DPP – 4

Video Solution on Website:- https://physicsaholics.com/home/courseDetails/46

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Q 1. One electron & one proton is accelerated by equal potential. Ratio in their de-broglie wavelength is-

(a) $\sqrt{\frac{m_p}{m_e}}$ (b) $\frac{m_e}{m_p}$

(c) $\frac{m_p}{m_e}$ (d) 1

Q 2. The de-Broglie wavelength associated with an electron having a kinetic energy of 10 eV is

(a) 10 Å (b) 12.27 Å (c) 3.9 Å (d) 0.10 Å

Q 3. A double slit interference experiment is performed by a beam of electrons of energy 100 eV and the fringe spacing is observed to be β. Now if the electrons energy is increased to 10 keV, then the fringe spacing -

(a) remains the same (b) becomes 10β

(c) becomes 100β (d) becomes β/10

Q 4. If E_1, E_2 and E_3 are the respective kinetic energies of an electron, an alpha particle and a proton, each having the same de Broglie wavelength, then

(a) $E_1 > E_3 > E_2$ (b) $E_2 > E_3 > E_1$

(c) $E_1 > E_2 > E_3$ (d) $E_1 = E_2 = E_3$

Q 5. If the momentum of electron is changed by P_m then the De Broglie wavelength associated with it changes by 0.50 %. The initial momentum of electron will be -

(a) $\frac{P_m}{200}$ (b) $\frac{P_m}{100}$ (c) 200 Pm (d) 400 Pm

Q.6 The thermal energy of a particle at temperature T°K is kT, then the associated de-Broglie wavelength will be -

(a) h/mkT (b) $\frac{h}{\sqrt{2mkT}}$

(b) $\frac{h}{2mkT}$ (d) $\frac{2h}{mkT}$

Q 7. Wrong statement in connection with Davisson-Germer experiment is -

(a) The inter-atomic distance in nickel crystal is of the order of the de- Broglie wavelength

(b) Electrons of constant energy are obtained by the electron gun

(c) Nickel crystal acts as a three-dimensional diffracting grating

(d) Davission-Germer experiment is a photoelectric experiment

Q 8. In Davisson-Germer experiment the relation between Bragg's angle θ and glancing angle ϕ is -

(a) $\theta = 90^\circ - \phi$ (b) $\theta = \frac{90^\circ - \phi}{2}$

(c) $\theta = 180^\circ - \phi$ (d) $\phi = \left(\frac{180^\circ - \theta}{2}\right)$

Q 9. The de-Broglie wavelength of a vehicle moving with velocity v is λ. Its load is changed so that the velocity as well as the kinetic energy are doubled. Then the new de-Broglie wavelength of the vehicle will be -

(a) λ (b) 2λ (c) λ/2 (d) λ/4

Q 10. An electron is confined to a tube of length L. The electron's potential energy in one half of the tube is zero, while the potential energy in the other half is 10 eV. If the electron has a total energy E = 15 eV, then the ratio of the de-Broglie wavelength of the electron in the 10 eV region of the tube to that in the other half is -

(a) $1/\sqrt{3}$ (b) $\sqrt{3}$ (c) 3 (d) $\frac{1}{3}$

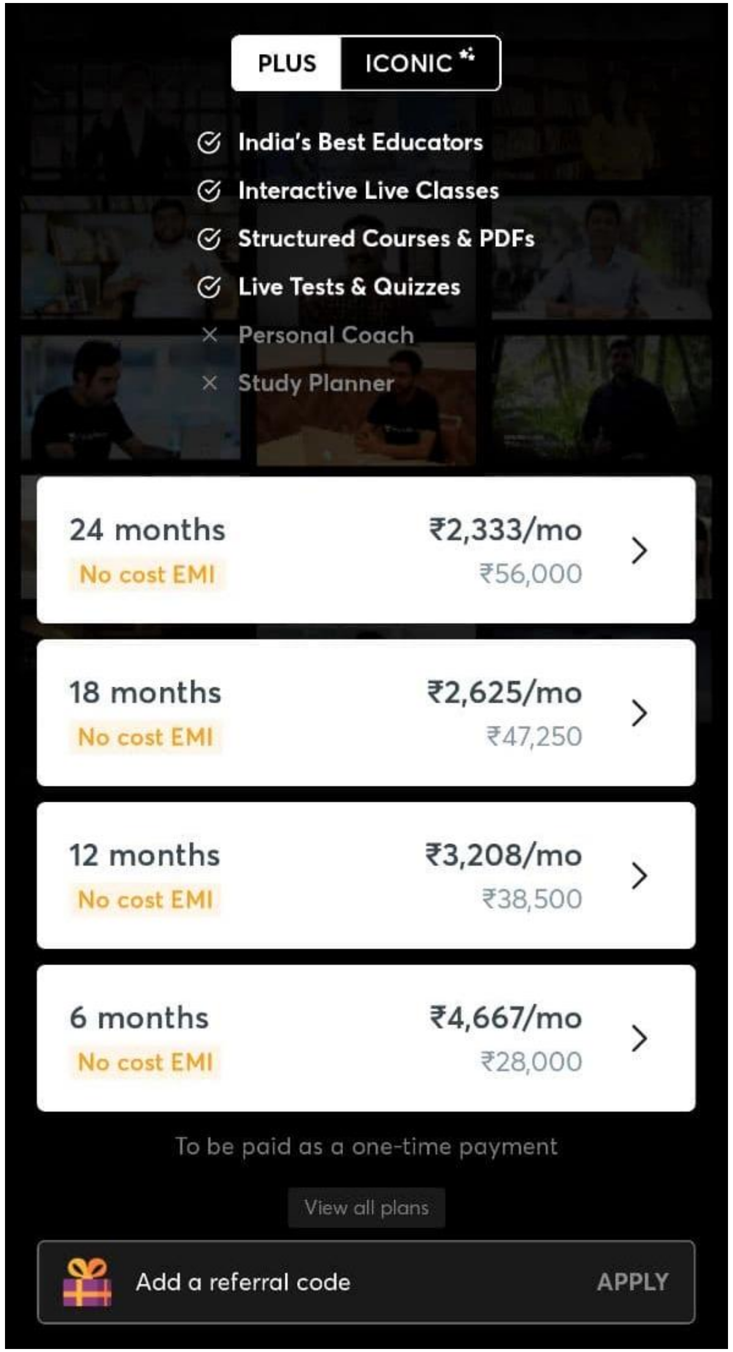
Q 11. In majority of crystals the value of lattice constant is of the order of 3Å. The proper X-rays with which the crystal structure can be studied are –

(a) 50Å to 100 Å (b) 10Å to 50 Å

(c) 5Å to 10 Å (d) 0.1Å to 2.7 Å

Answer Key

Q.1 a	**Q.2 c**	**Q.3 d**	**Q.4 a**	**Q.5 c**
Q.6 b	**Q.7 d**	**Q.8 d**	**Q.9 a**	**Q.10 b**
Q.11 d				



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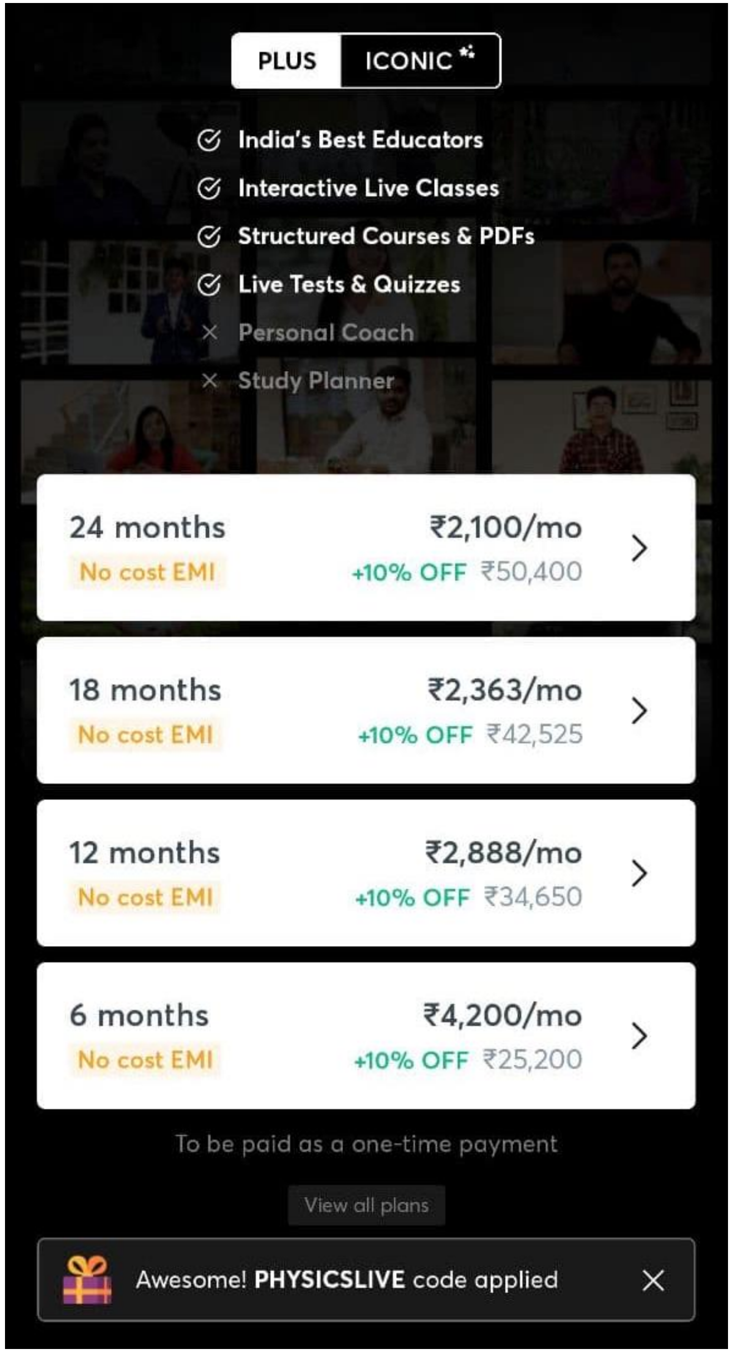

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Written Solution

DPP- 4: Matter Waves, Bragg's Law, Davission-Germer Experiment

By Physicsaholics Team

Q1) One electron & one proton is accelerated by equal potential difference. Ratio in their de-broglie wavelength is-

q , V

$KE = qV$

$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mqV}}$

$\frac{\lambda_e}{\lambda_p} = \sqrt{\frac{m_p}{m_e}}$

(a) $\sqrt{\frac{m_p}{m_e}}$ ✓

(b) $\frac{m_e}{m_p}$

(c) $\frac{m_p}{m_e}$

(d) 1

Q2) The de-Broglie wavelength associated with an electron having a kinetic energy of 10 eV is

$$\lambda_{de} = \frac{h}{\sqrt{2mE}} = \frac{6.6\times10^{-34}}{\sqrt{2\times9.1\times10^{-31}\times10\times1.6\times10^{-19}}} = \frac{6.6\times10^{-9}}{\sqrt{2\times145.6}}$$

$$= \frac{6.6\times10^{-10}}{\sqrt{291.2}} = \frac{6.6}{17}\times10^{-10}$$

(a) 10 Å (b) 12.27 Å (c) 3.9 Å (d) 0.10 Å

Q3) A double slit interference experiment is performed by a beam of electrons of energy 100 eV and the fringe spacing is observed to be β. Now if the electrons energy is increased to 10 keV, then the fringe spacing -

$$\beta = \frac{\lambda D}{d} \propto \lambda \propto \frac{h}{\sqrt{2mE}}$$

$$\beta \propto \frac{1}{\sqrt{E}}$$

(a) remains the same

(b) becomes 10β

(c) becomes 100β

(d) becomes β/10 ✓

Q4) If E_1, E_2 and E_3 are the respective kinetic energies of an electron, an alpha particle and a proton, each having the same de Broglie wavelength, then

same λ → $\lambda_{de} = \frac{h}{p}$ → same p

$KE = \frac{p^2}{2m} \Rightarrow KE \propto \frac{1}{m}$

(a) $E_1 > E_3 > E_2$ ✓

(b) $E_2 > E_3 > E_1$

(c) $E_1 > E_2 > E_3$

(d) $E_1 = E_2 = E_3$

Q5) If the momentum of electron is changed by P_m then the De Broglie wavelength associated with it changes by 0.50 % . The initial momentum of electron will be -

$$\lambda_{de} = \frac{h}{p}$$

$$\Rightarrow \left(\frac{\Delta\lambda}{\lambda} \times 100\right) = -\frac{\Delta P}{P} \times 100$$

$$\Rightarrow .5 = \frac{P_m}{P} \times 100$$

(a) $\frac{P_m}{200}$ (b) $\frac{P_m}{100}$ (c) 200 Pm (d) 400 Pm

$$P = 200 P_m$$

Q6) The thermal energy of a particle at temperature T°K is kT, then the associated de-Broglie wavelength will be -

$$\lambda_{dl} = \frac{h}{p} = \frac{h}{\sqrt{2m(KE)}} = \frac{h}{\sqrt{2mkT}}$$

(a) h/mkT

(b) $\frac{h}{\sqrt{2mkT}}$

(b) $\frac{h}{2mkT}$

(d) $\frac{2h}{mkT}$

Q7) Wrong statement in connection with Davisson-Germer experiment is -

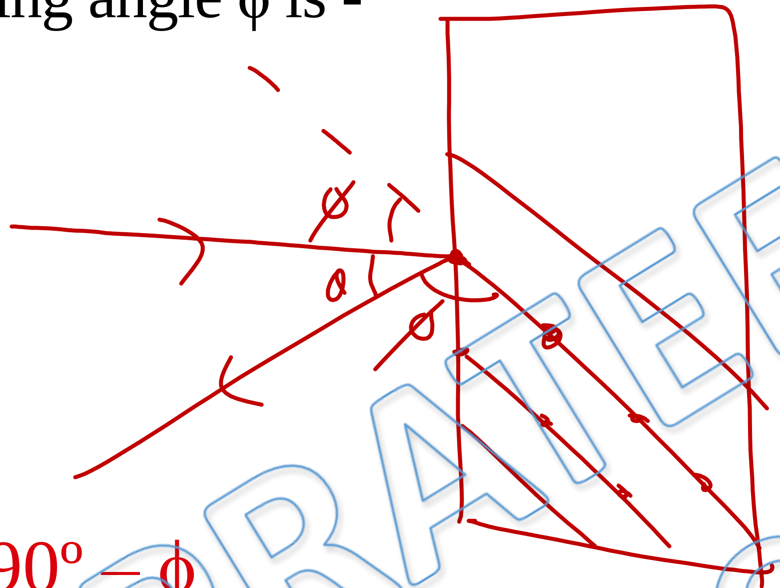
(a) The inter-atomic distance in nickel crystal is of the order of the de-Broglie wavelength of electron

(b) Electrons of constant energy are obtained by the electron gun

(c) Nickel crystal acts as a three dimensional diffracting grating

(d) Davission-Germer experiment is an photoelectric experiment

Q8) In Davisson-Germer experiment the relation between Bragg's angle θ and glancing angle ϕ is -



(a) $\theta = 90^o - \phi$

(b) $\theta = \dfrac{90^o - \varphi}{2}$

$2\phi + \theta = 180$

(c) $\theta = 180^o - \phi$

$\phi = \left(\dfrac{180 - \theta}{2}\right)$

(d) $\phi = \left(\dfrac{180^o - \theta}{2}\right)$

Q9) The de-Broglie wavelength of a vehicle moving with velocity v is λ. Its load is changed so that the velocity as well as the kinetic energy are doubled. Then the new de-Broglie wavelength of the vehicle will be -

$$\lambda = \frac{h}{mv}$$

m → ½ times, v → 2 times

$$KE = \frac{1}{2}mv^2$$

KE → 2 times, v^2 → 4 times

(a) λ ✓　　(b) 2λ　　(c) λ/2　　(d) λ/4

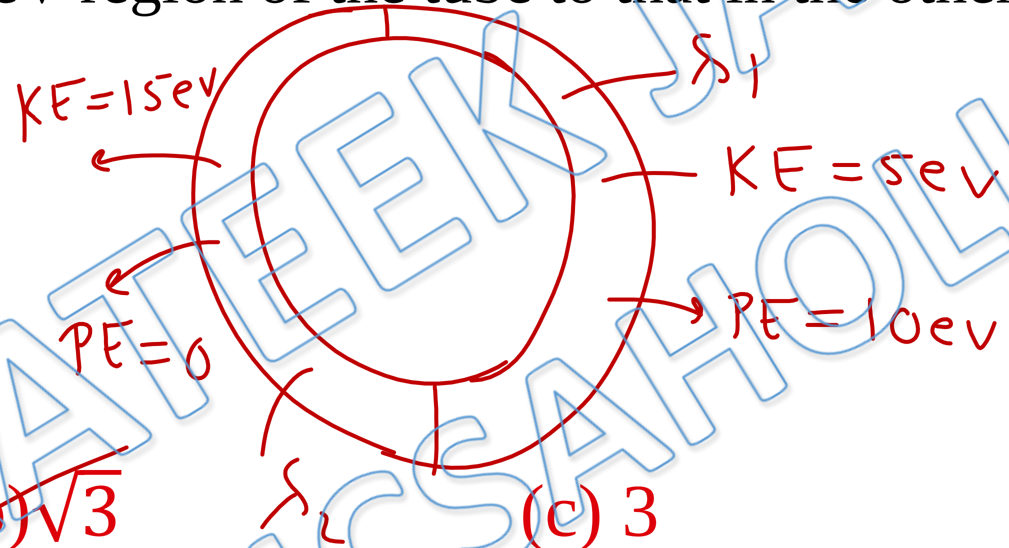
$$m = \frac{2(KE)}{v^2}$$

KE → 2 times, v^2 → 4 times, m → ½ times

Q10) An electron is confined to a tube of length L. The electron's potential energy in one half of the tube is zero, while the potential energy in the other half is 10 eV. If the electron has a total energy E = 15 eV, then the ratio of the de-Broglie wavelength of the electron in the 10 eV region of the tube to that in the other half is -

$$\lambda \propto \frac{1}{\sqrt{KE}}$$

$$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{KE_2}{KE_1}}$$



(a) $1/\sqrt{3}$ (b) $\sqrt{3}$ (c) 3 (d) $\frac{1}{3}$

$$= \sqrt{\frac{15\,eV}{5\,eV}}$$

$$= \sqrt{3}$$

Q11) In majority of crystals the value of lattice constant is of the order of 3Å. The proper X-rays with which the crystal structure can be studied are -

(a) 50Å to 100 Å

(b) 10Å to 50 Å

(c) 5Å to 10 Å

(d) 0.1Å to 2.7 Å

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Chalo Niklo