3s6NK)

**Q35** JEE Main 2021 · 31 Aug · Shift 1

A moving proton and electron have the same de-Broglie wavelength. If K and P denote the K.E. and momentum respectively. Then choose the correct option :

- (A)  $K_p < K_e$  and  $P_p = P_e$   
(B)  $K_p = K_e$  and  $P_p = P_e$   
(C)  $K_p < K_e$  and  $P_p < P_e$   
(D)  $K_p > K_e$  and  $P_p = P_e$

[Step-by-step solution ► prepwiser.in/questions/6XqXJ\\_AVtx](https://www.prepwiser.in/questions/6XqXJ_AVtx)

**Q36** JEE Main 2021 · 26 Aug · Shift 2

The de-Broglie wavelength of a particle having kinetic energy E is  $\lambda$ . How much extra energy must be given to this particle so that the de-Broglie wavelength reduces to 75% of the initial value?

- (A)  $\frac{1}{9}E$  (B)  $\frac{7}{9}E$   
(C) E (D)  $\frac{16}{9}E$

[Step-by-step solution ► prepwiser.in/questions/x9TV3LWL4m](https://www.prepwiser.in/questions/x9TV3LWL4m)

**Q37** JEE Main 2021 · 27 Jul · Shift 1

A particle of mass  $9.1 \times 10^{-31}$  kg travels in a medium with a speed of  $10^6$  m/s and a photon of a radiation of linear momentum  $10^{-27}$  kg m/s travels in vacuum. The wavelength of photon is \_\_\_\_\_ times the wavelength of the particle.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/KfCqL05nXg](https://www.prepwiser.in/questions/KfCqL05nXg)

**Q38** JEE Main 2021 · 25 Jul · Shift 1

A particle of mass  $4M$  at rest disintegrates into two particles of mass  $M$  and  $3M$  respectively having non zero velocities. The ratio of de-Broglie wavelength of particle of mass  $M$  to that of mass  $3M$  will be :

- (A)  $1 : 3$  (B)  $3 : 1$   
(C)  $1 : \sqrt{3}$  (D)  $1 : 1$

Step-by-step solution ► [prepwiser.in/questions/Go7ETuEVmb](https://www.prepwiser.in/questions/Go7ETuEVmb)

**Q39** JEE Main 2021 · 25 Jul · Shift 2

An electron moving with speed  $v$  and a photon moving with speed  $c$ , have same D-Broglie wavelength. The ratio of kinetic energy of electron to that of photon is :

- (A)  $\frac{3c}{v}$  (B)  $\frac{v}{3c}$   
(C)  $\frac{v}{2c}$  (D)  $\frac{2c}{v}$

Step-by-step solution ► [prepwiser.in/questions/9kDuHxfyje](https://www.prepwiser.in/questions/9kDuHxfyje)

**Q40** JEE Main 2021 · 25 Jul · Shift 1

What should be the order of arrangement of de-Broglie wavelength of electron ( $\lambda_e$ ), an  $\alpha$ -particle ( $\lambda_\alpha$ ) and proton ( $\lambda_p$ ) given that all have the same kinetic energy?

- (A)  $\lambda_e = \lambda_p = \lambda_\alpha$   
(B)  $\lambda_e < \lambda_p < \lambda_\alpha$   
(C)  $\lambda_e > \lambda_p > \lambda_\alpha$   
(D)  $\lambda_e = \lambda_p > \lambda_\alpha$

Step-by-step solution ► [prepwiser.in/questions/eSHqmTkduo](https://www.prepwiser.in/questions/eSHqmTkduo)

**Q41** JEE Main 2021 · 22 Jul · Shift 2

An electron of mass  $m_e$  and a proton of mass  $m_p$  are accelerated through the same potential difference. The ratio of the de-Broglie wavelength associated with the electron to that with the proton is

- (A)  $\frac{m_e}{m_p}$  (B)  $1$   
(C)  $\frac{m_p}{m_e}$  (D)  $\sqrt{\frac{m_p}{m_e}}$

Step-by-step solution ► [prepwiser.in/questions/dM3nQEpbFe](https://www.prepwiser.in/questions/dM3nQEpbFe)

**Q42** JEE Main 2021 · 20 Jul · Shift 2

An electron having de-Broglie wavelength  $\lambda$  is incident on a target in a X-ray tube. Cut-off wavelength of emitted X-ray is :

- (A)  $0$   
(B)  $\frac{2m^2c^2\lambda^2}{h^2}$   
(C)  $\frac{2mc\lambda^2}{h}$   
(D)  $\frac{hc}{mc}$

Step-by-step solution ► [prepwiser.in/questions/60oJUyqkUX](https://www.prepwiser.in/questions/60oJUyqkUX)

**Q43** JEE Main 2021 · 18 Mar · Shift 1

A particle is travelling 4 times as fast as an electron. Assuming the ratio of de-Broglie wavelength of a particle to that of electron is 2 : 1, the mass of the particle is :

- (A)  $\frac{1}{16}$  times the mass of  $e^-$
- (B) 8 times the mass of  $e^-$
- (C) 16 times the mass of  $e^-$
- (D)  $\frac{1}{8}$  times the mass of  $e^-$

[Step-by-step solution ► prepwiser.in/questions/v\\_MeHB9ZmO](https://www.prepwiser.in/questions/v_MeHB9ZmO)

**Q44** JEE Main 2021 · 18 Mar · Shift 2

The speed of electrons in a scanning electron microscope is  $1 \times 10^7 \text{ ms}^{-1}$ . If the protons having the same speed are used instead of electrons, then the resolving power of scanning proton microscope will be changed by a factor of :

- (A)  $\frac{1}{1837}$
- (B) 1837
- (C)  $\sqrt{1837}$
- (D)  $\frac{1}{\sqrt{1837}}$

[Step-by-step solution ► prepwiser.in/questions/TCEJCujT-K](https://www.prepwiser.in/questions/TCEJCujT-K)

**Q45** JEE Main 2021 · 17 Mar · Shift 1

An electron of mass  $m$  and a photon have same energy  $E$ . The ratio of wavelength of electron to that of photon is : ( $c$  being the velocity of light)

- (A)  $\frac{1}{c} \left( \frac{2m}{E} \right)^{1/2}$
- (B)  $\frac{1}{c} \left( \frac{E}{2m} \right)^{1/2}$
- (C)  $\left( \frac{E}{2m} \right)^{1/2}$
- (D)  $c(2mE)^{1/2}$

[Step-by-step solution ► prepwiser.in/questions/U6fjdPx3ot](https://www.prepwiser.in/questions/U6fjdPx3ot)

**Q46** JEE Main 2021 · 16 Mar · Shift 2

The de-Broglie wavelength associated with an electron and a proton were calculated by accelerating them through same potential of 100 V. What should nearly be the ratio of their wavelengths? ( $m_p = 1.00727u$ ,  $m_e = 0.00055u$ )

- (A) 41.4 : 1
- (B)  $(1860)^2$  : 1
- (C) 1860 : 1
- (D) 43 : 1

[Step-by-step solution ► prepwiser.in/questions/E5gMiRxxX3](https://www.prepwiser.in/questions/E5gMiRxxX3)

**Q47** JEE Main 2021 · 26 Feb · Shift 1

Given below are two statements : one is labeled as Assertion A and the other is labelled as Reason R.

Assertion A : An electron microscope can achieve better resolving power than an optical microscope.

Reason R : The de Broglie's wavelength of the electrons emitted from an electron gun is much less than wavelength of visible light.

In the light of the above statements, choose the correct answer from the options given below :

- (A) A is false but R is true.
- (B) Both A and R are true but R is NOT the correct explanation of A.
- (C) Both A and R are true and R is the correct explanation of A.
- (D) A is true but R is false.

[Step-by-step solution ► prepwiser.in/questions/nv2DFVJ4Hw](https://www.prepwiser.in/questions/nv2DFVJ4Hw)

**Q48** JEE Main 2021 · 25 Feb · Shift 2

An electron of mass  $m_e$  and a proton of mass  $m_p = 1836 m_e$  are moving with the same speed. The ratio of their de Broglie wavelength  $\frac{\lambda_{electron}}{\lambda_{proton}}$  will be :

- (A) 1
- (B) 1836
- (C)  $\frac{1}{1836}$
- (D) 918

[Step-by-step solution ► prepwiser.in/questions/UltF2fvHNA](https://www.prepwiser.in/questions/UltF2fvHNA)

**Q49** JEE Main 2021 · 25 Feb · Shift 1

An  $\alpha$  particle and a proton are accelerated from rest by a potential difference of 200V. After this, their de Broglie wavelengths are  $\lambda_\alpha$  and  $\lambda_p$  respectively. The ratio  $\frac{\lambda_p}{\lambda_\alpha}$  is :

- (A) 8
- (B) 2.8
- (C) 7.8
- (D) 3.8

[Step-by-step solution ► prepwiser.in/questions/G0M03sT8t4](https://www.prepwiser.in/questions/G0M03sT8t4)

**Q50** JEE Main 2021 · 25 Feb · Shift 2

The wavelength of an X-ray beam is  $10\overset{\circ}{\text{\AA}}$ . The mass of a fictitious particle having the same energy as that of the X-ray photons is  $\frac{x}{3}h$  kg. The value of x is \_\_\_\_\_. ( $h$  = Planck's constant)

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/w8SJesen4y](https://www.prepwiser.in/questions/w8SJesen4y)

**Q51** JEE Main 2021 · 24 Feb · Shift 1

Given below are two statements :

Statement I : Two photons having equal linear momenta have equal wavelengths.

Statement II : If the wavelength of photon is decreased, then the momentum and energy of a photon will also decrease.

In the light of the above statements, choose the correct answer from the options given below.

- (A) Statement I is false but Statement II is true
- (B) Both Statement I and Statement II are false
- (C) Both Statement I and Statement II are true
- (D) Statement I is true but Statement II is false

[Step-by-step solution ► prepwisser.in/questions/VGPo99NSbR](https://www.prepwisser.in/questions/VGPo99NSbR)

**Q52** JEE Main 2021 · 24 Feb · Shift 2

The de-Broglie wavelength of a proton and  $\alpha$ -particle are equal. The ratio of their velocities is :

- (A) 4 : 2
- (B) 4 : 3
- (C) 4 : 1
- (D) 1 : 4

[Step-by-step solution ► prepwisser.in/questions/sueBbqp90g](https://www.prepwisser.in/questions/sueBbqp90g)

**Q53** JEE Main 2020 · 6 Sep · Shift 1

An electron, a doubly ionized helium ion ( $\text{He}^{++}$ ) and a proton are having the same kinetic energy. The relation between their respective de-Broglie wavelengths  $\lambda_e$ ,  $\lambda_{\text{He}^{++}}$  and  $\lambda_p$  is :

- (A)  $\lambda_e > \lambda_{\text{He}^{++}} > \lambda_p$
- (B)  $\lambda_e < \lambda_p < \lambda_{\text{He}^{++}}$
- (C)  $\lambda_e > \lambda_p > \lambda_{\text{He}^{++}}$
- (D)  $\lambda_e < \lambda_{\text{He}^{++}} = \lambda_p$

[Step-by-step solution ► prepwisser.in/questions/Y3UiL7Do6F](https://www.prepwisser.in/questions/Y3UiL7Do6F)

**Q54** JEE Main 2020 · 6 Sep · Shift 2

Assuming the nitrogen molecule is moving with r.m.s. velocity at 400 K, the de-Broglie wavelength of nitrogen molecule is close to :

(Given : nitrogen molecule weight :  $4.64 \times 10^{-26}$  kg,

Boltzman constant:  $1.38 \times 10^{-23}$  J/K,

Planck constant :  $6.63 \times 10^{-34}$  J.s)

- (A)  $0.44 \text{ \AA}$
- (B)  $0.34 \text{ \AA}$
- (C)  $0.20 \text{ \AA}$
- (D)  $0.24 \text{ \AA}$

[Step-by-step solution ► prepwisser.in/questions/gQuYY0rqIb](https://www.prepwisser.in/questions/gQuYY0rqIb)

**Q55** JEE Main 2020 · 2 Sep · Shift 2

A particle is moving 5 times as fast as an electron. The ratio of the de-Broglie wavelength of the particle to that of the electron is  $1.878 \times 10^{-4}$ . The mass of the particle is close to

- (A)  $1.2 \times 10^{-28}$  kg
- (B)  $9.1 \times 10^{-31}$  kg
- (C)  $4.8 \times 10^{-27}$  kg
- (D)  $9.7 \times 10^{-28}$  kg

Step-by-step solution ► [prepwiser.in/questions/Hn1GLWXrR2](https://www.prepwiser.in/questions/Hn1GLWXrR2)

**Q56** JEE Main 2020 · 9 Jan · Shift 1

A particle moving with kinetic energy  $E$  has de Broglie wavelength  $\lambda$ . If energy  $\Delta E$  is added to its energy, the wavelength become  $\lambda/2$ . Value of  $\Delta E$ , is :

- (A)  $E$
- (B)  $3E$
- (C)  $2E$
- (D)  $4E$

Step-by-step solution ► [prepwiser.in/questions/RggoEC0poE](https://www.prepwiser.in/questions/RggoEC0poE)

**Q57** JEE Main 2020 · 9 Jan · Shift 2

An electron of mass  $m$  and magnitude of charge  $|e|$  initially at rest gets accelerated by a constant electric field  $E$ . The rate of change of de-Broglie wavelength of this electron at time  $t$  ignoring relativistic effects is :

- (A)  $\frac{-h}{|e|Et}$
- (B)  $\frac{-h}{|e|E\sqrt{t}}$
- (C)  $\frac{-h}{|e|Et^2}$
- (D)  $\frac{|e|Et}{h}$

Step-by-step solution ► [prepwiser.in/questions/CQpgba9\\_vD](https://www.prepwiser.in/questions/CQpgba9_vD)

**Q58** JEE Main 2020 · 8 Jan · Shift 2

An electron (mass  $m$ ) with initial velocity  $\vec{v} = v_0\hat{i} + v_0\hat{j}$  is in an electric field  $\vec{E} = -E_0\hat{k}$ . If  $\lambda_0$  is initial de-Broglie wavelength of electron, its de-Broglie wave length at time  $t$  is given by :

- (A)  $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$
- (B)  $\frac{\lambda_0 \sqrt{2}}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$
- (C)  $\frac{\lambda_0}{\sqrt{1 + \frac{e^2 E_0^2 t^2}{2m^2 v_0^2}}}$
- (D)  $\frac{\lambda_0}{\sqrt{2 + \frac{e^2 E_0^2 t^2}{m^2 v_0^2}}}$

Step-by-step solution ► [prepwiser.in/questions/IpNXnna6vo](https://www.prepwiser.in/questions/IpNXnna6vo)

**Q59** JEE Main 2020 · 7 Jan · Shift 2

An electron (of mass  $m$ ) and a photon have the same energy  $E$  in the range of a few eV. The ratio of the de-Broglie wavelength associated with the electron and the wavelength of the photon is ( $c$  = speed of light in vacuum)

- (A)  $\frac{1}{c} \left( \frac{2E}{m} \right)^{\frac{1}{2}}$
- (B)  $\frac{1}{c} \left( \frac{E}{2m} \right)^{\frac{1}{2}}$
- (C)  $\left( \frac{E}{2m} \right)^{\frac{1}{2}}$
- (D)  $c(2mE)^{\frac{1}{2}}$

Step-by-step solution ► [prepwisar.in/questions/gaM5hoSQah](https://www.prepwisar.in/questions/gaM5hoSQah)

## Photoelectric Effect · 59 PYQs

**Q60** JEE Main 2025 · 7 Apr · Shift 2

A photoemissive substance is illuminated with a radiation of wavelength  $\lambda_i$  so that it releases electrons with de-Broglie wavelength  $\lambda_e$ . The longest wavelength of radiation that can emit photoelectron is  $\lambda_o$ . Expression for de-Broglie wavelength is given by:

( $m$ : mass of the electron,  $h$ : Planck's constant and  $c$ : speed of light)

- (A)  $\lambda_e = \frac{\sqrt{h\lambda_i}}{\sqrt{2mc}}$
- (B)  $\lambda_e = \frac{h}{\sqrt{2mc \left( \frac{1}{\lambda_i} - \frac{1}{\lambda_o} \right)}}$
- (C)  $\lambda_e = \sqrt{\frac{h}{2mc \left( \frac{1}{\lambda_i} - \frac{1}{\lambda_o} \right)}}$
- (D)  $\lambda_e = \sqrt{\frac{h\lambda_o}{2mc}}$

Step-by-step solution ► [prepwisar.in/questions/1E7iDbDVj5](https://www.prepwisar.in/questions/1E7iDbDVj5)

**Q61** JEE Main 2025 · 4 Apr · Shift 1

Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A** : In photoelectric effect, on increasing the intensity of incident light the stopping potential increases.

**Reason R** : Increase in intensity of light increases the rate of photoelectrons emitted, provided the frequency of incident light is greater than threshold frequency.

In the light of the above statements, choose the correct answer from the options given below

- (A) Both **A** and **R** are true and **R** is the correct explanation of **A**
- (B) **A** is false but **R** is true
- (C) Both **A** and **R** are true but **R** is NOT the correct explanation of **A**
- (D) **A** is true but **R** is false

Step-by-step solution ► [prepwisar.in/questions/XyZh\\_xZwiU](https://www.prepwisar.in/questions/XyZh_xZwiU)

**Q62** JEE Main 2025 · 29 Jan · Shift 2

In an experiment with photoelectric effect, the stopping potential,

- (A) is  $\left(\frac{1}{e}\right)$  times the maximum kinetic energy of the emitted photoelectrons
- (B) increases with increase in the intensity of the incident light
- (C) decreases with increase in the intensity of the incident light
- (D) increases with increase in the wavelength of the incident light

[Step-by-step solution ► prepwiser.in/questions/gdH67tfMzF](https://www.prepwiser.in/questions/gdH67tfMzF)

**Q63** JEE Main 2025 · 29 Jan · Shift 1

Given below are two statements: one is labelled as Assertion (A) and the other is labelled as Reason (R).

**Assertion (A) :** Emission of electrons in photoelectric effect can be suppressed by applying a sufficiently negative electron potential to the photoemissive substance.

**Reason (R) :** A negative electric potential, which stops the emission of electrons from the surface of a photoemissive substance, varies linearly with frequency of incident radiation.

In the light of the above statements, choose the most appropriate answer from the options given below :

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
- (B) Both (A) and (R) are true but (R) is not the correct explanation of (A).
- (C) (A) is false but (R) is true
- (D) (A) is true but (R) is false

[Step-by-step solution ► prepwiser.in/questions/cCbAS27qxK](https://www.prepwiser.in/questions/cCbAS27qxK)

**Q64** JEE Main 2025 · 28 Jan · Shift 2

Which of the following phenomena cannot be explained by wave theory of light?

- (A) Refraction of light
- (B) Reflection of light
- (C) Diffraction of light
- (D) Compton effect

[Step-by-step solution ► prepwiser.in/questions/PyW9r8Lumd](https://www.prepwiser.in/questions/PyW9r8Lumd)

**Q65** JEE Main 2025 · 24 Jan · Shift 2

The ratio of the power of a light source  $S_1$  to that the light source  $S_2$  is 2.  $S_1$  is emitting  $2 \times 10^{15}$  photons per second at 600 nm . If the wavelength of the source  $S_2$  is 300 nm , then the number of photons per second emitted by  $S_2$  is \_\_\_\_\_  $\times 10^{14}$ .

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/APXTK5eFfM](https://www.prepwiser.in/questions/APXTK5eFfM)

**Q66** JEE Main 2025 · 24 Jan · Shift 2

In photoelectric effect, the stopping potential ( $V_0$ ) v/s frequency ( $\nu$ ) curve is plotted.

( $h$  is the Planck's constant and  $\phi_0$  is work function of metal )

(A)  $V_0\nu/s\nu$  is linear.

(B) The slope of  $V_0\nu/s\nu$  curve =  $\frac{\phi_0}{h}$

(C)  $h$  constant is related to the slope of  $V_0\nu/s\nu$  line.

(D) The value of electric charge of electron is not required to determine  $h$  using the  $V_0\nu/s\nu$  curve.

(E) The work function can be estimated without knowing the value of  $h$ .

Choose the correct answer from the options given below :

(A) (A), (C) and (E) only

(B) (C) and (D) only

(C) (A), (B) and (C) only

(D) (D) and (E) only

[Step-by-step solution ► prepwisser.in/questions/7G6r\\_6qg9J](https://www.prepwisser.in/questions/7G6r_6qg9J)

**Q67** JEE Main 2025 · 23 Jan · Shift 2

In photoelectric effect an em-wave is incident on a metal surface and electrons are ejected from the surface. If the work function of the metal is 2.14 eV and stopping potential is 2 V , what is the wavelength of the em-wave? (Given  $hc = 1242 \text{ eV nm}$  where  $h$  is the Planck's constant and  $c$  is the speed of light in vacuum.)

(A) 400 nm

(B) 600 nm

(C) 300 nm

(D) 200 nm

[Step-by-step solution ► prepwisser.in/questions/0TLpEhLfBd](https://www.prepwisser.in/questions/0TLpEhLfBd)

**Q68** JEE Main 2025 · 22 Jan · Shift 2

A light source of wavelength  $\lambda$  illuminates a metal surface and electrons are ejected with maximum kinetic energy of 2 eV . If the same surface is illuminated by a light source of wavelength  $\frac{\lambda}{2}$ , then the maximum kinetic energy of ejected electrons will be (The work function of metal is 1 eV )

(A) 5 eV

(B) 3 eV

(C) 2 eV

(D) 6 eV

[Step-by-step solution ► prepwisser.in/questions/tFsKb0dFNY](https://www.prepwisser.in/questions/tFsKb0dFNY)

**Q69** JEE Main 2025 · 22 Jan · Shift 1

The work functions of cesium (Cs) and lithium (Li) metals are 1.9 eV and 2.5 eV , respectively. If we incident a light of wavelength 550 nm on these two metal surfaces, then photo-electric effect is possible for the case of

(A) Both Cs and Li

(B) Neither Cs nor Li

(C) Li only

(D) Cs only

[Step-by-step solution ► prepwisser.in/questions/0qiS9GK\\_-f](https://www.prepwisser.in/questions/0qiS9GK_-f)

**Q70** JEE Main 2024 · 9 Apr · Shift 2

UV light of  $4.13\text{eV}$  is incident on a photosensitive metal surface having work function  $3.13\text{eV}$ . The maximum kinetic energy of ejected photoelectrons will be:

- (A)  $4.13\text{ eV}$  (B)  $1\text{ eV}$   
(C)  $7.26\text{ eV}$  (D)  $3.13\text{ eV}$

Step-by-step solution ► [prepwisser.in/questions/GCmaLtO6jY](https://www.prepwisser.in/questions/GCmaLtO6jY)

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**Q71** JEE Main 2024 · 6 Apr · Shift 1

Which of the following phenomena does not explain by wave nature of light.

- A. reflection  
B. diffraction  
C. photoelectric effect  
D. interference  
E. polarization

Choose the most appropriate answer from the options given below:

- (A) C only (B) B, D only  
(C) A, C only (D) E only

Step-by-step solution ► [prepwisser.in/questions/TPgIKmIv0j](https://www.prepwisser.in/questions/TPgIKmIv0j)

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**Q72** JEE Main 2024 · 6 Apr · Shift 2

When UV light of wavelength  $300\text{nm}$  is incident on the metal surface having work function  $2.13\text{eV}$ , electron emission takes place. The stopping potential is :

(Given  $hc = 1240\text{eVnm}$  )

- (A)  $4\text{ V}$  (B)  $2\text{ V}$   
(C)  $4.1\text{ V}$  (D)  $1.5\text{ V}$

Step-by-step solution ► [prepwisser.in/questions/fjJinhyOWS](https://www.prepwisser.in/questions/fjJinhyOWS)

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**Q73** JEE Main 2024 · 6 Apr · Shift 1

In photoelectric experiment energy of  $2.48\text{eV}$  irradiates a photo sensitive material. The stopping potential was measured to be  $0.5\text{V}$ . Work function of the photo sensitive material is :

- (A)  $1.98\text{ eV}$  (B)  $1.68\text{ eV}$   
(C)  $2.48\text{ eV}$  (D)  $0.5\text{ eV}$

Step-by-step solution ► [prepwisser.in/questions/VEpfrT3Vgp](https://www.prepwisser.in/questions/VEpfrT3Vgp)

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**Q74** JEE Main 2024 · 5 Apr · Shift 2

Which of the following statement is not true about stopping potential ( $V_0$ ) ?

- (A) It depends upon frequency of the incident light.  
(B) It is  $1/e$  times the maximum kinetic energy of electrons emitted.  
(C) It increases with increase in intensity of the incident light.  
(D) It depends on the nature of emitter material.

Step-by-step solution ► [prepwisser.in/questions/u0b9Y-4CA7](https://www.prepwisser.in/questions/u0b9Y-4CA7)

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**Q75** JEE Main 2024 · 4 Apr · Shift 2

Given below are two statements: one is labelled as Assertion **A** and the other is labelled as Reason **R**.

Assertion **A**: Number of photons increases with increase in frequency of light.

Reason **R**: Maximum kinetic energy of emitted electrons increases with the frequency of incident radiation.

In the light of the above statements, choose the most appropriate answer from the options given below:

- (A) **A** is not correct but **R** is correct.
- (B) **A** is correct but **R** is not correct.
- (C) Both **A** and **R** are correct and **R** is the correct explanation of **A**.
- (D) Both **A** and **R** are correct and **R** is NOT the correct explanation of **A**.

[Step-by-step solution ► prepwiser.in/questions/GLzuNOnZo5](https://www.prepwiser.in/questions/GLzuNOnZo5)

**Q76** JEE Main 2024 · 1 Feb · Shift 2

Monochromatic light of frequency  $6 \times 10^{14} \text{ Hz}$  is produced by a laser. The power emitted is  $2 \times 10^{-3} \text{ W}$ .

How many photons per second on an average, are emitted by the source ?

(Given  $h = 6.63 \times 10^{-34} \text{ Js}$ )

- (A)  $5 \times 10^{15}$
- (B)  $7 \times 10^{16}$
- (C)  $6 \times 10^{15}$
- (D)  $9 \times 10^{18}$

[Step-by-step solution ► prepwiser.in/questions/hY-PQ-7U9w](https://www.prepwiser.in/questions/hY-PQ-7U9w)

**Q77** JEE Main 2024 · 31 Jan · Shift 2

In a photoelectric effect experiment a light of frequency 1.5 times the threshold frequency is made to fall on the surface of photosensitive material. Now if the frequency is halved and intensity is doubled, the number of photo electrons emitted will be:

- (A) doubled
- (B) halved
- (C) Zero
- (D) quadrupled

[Step-by-step solution ► prepwiser.in/questions/vASPsIV\\_Qe](https://www.prepwiser.in/questions/vASPsIV_Qe)

**Q78** JEE Main 2024 · 31 Jan · Shift 1

When a metal surface is illuminated by light of wavelength  $\lambda$ , the stopping potential is 8V. When the same surface is illuminated by light of wavelength  $3\lambda$ , stopping potential is 2V. The threshold wavelength for this surface is:

- (A)  $3\lambda$
- (B)  $9\lambda$
- (C)  $5\lambda$
- (D)  $4.5\lambda$

[Step-by-step solution ► prepwiser.in/questions/9DruLKND-H](https://www.prepwiser.in/questions/9DruLKND-H)

**Q79** JEE Main 2024 · 29 Jan · Shift 2

Two sources of light emit with a power of 200W. The ratio of number of photons of visible light emitted by each source having wavelengths 300nm and 500nm respectively, will be :

- (A) 5 : 3
- (B) 3 : 5
- (C) 1 : 5
- (D) 1 : 3

[Step-by-step solution ► prepwiser.in/questions/uxIbdb04aR](https://www.prepwiser.in/questions/uxIbdb04aR)

**Q80** JEE Main 2023 · 13 Apr · Shift 2

Given below are two statements:

Statement I : Out of microwaves, infrared rays and ultraviolet rays, ultraviolet rays are the most effective for the emission of electrons from a metallic surface.

Statement II : Above the threshold frequency, the maximum kinetic energy of photoelectrons is inversely proportional to the frequency of the incident light.

In the light of above statements, choose the correct answer form the options given below

- (A) Both Statement I and Statement II are true
- (B) Statement I is true but statement II is false
- (C) Statement I is false but statement II is true
- (D) Both Statement I and Statement II are false

[Step-by-step solution ► prepwiser.in/questions/C99Pdwklnw](https://www.prepwiser.in/questions/C99Pdwklnw)

**Q81** JEE Main 2023 · 8 Apr · Shift 2

In photo electric effect

- A. The photocurrent is proportional to the intensity of the incident radiation
- B. Maximum Kinetic energy with which photoelectrons are emitted depends on the intensity of incident light.
- C. Max. K.E with which photoelectrons are emitted depends on the frequency of incident light.
- D. The emission of photoelectrons require a minimum threshold intensity of incident radiation.
- E. Max. K.E of the photoelectrons is independent of the frequency of the incident light.

Choose the correct answer from the options given below:

- (A) A and E only
- (B) A and B only
- (C) B and C only
- (D) A and C only

[Step-by-step solution ► prepwiser.in/questions/4s6pAGr92h](https://www.prepwiser.in/questions/4s6pAGr92h)

**Q82** JEE Main 2023 · 6 Apr · Shift 2

The work functions of Aluminium and Gold are 4.1eV and 5.1eV respectively. The ratio of the slope of the stopping potential versus frequency plot for Gold to that of Aluminium is

- (A) 1.5
- (B) 1.24
- (C) 1
- (D) 2

[Step-by-step solution ► prepwiser.in/questions/hDWqXFUoEB](https://www.prepwiser.in/questions/hDWqXFUoEB)

**Q83** JEE Main 2023 · 1 Feb · Shift 2

The threshold frequency of a metal is  $f_0$ . When the light of frequency  $2f_0$  is incident on the metal plate, the maximum velocity of photoelectrons is  $v_1$ . When the frequency of incident radiation is increased to  $5f_0$ , the maximum velocity of photoelectrons emitted is  $v_2$ . The ratio of  $v_1$  to  $v_2$  is :

- (A)  $\frac{v_1}{v_2} = \frac{1}{2}$
- (B)  $\frac{v_1}{v_2} = \frac{1}{16}$
- (C)  $\frac{v_1}{v_2} = \frac{1}{4}$
- (D)  $\frac{v_1}{v_2} = \frac{1}{8}$

[Step-by-step solution ► prepwiser.in/questions/UnAVe1PnFP](https://www.prepwiser.in/questions/UnAVe1PnFP)

**Q84** JEE Main 2023 · 31 Jan · Shift 2

If the two metals A and B are exposed to radiation of wavelength  $350\text{nm}$ . The work functions of metals A and B are  $4.8\text{eV}$  and  $2.2\text{eV}$ . Then choose the correct option.

- (A) Metal B will not emit photo-electrons
- (B) Both metals A and B will not emit photo-electrons
- (C) Metal A will not emit photo-electrons
- (D) Both metals A and B will emit photo-electrons

Step-by-step solution ► [prepwisar.in/questions/izAJ7aT3yr](https://prepwisar.in/questions/izAJ7aT3yr)

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**Q85** JEE Main 2023 · 29 Jan · Shift 1

The threshold wavelength for photoelectric emission from a material is  $5500\text{ \AA}$ . Photoelectrons will be emitted, when this material is illuminated with monochromatic radiation from a

- A. 75 W infra-red lamp
- B. 10 W infra-red lamp
- C. 75 W ultra-violet lamp
- D. 10 W ultra-violet lamp

Choose the correct answer from the options given below :

- (A) C only
- (B) A and D only
- (C) C and D only
- (D) B and C only

Step-by-step solution ► [prepwisar.in/questions/xulJM\\_GEix](https://prepwisar.in/questions/xulJM_GEix)

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**Q86** JEE Main 2023 · 25 Jan · Shift 2

Given below are two statements :

Statement I : Stopping potential in photoelectric effect does not depend on the power of the light source.

Statement II : For a given metal, the maximum kinetic energy of the photoelectron depends on the wavelength of the incident light.

In the light of above statements, choose the most appropriate answer from the options given below

- (A) Both Statement I and Statement II are incorrect
- (B) Statement I is correct but Statement II is incorrect
- (C) Both Statement I and Statement II are correct
- (D) Statement I is incorrect but Statement II is correct

Step-by-step solution ► [prepwisar.in/questions/qXHu-x1e1Z](https://prepwisar.in/questions/qXHu-x1e1Z)

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**Q87** JEE Main 2023 · 24 Jan · Shift 1

From the photoelectric effect experiment, following observations are made. Identify which of these are correct.

- A. The stopping potential depends only on the work function of the metal.
- B. The saturation current increases as the intensity of incident light increases.
- C. The maximum kinetic energy of a photo electron depends on the intensity of the incident light.
- D. Photoelectric effect can be explained using wave theory of light.

Choose the correct answer from the options given below :

- (A) A, B, D only
- (B) A, C, D only
- (C) B, C only
- (D) B only

[Step-by-step solution ► prepwisser.in/questions/T34If\\_KLcg](https://www.prepwisser.in/questions/T34If_KLcg)

**Q88** JEE Main 2022 · 29 Jul · Shift 1

The kinetic energy of emitted electron is  $E$  when the light incident on the metal has wavelength  $\lambda$ . To double the kinetic energy, the incident light must have wavelength:

- (A)  $\frac{hc}{E\lambda - hc}$
- (B)  $\frac{hc\lambda}{E\lambda + hc}$
- (C)  $\frac{h\lambda}{E\lambda + hc}$
- (D)  $\frac{hc\lambda}{E\lambda - hc}$

[Step-by-step solution ► prepwisser.in/questions/D0w9ijSgza](https://www.prepwisser.in/questions/D0w9ijSgza)

**Q89** JEE Main 2022 · 28 Jul · Shift 2

Two streams of photons, possessing energies equal to five and ten times the work function of metal are incident on the metal surface successively. The ratio of maximum velocities of the photoelectron emitted, in the two cases respectively, will be

- (A) 1 : 2
- (B) 1 : 3
- (C) 2 : 3
- (D) 3 : 2

[Step-by-step solution ► prepwisser.in/questions/34jx2lun8R](https://www.prepwisser.in/questions/34jx2lun8R)

**Q90** JEE Main 2022 · 27 Jul · Shift 2

With reference to the observations in photo-electric effect, identify the correct statements from below :

- (A) The square of maximum velocity of photoelectrons varies linearly with frequency of incident light.
- (B) The value of saturation current increases on moving the source of light away from the metal surface.
- (C) The maximum kinetic energy of photo-electrons decreases on decreasing the power of LED (light emitting diode) source of light.
- (D) The immediate emission of photo-electrons out of metal surface can not be explained by particle nature of light/electromagnetic waves.
- (E) Existence of threshold wavelength can not be explained by wave nature of light/ electromagnetic waves.

Choose the correct answer from the options given below :

- (A) (A) and (B) only
- (B) (A) and (E) only
- (C) (C) and (E) only
- (D) (D) and (E) only

[Step-by-step solution ► prepwisser.in/questions/AIG10VvKoD](https://www.prepwisser.in/questions/AIG10VvKoD)

**Q91** JEE Main 2022 · 26 Jul · Shift 1

A parallel beam of light of wavelength  $900\text{nm}$  and intensity  $100\text{ Wm}^{-2}$  is incident on a surface perpendicular to the beam. The number of photons crossing  $1\text{cm}^2$  area perpendicular to the beam in one second is :

- (A)  $3 \times 10^{16}$  (B)  $4.5 \times 10^{16}$   
(C)  $4.5 \times 10^{17}$  (D)  $4.5 \times 10^{20}$

[Step-by-step solution ► prepwiser.in/questions/1mTnqqW6kO](https://www.prepwiser.in/questions/1mTnqqW6kO)

**Q92** JEE Main 2022 · 25 Jul · Shift 1

A metal exposed to light of wavelength  $800\text{nm}$  and emits photoelectrons with a certain kinetic energy. The maximum kinetic energy of photo-electron doubles when light of wavelength  $500\text{nm}$  is used. The workfunction of the metal is : (Take  $hc = 1230\text{ eV} - \text{nm}$  ).

- (A)  $1.537\text{ eV}$  (B)  $2.46\text{ eV}$   
(C)  $0.615\text{ eV}$  (D)  $1.23\text{ eV}$

[Step-by-step solution ► prepwiser.in/questions/T05m6bCg7C](https://www.prepwiser.in/questions/T05m6bCg7C)

**Q93** JEE Main 2022 · 30 Jun · Shift 1

A source of monochromatic light liberates  $9 \times 10^{20}$  photon per second with wavelength  $600\text{ nm}$  when operated at  $400\text{ W}$ . The number of photons emitted per second with wavelength of  $800\text{ nm}$  by the source of monochromatic light operating at same power will be :

- (A)  $12 \times 10^{20}$   
(B)  $6 \times 10^{20}$   
(C)  $9 \times 10^{20}$   
(D)  $24 \times 10^{20}$

[Step-by-step solution ► prepwiser.in/questions/XFpw8smhHm](https://www.prepwiser.in/questions/XFpw8smhHm)

**Q94** JEE Main 2022 · 29 Jun · Shift 1

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R :  
Assertion A : The photoelectric effect does not takes place, if the energy of the incident radiation is less than the work function of a metal.

Reason R : Kinetic energy of the photoelectrons is zero, if the energy of the incident radiation is equal to the work function of a metal.

In the light of the above statements, choose the most appropriate answer from the options given below.

- (A) Both A and R are correct and R is the correct explanation of A.  
(B) Both A and R are correct but R is not the correct explanation of A.  
(C) A is correct but R is not correct.  
(D) A is not correct but R is correct.

[Step-by-step solution ► prepwiser.in/questions/13mD2akX0j](https://www.prepwiser.in/questions/13mD2akX0j)

**Q95** JEE Main 2022 · 29 Jun · Shift 2

The electric field at a point associated with a light wave is given by

$$E = 200 [\sin(6 \times 10^{15}t) + \sin(9 \times 10^{15}t)] \text{ Vm}^{-1}$$

Given :  $h = 4.14 \times 10^{-15} \text{ eVs}$

If this light falls on a metal surface having a work function of 2.50 eV, the maximum kinetic energy of the photoelectrons will be

- (A) 1.90 eV (B) 3.27 eV  
(C) 3.60 eV (D) 3.42 eV

[Step-by-step solution ► prepwiser.in/questions/pfCiQ\\_6iW](https://www.prepwiser.in/questions/pfCiQ_6iW)

**Q96** JEE Main 2022 · 28 Jun · Shift 2

Let  $K_1$  and  $K_2$  be the maximum kinetic energies of photo-electrons emitted when two monochromatic beams of wavelength  $\lambda_1$  and  $\lambda_2$ , respectively are incident on a metallic surface. If  $\lambda_1 = 3\lambda_2$  then :

- (A)  $K_1 > \frac{K_2}{3}$   
(B)  $K_1 < \frac{K_2}{3}$   
(C)  $K_1 = \frac{K_2}{3}$   
(D)  $K_2 = \frac{K_1}{3}$

[Step-by-step solution ► prepwiser.in/questions/VFZAjuvF15](https://www.prepwiser.in/questions/VFZAjuvF15)

**Q97** JEE Main 2022 · 26 Jun · Shift 2

The stopping potential for photoelectrons emitted from a surface illuminated by light of wavelength  $6630 \text{ \AA}$  is 0.42 V. If the threshold frequency is  $x \times 10^{13} \text{ /s}$ , where  $x$  is \_\_\_\_\_ (nearest integer).

(Given, speed light =  $3 \times 10^8 \text{ m/s}$ , Planck's constant =  $6.63 \times 10^{-34} \text{ Js}$ )

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/PF61VFfn-7f](https://www.prepwiser.in/questions/PF61VFfn-7f)

**Q98** JEE Main 2022 · 24 Jun · Shift 1

When light of frequency twice the threshold frequency is incident on the metal plate, the maximum velocity of emitted electron is  $v_1$ . When the frequency of incident radiation is increased to five times the threshold value, the maximum velocity of emitted electron becomes  $v_2$ . If  $v_2 = x v_1$ , the value of  $x$  will be \_\_\_\_\_.

*Numerical answer — enter the value.*

[Step-by-step solution ► prepwiser.in/questions/VrBpnl48Sr](https://www.prepwiser.in/questions/VrBpnl48Sr)

**Q99** JEE Main 2022 · 24 Jun · Shift 2

The light of two different frequencies whose photons have energies 3.8 eV and 1.4 eV respectively, illuminate a metallic surface whose work function is 0.6 eV successively. The ratio of maximum speeds of emitted electrons for the two frequencies respectively will be :

- (A) 1 : 1 (B) 2 : 1  
(C) 4 : 1 (D) 1 : 4

[Step-by-step solution ► prepwiser.in/questions/0ClkzkaHO3](https://www.prepwiser.in/questions/0ClkzkaHO3)

**Q100** JEE Main 2021 · 27 Aug · Shift 2

A monochromatic neon lamp with wavelength of 670.5 nm illuminates a photo-sensitive material which has a stopping voltage of 0.48 V. What will be the stopping voltage if the source light is changed with another source of wavelength of 474.6 nm?

- (A) 0.96 V (B) 1.25 V  
(C) 0.24 V (D) 1.5 V

[Step-by-step solution ► prepwiser.in/questions/Hj36tz\\_8ot](https://www.prepwiser.in/questions/Hj36tz_8ot)

**Q101** JEE Main 2021 · 27 Aug · Shift 1

In a photoelectric experiment, increasing the intensity of incident light :

- (A) increases the number of photons incident and also increases the K.E. of the ejected electrons  
(B) increases the frequency of photons incident and increases the K.E. of the ejected electrons  
(C) increases the frequency of photons incident and the K.E. of the ejected electrons remains unchanged  
(D) increases the number of photons incident and the K.E. of the ejected electrons remains unchanged

[Step-by-step solution ► prepwiser.in/questions/pjUzTmuXti](https://www.prepwiser.in/questions/pjUzTmuXti)

**Q102** JEE Main 2021 · 26 Aug · Shift 1

In a photoelectric experiment ultraviolet light of wavelength 280 nm is used with lithium cathode having work function  $\phi = 2.5$  eV. If the wavelength of incident light is switched to 400 nm, find out the change in the stopping potential. ( $h = 6.63 \times 10^{-34}$  Js,  $c = 3 \times 10^8$  ms $^{-1}$ )

- (A) 1.3 V (B) 1.1 V  
(C) 1.9 V (D) 0.6 V

[Step-by-step solution ► prepwiser.in/questions/Vx3PnUszAO](https://www.prepwiser.in/questions/Vx3PnUszAO)

**Q103** JEE Main 2021 · 27 Jul · Shift 2

An electron and proton are separated by a large distance. The electron starts approaching the proton with energy 3 eV. The proton captures the electron and forms a hydrogen atom in second excited state. The resulting photon is incident on a photosensitive metal of threshold wavelength  $4000 \text{ \AA}$ . What is the maximum kinetic energy of the emitted photoelectron?

- (A) 7.61 eV (B) 1.41 eV  
(C) 3.3 eV (D) No photoelectron would be emitted

[Step-by-step solution ► prepwiser.in/questions/4kZZEmL5ul](https://www.prepwiser.in/questions/4kZZEmL5ul)

**Q104** JEE Main 2021 · 25 Jul · Shift 2

A light beam of wavelength 500 nm is incident on a metal having work function of 1.25 eV, placed in a magnetic field of intensity B. The electrons emitted perpendicular to the magnetic field B, with maximum kinetic energy are bent into circular arc of radius 30 cm. The value of B is \_\_\_\_\_  $\times 10^{-7}$  T.

Given  $hc = 20 \times 10^{-26}$  J-m, mass of electron =  $9 \times 10^{-31}$  kg

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/9KTvrsmA7f](https://www.prepwiser.in/questions/9KTvrsmA7f)

**Q105** JEE Main 2021 · 25 Jul · Shift 2

When radiation of wavelength  $\lambda$  is incident on a metallic surface, the stopping potential of ejected photoelectrons is 4.8 V. If the same surface is illuminated by radiation of double the previous wavelength, then the stopping potential becomes 1.6 V. The threshold wavelength of the metal is :

- (A)  $2\lambda$  (B)  $4\lambda$   
(C)  $8\lambda$  (D)  $6\lambda$

[Step-by-step solution ► prepwisser.in/questions/LSJFWdZK6-](https://www.prepwisser.in/questions/LSJFWdZK6-)

**Q106** JEE Main 2021 · 20 Jul · Shift 2

A certain metallic surface is illuminated by monochromatic radiation of wavelength  $\lambda$ . The stopping potential for photoelectric current for this radiation is  $3V_0$ . If the same surface is illuminated with a radiation of wavelength  $2\lambda$ , the stopping potential is  $V_0$ . The threshold wavelength of this surface for photoelectric effect is \_\_\_\_\_  $\lambda$ .

Numerical answer — enter the value.

[Step-by-step solution ► prepwisser.in/questions/b\\_QJACVezF](https://www.prepwisser.in/questions/b_QJACVezF)

**Q107** JEE Main 2021 · 20 Jul · Shift 1

The radiation corresponding to  $3 \rightarrow 2$  transition of a hydrogen atom falls on a gold surface to generate photoelectrons. The electrons are passed through a magnetic field of  $5 \times 10^{-4}$  T. Assume that the radius of the largest circular path followed by these electrons is 7 mm, the work function of the metal is : (Mass of electron =  $9.1 \times 10^{-31}$  kg)

- (A) 1.36 eV (B) 1.88 eV  
(C) 0.82 eV (D) 0.16 eV

[Step-by-step solution ► prepwisser.in/questions/ov8pqD2tMs](https://www.prepwisser.in/questions/ov8pqD2tMs)

**Q108** JEE Main 2021 · 17 Mar · Shift 2

Two identical photocathodes receive the light of frequencies  $f_1$  and  $f_2$  respectively. If the velocities of the photo-electrons coming out are  $v_1$  and  $v_2$  respectively, then

- (A)  $v_1 - v_2 = \left[ \frac{2h}{m}(f_1 - f_2) \right]^{\frac{1}{2}}$   
(B)  $v_1^2 + v_2^2 = \frac{2h}{m}[f_1 + f_2]$   
(C)  $v_1 + v_2 = \left[ \frac{2h}{m}(f_1 + f_2) \right]^{\frac{1}{2}}$   
(D)  $v_1^2 - v_2^2 = \frac{2h}{m}[f_1 - f_2]$

[Step-by-step solution ► prepwisser.in/questions/IOCap0iu7C](https://www.prepwisser.in/questions/IOCap0iu7C)

**Q109** JEE Main 2021 · 16 Mar · Shift 1

The stopping potential in the context of photoelectric effect depends on the following property of incident electromagnetic radiation :

- (A) Phase (B) Frequency  
(C) Amplitude (D) Intensity

[Step-by-step solution ► prepwisser.in/questions/aWQ\\_OJo\\_Vd](https://www.prepwisser.in/questions/aWQ_OJo_Vd)

**Q110** JEE Main 2021 · 26 Feb · Shift 2

Two stream of photons, possessing energies equal to twice and ten times the work function of metal are incident on the metal surface successively. The value of ratio of maximum velocities of the photoelectrons emitted in the two respective cases is  $x : y$ . The value of  $x$  is \_\_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/QebWJAV\\_sr](https://www.prepwiser.in/questions/QebWJAV_sr)

**Q111** JEE Main 2021 · 25 Feb · Shift 2

The stopping potential for electrons emitted from a photosensitive surface illuminated by light of wavelength 491 nm is 0.710 V. When the incident wavelength is changed to a new value, the stopping potential is 1.43 V. The new wavelength is :

- (A) 400 nm (B) 329 nm  
(C) 309 nm (D) 382 nm

[Step-by-step solution ► prepwiser.in/questions/2RK4XsGeWC](https://www.prepwiser.in/questions/2RK4XsGeWC)

**Q112** JEE Main 2020 · 5 Sep · Shift 2

The surface of a metal is illuminated alternately with photons of energies  $E_1 = 4$  eV and  $E_2 = 2.5$  eV respectively. The ratio of maximum speeds of the photoelectrons emitted in the two cases is 2. The work function of the metal in (eV) is \_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Fy7UzPNdyl](https://www.prepwiser.in/questions/Fy7UzPNdyl)

**Q113** JEE Main 2020 · 3 Sep · Shift 1

When the wavelength of radiation falling on a metal is changed from 500 nm to 200 nm, the maximum kinetic energy of the photoelectrons becomes three times larger. The work function of the metal is close to :

- (A) 1.02 eV (B) 0.81 eV  
(C) 0.61 eV (D) 0.52 eV

[Step-by-step solution ► prepwiser.in/questions/PeU1g8gW30](https://www.prepwiser.in/questions/PeU1g8gW30)

**Q114** JEE Main 2020 · 3 Sep · Shift 2

Two sources of light emit X-rays of wavelength 1 nm and visible light of wavelength 500 nm, respectively. Both the sources emit light of the same power 200 W. The ratio of the number density of photons of X-rays to the number density of photons of the visible light of the given wavelengths is :

- (A)  $\frac{1}{500}$  (B) 500  
(C) 250 (D)  $\frac{1}{250}$

[Step-by-step solution ► prepwiser.in/questions/Fgl7ywGldk](https://www.prepwiser.in/questions/Fgl7ywGldk)

**Q115** JEE Main 2020 · 2 Sep · Shift 1

When radiation of wavelength  $\lambda$  is used to illuminate a metallic surface, the stopping potential is  $V$ . When the same surface is illuminated with radiation of wavelength  $3\lambda$ , the stopping potential is  $\frac{V}{4}$ . If the threshold wavelength for the metallic surface is  $n\lambda$  then value of  $n$  will be \_\_\_\_\_.

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/tKketix3vu](https://www.prepwiser.in/questions/tKketix3vu)

**Q116** JEE Main 2020 · 9 Jan · Shift 1

Radiation, with wavelength  $6561 \text{ \AA}$  falls on a metal surface to produce photoelectrons. The electrons are made to enter a uniform magnetic field of  $3 \times 10^{-4} \text{ T}$ . If the radius of the largest circular path followed by the electrons is 10 mm, the work function of the metal is close to :

- (A) 1.8eV (B) 0.8eV  
(C) 1.1eV (D) 1.6eV

Step-by-step solution ► [prepwiser.in/questions/ZxxR8i3Mlf](https://www.prepwiser.in/questions/ZxxR8i3Mlf)

**Q117** JEE Main 2020 · 8 Jan · Shift 1

When photon of energy 4.0 eV strikes the surface of a metal A, the ejected photoelectrons have maximum kinetic energy  $T_A$  eV and de-Broglie wavelength  $\lambda_A$ . The maximum kinetic energy of photoelectrons liberated from another metal B by photon of energy 4.50 eV is  $T_B = (T_A - 1.5) \text{ eV}$ . If the de-Broglie wavelength of these photoelectrons  $\lambda_B = 2\lambda_A$ , then the work function of metal B is :

- (A) 1.5eV (B) 4eV  
(C) 2eV (D) 3eV

Step-by-step solution ► [prepwiser.in/questions/rDesjTwnhG](https://www.prepwiser.in/questions/rDesjTwnhG)

**Q118** JEE Main 2020 · 7 Jan · Shift 1

A beam of electromagnetic radiation of intensity  $6.4 \times 10^{-5} \text{ W/cm}^2$  is comprised of wavelength,  $\lambda = 310 \text{ nm}$ . It falls normally on a metal (work function  $\phi = 2\text{ eV}$ ) of surface area of  $1 \text{ cm}^2$ . If one in  $10^3$  photons ejects an electron, total number of electrons ejected in 1 s is  $10^x$ . ( $hc = 1240 \text{ eVnm}$ ,  $1\text{ eV} = 1.6 \times 10^{-19} \text{ J}$ ), then x is \_\_\_\_.

Numerical answer — enter the value.

Step-by-step solution ► [prepwiser.in/questions/CU40uwh\\_oZ](https://www.prepwiser.in/questions/CU40uwh_oZ)

## Davisson-Germer Experiment · 3 PYQs

**Q119** JEE Main 2023 · 31 Jan · Shift 1

Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R

Assertion A : The beam of electrons show wave nature and exhibit interference and diffraction.

Reason R : Davisson Germer Experimentally verified the wave nature of electrons.

In the light of the above statements, choose the most appropriate answer from the options given below :

- (A) A is not correct but R is correct.  
(B) Both A and R are correct and R is the correct explanation of A  
(C) Both A and R are correct but R is Not the correct explanation of A  
(D) A is correct but R is not correct

Step-by-step solution ► [prepwiser.in/questions/4mHhjyg6ES](https://www.prepwiser.in/questions/4mHhjyg6ES)

**Q120** JEE Main 2022 · 25 Jun · Shift 1

Given below are two statements :

Statement I : Davisson-Germer experiment establishes the wave nature of electrons.

Statement II : If electrons have wave nature, they can interfere and show diffraction.

In the light of the above statements choose the correct answer from the option given below :

(A) Both Statement I and Statement II are true.

(B) Both Statement I and Statement II are false.

(C) Statement I is true but Statement II is false.

(D) Statement I is false but Statement II is true.

[Step-by-step solution ► prepwiser.in/questions/fDpl\\_8MYPY](https://www.prepwiser.in/questions/fDpl_8MYPY)

**Q121** JEE Main 2020 · 5 Sep · Shift 1

A beam of electrons of energy  $E$  scatters from a target having atomic spacing of  $1 \text{ \AA}$ . The first maximum intensity occurs at  $\theta = 60^\circ$ . Then  $E$  (in eV) is \_\_\_\_\_.

(Planck constant  $h = 6.64 \times 10^{-34} \text{ Js}$ ,

$1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$ , electron

mass  $m = 9.1 \times 10^{-31} \text{ kg}$ )

Numerical answer — enter the value.

[Step-by-step solution ► prepwiser.in/questions/Qy5nXmlxjQ](https://www.prepwiser.in/questions/Qy5nXmlxjQ)

## Work Function and Threshold Frequency · 6 PYQs

**Q122** JEE Main 2025 · 3 Apr · Shift 1

The work function of a metal is  $3 \text{ eV}$ . The color of the visible light that is required to cause emission of photoelectrons is

(A) Red

(B) Green

(C) Blue

(D) Yellow

[Step-by-step solution ► prepwiser.in/questions/ZO4FOAAbGo](https://www.prepwiser.in/questions/ZO4FOAAbGo)

**Q123** JEE Main 2024 · 30 Jan · Shift 1

The work function of a substance is  $3.0 \text{ eV}$ . The longest wavelength of light that can cause the emission of photoelectrons from this substance is approximately;

(A)  $215 \text{ nm}$

(B)  $400 \text{ nm}$

(C)  $414 \text{ nm}$

(D)  $200 \text{ nm}$

[Step-by-step solution ► prepwiser.in/questions/O819OcUN7D](https://www.prepwiser.in/questions/O819OcUN7D)

**Q124** JEE Main 2024 · 27 Jan · Shift 2

The threshold frequency of a metal with work function  $6.63 \text{ eV}$  is :

(A)  $16 \times 10^{15} \text{ Hz}$

(B)  $16 \times 10^{12} \text{ Hz}$

(C)  $1.6 \times 10^{15} \text{ Hz}$

(D)  $1.6 \times 10^{12} \text{ Hz}$

[Step-by-step solution ► prepwiser.in/questions/0KcxOwp9PH](https://www.prepwiser.in/questions/0KcxOwp9PH)

**Q125** JEE Main 2023 · 13 Apr · Shift 1

The difference between threshold wavelengths for two metal surfaces A and B having work function  $\phi_A = 9\text{eV}$  and  $\phi_B = 4.5\text{eV}$  in nm is:

{ Given,  $hc = 1242\text{eVnm}$  }

(A) 264

(B) 138

(C) 540

(D) 276

[Step-by-step solution ► prepwiser.in/questions/DJuyWDnsfW](https://www.prepwiser.in/questions/DJuyWDnsfW)

**Q126** JEE Main 2023 · 11 Apr · Shift 1

A metallic surface is illuminated with radiation of wavelength  $\lambda$ , the stopping potential is  $V_0$ . If the same surface is illuminated with radiation of wavelength  $2\lambda$ , the stopping potential becomes  $\frac{V_0}{4}$ . The threshold wavelength for this metallic surface will be

(A)  $3\lambda$

(B)  $4\lambda$

(C)  $\frac{3}{2}\lambda$

(D)  $\frac{\lambda}{4}$

[Step-by-step solution ► prepwiser.in/questions/hYIB\\_FIPSu](https://www.prepwiser.in/questions/hYIB_FIPSu)

**Q127** JEE Main 2022 · 26 Jun · Shift 2

A metal surface is illuminated by a radiation of wavelength  $4500\text{ \AA}$ . The ejected photo-electron enters a constant magnetic field of 2 mT making an angle of  $90^\circ$  with the magnetic field. If it starts revolving in a circular path of radius 2 mm, the work function of the metal is approximately :

(A) 1.36 eV

(B) 1.69 eV

(C) 2.78 eV

(D) 2.23 eV

[Step-by-step solution ► prepwiser.in/questions/XGTJ2NDk2w](https://www.prepwiser.in/questions/XGTJ2NDk2w)

## Answer key — Dual Nature of Radiation & Matter

Numbers match the question numbers above. For full working, open the solution link under each question.

|     |    |     |    |     |   |     |   |     |     |     |    |     |   |     |     |
|-----|----|-----|----|-----|---|-----|---|-----|-----|-----|----|-----|---|-----|-----|
| 1   | 2  | 2   | B  | 3   | D | 4   | C | 5   | C   | 6   | A  | 7   | A | 8   | B   |
| 9   | C  | 10  | C  | 11  | A | 12  | C | 13  | B   | 14  | A  | 15  | A | 16  | C   |
| 17  | A  | 18  | A  | 19  | C | 20  | D | 21  | D   | 22  | C  | 23  | C | 24  | D   |
| 25  | B  | 26  | D  | 27  | D | 28  | D | 29  | A   | 30  | B  | 31  | B | 32  | B   |
| 33  | A  | 34  | C  | 35  | A | 36  | B | 37  | 910 | 38  | D  | 39  | C | 40  | C   |
| 41  | D  | 42  | C  | 43  | D | 44  | B | 45  | B   | 46  | D  | 47  | C | 48  | B   |
| 49  | B  | 50  | 10 | 51  | D | 52  | C | 53  | C   | 54  | D  | 55  | D | 56  | B   |
| 57  | C  | 58  | C  | 59  | B | 60  | C | 61  | B   | 62  | A  | 63  | B | 64  | D   |
| 65  | 5  | 66  | A  | 67  | C | 68  | A | 69  | D   | 70  | B  | 71  | A | 72  | B   |
| 73  | A  | 74  | C  | 75  | A | 76  | A | 77  | C   | 78  | B  | 79  | B | 80  | B   |
| 81  | D  | 82  | C  | 83  | A | 84  | C | 85  | C   | 86  | C  | 87  | D | 88  | B   |
| 89  | C  | 90  | B  | 91  | B | 92  | C | 93  | A   | 94  | B  | 95  | D | 96  | B   |
| 97  | 35 | 98  | 2  | 99  | B | 100 | B | 101 | D   | 102 | A  | 103 | B | 104 | 125 |
| 105 | B  | 106 | 4  | 107 | C | 108 | D | 109 | B   | 110 | 1  | 111 | D | 112 | 2   |
| 113 | C  | 114 | A  | 115 | 9 | 116 | C | 117 | B   | 118 | 11 | 119 | B | 120 | A   |
| 121 | 50 | 122 | C  | 123 | C | 124 | C | 125 | B   | 126 | A  | 127 | A |     |     |

### Want the next chapter?

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