

**Q1. JEE Main 2026 (21 January Shift 2)**

A particle having electric charge  $3 \times 10^{-19} \text{ C}$  and mass  $6 \times 10^{-27} \text{ kg}$  is accelerated by applying an electric potential of 1.21 V. Wavelength of the matter wave associated with the particle is  $\alpha \times 10^{-12} \text{ m}$ . The value of  $\alpha$  is \_\_\_\_ -  
(Take Planck's constant =  $6.6 \times 10^{-34} \text{ J.s}$ )

**Q2. JEE Main 2026 (23 January Shift 1)**

The de Broglie wavelength of an oxygen molecule at  $27^\circ \text{C}$  is  $x \times 10^{-12} \text{ m}$ . The value of  $x$  is (take Planck's constant =  $6.63 \times 10^{-34} \text{ J.s}$ , Boltzmann constant =  $1.38 \times 10^{-23} \text{ J/K}$ , mass of oxygen molecule =  $5.31 \times 10^{-26} \text{ kg}$ )

- (1) 24 (2) 26 (3) 30 (4) 20

**Q3. JEE Main 2026 (28 January Shift 2)**

Number of photons of equal energy emitted per second by a 6 mW laser source operating at 663 nm is \_\_\_\_.  
(Given :  $h = 6.63 \times 10^{-34} \text{ J.s}$  and  $c = 3 \times 10^8 \text{ m/s}$ )

- (1)  $2 \times 10^{16}$  (2)  $10 \times 10^{15}$   
(3)  $5 \times 10^{15}$  (4)  $5 \times 10^{16}$

**Q4. JEE Main 2026 (24 January Shift 2)**

When a light of a given wavelength falls on a metallic surface the stopping potential for photoelectrons is 3.2 V. If a second light having wavelength twice of first light is used, the stopping potential drops to 0.7 V. The wavelength of first light is \_\_\_\_ m. ( $h = 6.63 \times 10^{-34} \text{ J.s}$ ,  $e = 1.6 \times 10^{-19} \text{ C}$ ,  $c = 3 \times 10^8 \text{ m/s}$ )

- (1)  $2.5 \times 10^{-7}$  (2)  $2.2 \times 10^{-8}$   
(3)  $3.1 \times 10^{-7}$  (4)  $2.9 \times 10^{-8}$

**Q5. JEE Main 2026 (22 January Shift 2)**

Light is incident on a metallic plate having work function  $110 \times 10^{-20} \text{ J}$ . If the produced photoelectrons have zero kinetic energy then the angular frequency of the incident light is \_\_\_\_ rad/s. ( $h = 6.63 \times 10^{-34} \text{ J.s}$ ).

- (1)  $1.04 \times 10^{13}$  (2)  $1.04 \times 10^{16}$   
(3)  $1.66 \times 10^{16}$  (4)  $1.66 \times 10^{15}$

**Q6. JEE Main 2026 (21 January Shift 1)**

A light wave described by  $E = 60 [\sin(3 \times 10^{15})t + \sin(12 \times 10^{15})t]$  (in SI units) falls on a metal surface of work function 2.8 eV. The maximum kinetic energy of ejected photoelectron is (approximately) \_\_\_\_ eV.  
( $h = 6.6 \times 10^{-34} \text{ J.s}$  and  $e = 1.6 \times 10^{-19} \text{ C}$ )

- (1) 7.8 (2) 6.0 (3) 5.1 (4) 3.8

Q7. JEE Main 2026 (28 January Shift 1)

The ratio of de Broglie wavelength of a deuteron with kinetic energy  $E$  to that of an alpha particle with kinetic energy  $2E$ , is  $n : 1$ . The value of  $n$  is \_\_\_\_\_.

(Assume mass of proton = mass of neutron) :

## ANSWERS AND SOLUTIONS

1. 10      2. (2)      3. (1)      4. (1)      5. (2)      6. (3)      7. 2

1. (10) The de Broglie wavelength is  $\lambda = \frac{h}{mv}$  where  $v$  is found from energy conservation.

$$\text{From } qV = \frac{1}{2}mv^2: v = \sqrt{\frac{2qV}{m}} = \sqrt{\frac{2 \times 3 \times 10^{-19} \times 1.21}{6 \times 10^{-27}}} = \sqrt{1.21 \times 10^8} = 1.1 \times 10^4 \text{ m/s.}$$

$$\text{Therefore: } \lambda = \frac{6.6 \times 10^{-34}}{6 \times 10^{-27} \times 1.1 \times 10^4} = \frac{6.6 \times 10^{-34}}{6.6 \times 10^{-23}} = 10^{-11} \text{ m} = 10 \times 10^{-12} \text{ m.}$$

Thus  $\alpha = 10$ .

2. (2) The de Broglie wavelength is  $\lambda = \frac{h}{mv}$ . For an ideal gas,  $v_{rms} = \sqrt{\frac{3kT}{m}}$

$$\text{Therefore: } \lambda = \frac{h}{\sqrt{3mkT}}$$

$$\text{Substituting values: } \lambda = \frac{6.63 \times 10^{-34}}{\sqrt{3 \times 5.31 \times 10^{-26} \times 1.38 \times 10^{-23} \times 300}}$$

$$\lambda = \frac{6.63 \times 10^{-34}}{\sqrt{6.62 \times 10^{-46}}} = \frac{6.63 \times 10^{-34}}{2.57 \times 10^{-23}}$$

$$\lambda = 2.58 \times 10^{-11} \text{ m} = 25.8 \times 10^{-12} \text{ m, so } x \approx 26$$

3. (1) Power of laser:  $P = 6 \text{ mW} = 6 \times 10^{-3} \text{ J/s}$

Energy of a single photon at wavelength  $\lambda = 663 \text{ nm}$ :

$$E = h\nu = \frac{hc}{\lambda} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{663 \times 10^{-9}}$$

$$E = \frac{6.63 \times 3}{663} \times 10^{-34+8+9} = \frac{19.89}{663} \times 10^{-17} = 3 \times 10^{-19} \text{ J}$$

Number of photons emitted per second:

$$N = \frac{\text{Total Energy per second}}{\text{Energy per photon}} = \frac{6 \times 10^{-3}}{3 \times 10^{-19}} = 2 \times 10^{16}$$

4. (1) Using Einstein's photoelectric equation with stopping potentials:

$$\text{For first light, } h\nu_1 = \phi + eV_{s1}.$$

$$\text{For second light with } \lambda_2 = 2\lambda_1 \text{ (so } \nu_2 = \nu_1/2): h\nu_1/2 = \phi + eV_{s2}.$$

$$\text{From given values: } h\nu_1 - 3.2e = h\nu_1/2 - 0.7e \text{ gives } h\nu_1/2 = 2.5e.$$

$$\text{Thus } \lambda_1 = \frac{hc}{5e} = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{5 \times 1.6 \times 10^{-19}} \approx 2.5 \times 10^{-7} \text{ m.}$$

5. (2) From Einstein's photoelectric equation,  $h\nu = W + KE$ .

With zero kinetic energy,  $h\nu = W$ .

$$\text{The frequency is } \nu = \frac{W}{h} = \frac{110 \times 10^{-20}}{6.63 \times 10^{-34}} = 16.59 \times 10^{14} \text{ Hz.}$$

$$\text{The angular frequency is } \omega = 2\pi\nu = 2\pi \times 16.59 \times 10^{14} \\ = 104.25 \times 10^{14} = 1.04 \times 10^{16} \text{ rad/s.}$$

6. (3) Light contains two frequencies:  $\omega_1 = 3 \times 10^{15} \text{ rad/s}$  and  $\omega_2 = 12 \times 10^{15} \text{ rad/s}$

For maximum KE, use higher frequency  $\omega_2$ .

$$\text{Energy: } E_2 = \frac{h\omega_2}{2\pi} = \frac{6.6 \times 10^{-34} \times 12 \times 10^{15}}{2\pi}$$

$$= \frac{79.2 \times 10^{-19}}{6.28} = 12.6 \times 10^{-19} \text{ J} = 7.9 \text{ eV}$$

$$KE_{max} = E_2 - \phi = 7.9 - 2.8 = 5.1 \text{ eV}$$

7. (2) The de Broglie wavelength is  $\lambda = \frac{h}{\sqrt{2mE}}$ .

$$\text{For a deuteron (mass } m_d = 2m_p) \text{ with energy } E: \lambda_d = \frac{h}{\sqrt{2 \cdot 2m_p \cdot E}} = \frac{h}{\sqrt{4m_p E}}$$

$$\text{For an alpha particle (mass } m_\alpha = 4m_p) \text{ with energy } 2E: \lambda_\alpha = \frac{h}{\sqrt{2 \cdot 4m_p \cdot 2E}} = \frac{h}{\sqrt{16m_p E}}$$

$$\text{The ratio: } \frac{\lambda_d}{\lambda_\alpha} = \frac{\sqrt{16m_p E}}{\sqrt{4m_p E}} = \sqrt{4} = 2$$