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Subject: Physics

Vol-I → II

+2 - one mark Book Back Problems

L. No. 1

(3) Count the number of lines on each charge

(4) $\tau = PE \sin\theta$ $[\because 2l = 1\, cm]$

$\therefore P = q \times 2l$

$\tau = q \times 2l \times E \times \sin\theta$

$\tau = q \times 1 \times 10^{-2} \times 2 \times 10^{5} \times \sin 30^\circ$

$8 = q \times 1 \times 10^{-2} \times 2 \times 10^{5} \times \frac{1}{2}$

$8 = q \times 1 \times 10^{3}$

$\therefore q = \frac{8}{10^3} = 8 \times 10^{-3} = \boxed{8\, mC}$

(6) $\phi = \frac{q}{\varepsilon_0} = \frac{q}{\varepsilon_0 \varepsilon_r} = \frac{2q}{80 \varepsilon_0}$

$= \boxed{\frac{q}{40 \varepsilon_0}}$

(8) $U = K \frac{q_1 q_2}{r}$

i) $U = \frac{-Kq^2}{r}$ ii) $U = \frac{Kq^2}{r}$

iii) $U = \frac{2Kq^2}{r}$ iv) $U = \frac{-K2q^2}{2r}$

$U = \frac{-Kq^2}{r}$

(9) $E = -\frac{dV}{dx}$

$dV = E\, dx$

$dV = 10 \times 2 = \boxed{20\, V}$

(11) $W_{A \to B} = (V_A - V_B)\, q$ $[\because q = ne]$

$= (7+4)\, ne$

$= 11 \times 50 \times 1.6 \times 10^{-19}$

$\boxed{W_{A \to B} = 8.8 \times 10^{-17}}$

(14) $C_s = \frac{1}{2} + \frac{1}{2} + \frac{1}{1}$

$= \frac{1+1+2}{2} = \frac{4}{2} = \boxed{2}$

(15) $\frac{q_1}{R_1} = \frac{q_2}{R_2}$

$[\because q_2 = 3q_1]$

$q_1 + q_2 = 4 \times 10^{-2}\, C$

$q_1 + 3q_1 = 4 \times 10^{-2}\, C$

$4q_1 = 4 \times 10^{-2}\, C$

$q_1 = 10^{-2}\, C$

$q_2 = 3 \times 10^{-2}\, C$

L. No. 2

(1) $R = \frac{V}{I} = \frac{2}{1} = \boxed{2\, \Omega}$

$R = \frac{4}{2} = \boxed{2\, \Omega}$

2) circumference of circle $= 2\pi r$

Resistance of wire $= 2 \times 2\pi$

Resistance of each section $= \frac{4\pi}{2}$

$= 2\pi$

equivalent resistance $= \frac{2\pi \times 2\pi}{2\pi + 2\pi}$

$= \frac{4\pi^2}{4\pi} = \boxed{\pi}$

3) $P = V \times I$

$= V \times \frac{V}{R} = \frac{V^2}{R}$

$= \frac{240 \times 240}{120} = \boxed{480\ w}$

6) $R \propto \frac{1}{r^2}$, $R_A = \frac{1}{r_1^2}$

$R_B = \frac{1}{r_2^2}$

$\frac{1}{r_1^2} = 3 \frac{1}{r_2^2} \Rightarrow \frac{r_1^2}{r_2^2} = \frac{1}{3}$

$\boxed{\frac{r_1}{r_2} = \frac{1}{\sqrt{3}}}$

7) $P_1 = \frac{V^2}{R}$, $P_2 = \frac{V^2}{R/4}$

$\frac{P_2}{P_1} = \frac{\left(\frac{V^2}{\frac{R}{4}}\right)}{\left(\frac{V^2}{R}\right)} = \frac{V^2}{\frac{R}{4}} \times \frac{R}{V^2}$

$\boxed{\frac{P_2}{P_1} = 4R}$

8) $P = \frac{V^2}{R}$

$R = \frac{V^2}{P}$

$\frac{R'}{R} = \frac{V_1^2}{V_2^2} = \frac{110 \times 110}{220 \times 220}$

$\frac{R'}{R} = \frac{1}{4}$

$\boxed{R' = \frac{R}{4}}$

9) $15 \times 40 = 600$

$5 \times 100 = 500$

$5 \times 80 = 400$

$1 \times 1000 = 1000$

25000

$P = V \times I$

$I = \frac{P}{V} = \frac{2500\not{0}}{22\not{0}} = \frac{2500}{22}$

$= \boxed{11.4A}$

10) Kirchaf's voltage Rule

$V = IR$

$9 = (3 \times 1) + (2.5 \times 1) + (P \times 1)$

$9 = 3 + 2.5 + P$

$9 = 5.5 + P$

$P = 9 - 5.5 = \boxed{3.5\ \Omega}$

11) $I = V/R$

$\frac{1}{R_p} = \frac{1}{15} + \frac{1}{15} + \frac{1}{15} = \frac{3}{15} = \boxed{\frac{1}{5}}$

$\boxed{\therefore R_p = 5\ \Omega}$

$I = \frac{V}{R} = \frac{5}{5} = \boxed{1\ A}$

13) $r = \left[\frac{E - V}{V}\right] R$

$E = 2.1V$

$V = IR$

$= 0.2 \times 10$

$\boxed{V = 2V}$

$r = \left[\frac{2.1 - 2}{2}\right] 10$

$= \frac{0.1}{2} \times 10 = \boxed{0.5\ \Omega}$

L.NO.3

(4) $m = NIA \quad [\because A = \pi r^2]$

$= 50 \times 3 \times 3.14 \times (5 \times 10^{-2})^2$

$\boxed{m = 1.2 \text{ Amp-m}^2}$

(5) $B = \dfrac{\mu_0 N I}{2(b-a)} \ln\left(\dfrac{b}{a}\right)$

$= \dfrac{4 \times 3.14 \times 10^{-7} \times 100 \times 8 \times 10^{-3}}{2[100-50]} \ln\left[\dfrac{100}{50}\right]$

$\boxed{B = 6.9 \times 10^{-6}\, T}$

(12) $B = \dfrac{\mu_0}{4\pi} \dfrac{m}{(d^2+l^2)^{3/2}}$

$B_1 = \dfrac{4\pi \times 10^{-7} \times 1.2}{4\pi[(0.1)^2 + (0.005)^2]^{3/2}}$

$\boxed{B_1 = 1.1955 \times 10^{-4}\, wb/m^2}$

$B_2 = \dfrac{4\pi \times 10^{-7} \times 1}{4\pi[(0.10)^2 + (0.005)^2]^{3/2}}$

$\boxed{B_2 = 1.1963 \times 10^{-4}\, wb/m^2}$

$B_{TOT} = B_1 + B_2 + B_{earth}$

$= (1.1955 + 1.1963) \times 10^{-4} + 0.36$

$\boxed{B_{TOT} = 2.56 \times 10^{-4}\, wb/m^2}$

(3) $B_H = B_E \cos I$

$B_V = B_E \sin I$

$\dfrac{B_E \sin I}{B_E \cos I} = 1$

$\tan I = 1$

$\boxed{I = 45^0}$

L.NO.4

(3) $\varepsilon = -\dfrac{d\phi}{dt}$

$\varepsilon = -\dfrac{d}{dt}(10t^2 - 50t + 250)$

$= -[20t - 50] \quad [\because t = 3s]$

$\varepsilon = -20t + 50$

$\varepsilon = (-20 \times 3) + 50$

$\varepsilon = -60 + 50 = \boxed{-10V}$

(4) $\varepsilon = -L \dfrac{dF}{dt}$

$8 = L\left[\dfrac{(2+2)}{0.05}\right] = L\left(\dfrac{4}{0.05}\right)$

$L = \dfrac{0.40}{4} = \boxed{0.1\ H}$

(6) $m = \mu_0 N_1 N_2 A_2$

$= 4\pi \times 10^{-7} \times 1500 \times 10 \times 4 \times 10^{-4}$

$\boxed{m = 7.54 \times 10^{-6}\ H}$

(4) $\varepsilon = -L\left(\dfrac{di}{dt}\right)$

$L = -\dfrac{\varepsilon}{(di/dt)} = \dfrac{\varepsilon}{\left(\dfrac{i_2 - i_1}{dt}\right)}$

$= -\dfrac{8}{\left(\dfrac{-2-2}{0.05}\right)} = -\dfrac{8}{\left(\dfrac{-4}{0.05}\right)} = \dfrac{8 \times 0.05}{4}$

$\boxed{L = 0.1 H}$

(7) $\dfrac{N_s}{N_p} = \dfrac{I_p}{I_s}$

$\dfrac{1230}{410} = \dfrac{6}{I_s}$

$I_s = \dfrac{6 \times 410}{1230}$

$\boxed{I_s = 2A}$

(8) Primary power $= 220 \times 6 = 1320\,W$

secondary power $= 11 \times 100 = 110\,W$

efficiency $= \dfrac{\text{secon. pow}}{\text{pri. pow}} = \dfrac{1100}{1320}$

$\boxed{\eta = 0.833}$

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(9) $\tan^{-1}\left[\dfrac{X_C}{R}\right] = \dfrac{\pi}{3}$

$\tan^{-1}\left[\dfrac{X_L}{R}\right] = \pi/3$

$\therefore X_L = X_C$

power factor = 1

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(10) $\tan\phi = \dfrac{X_L}{R} = 1$

$\phi = \tan^{-1}(1) = 45^0$ (or) $\boxed{\pi/4}$

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(11) $R = 100\,\Omega$, $V_R = 40V$, $\omega = 2\pi\nu = 250\,rad/s$

$C = 4\,\mu F$, $V_C = ?$

At resonance C and L are same

$I = \dfrac{V}{Z} = \dfrac{V}{R} = \dfrac{40}{100} = 0.4\,A$

$X_C = \dfrac{1}{\omega_c} = \dfrac{1}{250 \times 4 \times 10^{-6}}$

$\boxed{X_C = 10^3\,\Omega}$ $\therefore X_L = X_C$

$V_L = I X_C = 0.4 \times 10^3 = \boxed{400V}$

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(12) $L = 20\,mH$, $C = 50\,\mu F$, $R = 40\,\Omega$

$V = 10 \sin 340 t$

$P_{av} = I_v^2 R = \left[\dfrac{\varepsilon_V}{2}\right]^2 \cdot R$

$= \left[\dfrac{10}{\sqrt{2}}\right]^2 \cdot 40 \left[\dfrac{1}{(40)^2 + [340 \times 20 \times 10^{-3} - \dfrac{1}{340 \times 50 \times 10^{-6}}]}\right]$

$= \dfrac{100}{2} \times 40 \times \dfrac{1}{1600 + (6.8 - 58.8)^2}$

$P_{avg} = \dfrac{2000}{1600 + 2704} = \boxed{0.46\,W}$

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(15) $\omega = 2\pi\nu = 2\pi \times 50 = 100\pi$

$\omega = 314$

$X_L = X_C$

$\omega L = \dfrac{1}{\omega C}$

$C = \dfrac{1}{L\omega^2} = \dfrac{1}{(100\pi)^2 \times \dfrac{20}{\pi^2}}$

$C = \dfrac{1}{2 \times 10^5} = 0.5 \times 10^{-5} = \boxed{5\,\mu F}$

L.No.5

(2) $C = \dfrac{E_0}{B_0}$, $E_0 = C B_0$

$E_0 = 3 \times 10^8 \times 3 \times 10^{-6}$

$\boxed{E_0 = 900\,Vm^{-1}}$

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(5) $C = \nu\lambda$

$\lambda = \dfrac{C}{\nu} = \dfrac{3 \times 10^8}{300 \times 10^6} = \boxed{1\,m}$

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(7) $C = \dfrac{E_{rms}}{B_{rms}}$

$B_{rms} = \dfrac{E_{rms}}{C}$

$B_{rms} = \dfrac{B_0}{\sqrt{2}}$

$B_0 = \sqrt{2}\,\dfrac{E_{rms}}{C}$

$B_0 = \dfrac{1.414 \times 3}{3 \times 10^8}$

$\boxed{B_0 = 1.414 \times 10^{-8}\,T}$

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(13) $E = E_0 \sin[10^6 x - \omega t]$

$E = E_0 \sin[kx - \omega t]$

$K = 10^6$

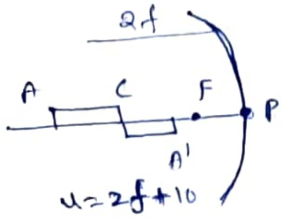
$k = \dfrac{\omega}{c}$

$\omega = kc = 10^6 \times 3 \times 10^8$

$\boxed{\omega = 3 \times 10^{14}\,rad\,s^{-1}}$

L.NO.6

(2)



$$\frac{1}{f} = \frac{1}{V_A} + \frac{1}{u}$$

$$\frac{1}{-10} = \frac{1}{V_A} + \frac{1}{(-30)}$$

$V_A = -15\,cm$, $V_C = -20\,cm$

length of the image is

$= |V_A - V_C|$

$= |-15-(20)| = \boxed{5\,cm}$

(4) $n = 2$, $i = 90^\circ$

$$n = \frac{\sin i}{\sin r}$$

$$\sin r = \frac{\sin i}{n} = \frac{\sin 90^\circ}{2}$$

$$\sin r = \frac{1}{2}$$

$\therefore r = \sin^{-1}\left(\frac{1}{2}\right) = \boxed{30^\circ}$

(8)
$$\frac{1}{f} = \frac{2(n-1)}{R}$$

$$f = \frac{R}{2(n-1)} = \frac{10}{2(1.5-1)} = \frac{10}{2(0.5)}$$

$\boxed{f = 10\,cm}$

(9) $n = 1.5$, $d' = nd$

one side of bubble depth is 5cm

original depth $= 1.5 \times 5 = \boxed{7.5\,cm}$

on other side depth is 3 cm

original depth $= 1.5 \times 3 = \boxed{4.5\,cm}$

Thickness is $= 7.5 + 4.5$

$= \boxed{12\,cm}$

L.NO.7

(2) Resolution limit $= 1.22 \times \frac{\lambda}{D}$

$D = 3\,mm$, $\lambda = 500\,nm$

Resolu limit $= \frac{\text{distan bet the dots}}{\text{Resol diameter}}$

$= \frac{1\,mm}{d}$

$$\frac{1.22\lambda}{D} = \frac{1\,mm}{d}$$

$$\therefore d = \frac{(1\,mm \times D)}{1.22\lambda} = \frac{1\times10^{-3} \times 3\times10^{-3}}{1.22 \times 500\times10^{-9}}$$

$d = 4.918 \approx \boxed{5\,m}$

(4) $I_{max} = I_1 + I_2 + 2\sqrt{I_1 I_2}$

$= I + 4I + 2\sqrt{4I^2}$

$= 5I + 2\times 2I = 5I + 4I$

$\boxed{I_{max} = 9I}$

$I_{min} = I_1 + I_2 - 2\sqrt{I_1 I_2}$

$= I + 4I - 2\sqrt{4I^2}$

$= I + 4I - 2\times 2I = I + 4I - 4I$

$\boxed{I_{min} = I}$

(5) $d = 5\times10^{-5}\,cm$, $\lambda = 5320\,A^\circ$, $n = 2$

For visible region $\boxed{n=2}$

$\mu = ?$

$$2\mu d = (2n+1)\frac{\lambda}{2}$$

$$\mu = \frac{(2n+1)\lambda}{4d} = \frac{5\times 5.32\times10^{-7}}{4\times5\times10^{-7}}$$

$\boxed{\mu = 1.33}$

$\lambda = a \sin\theta = 1\times10^{-7}\times\sin 30^\circ$

$\boxed{\lambda = 500\, A}$

$n = \tan i_p = \tan 60^\circ$

$\boxed{n = \sqrt{3}}$

L. NO. 8

(2) $\lambda \propto \frac{1}{\sqrt{V}}$, $\lambda_1 = \frac{1}{\sqrt{V_1}}$

$\lambda_2 = \frac{1}{\sqrt{V_2}}$

$\frac{\lambda_1}{\lambda_2} = \sqrt{\frac{V_1}{V_2}} = \sqrt{\frac{224}{14}} = \sqrt{16} = \boxed{4}$

$\lambda_1 = 4\lambda_2$

$\lambda_2 = \lambda_1/4$

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(3) $\lambda_p = \lambda_e$; $\frac{h}{P_p} = \frac{h}{P_e}$

$P_p = P_e$

$m_p v_p = m_e v_e$

$v_p = \frac{m_e v_e}{m_p} = \frac{9.1\times10^{-31}\times 6\times10^{6}}{3\times10^{-9}}$

$\boxed{v_p = 1.82\times10^{-15}\, m s^{-1}}$

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(4) $\phi_0 = \frac{hc}{\lambda} - eV$ — (1)

$\phi_0 = \frac{hc}{2\lambda} - \frac{eV}{4}$

$4\phi_0 = \frac{2hc}{\lambda} - eV$ — (2)

(2) = (1)

$3\phi_0 = \frac{3hc}{\lambda_0} = \frac{hc}{\lambda_0}$

$\boxed{\lambda_0 = 3\lambda}$

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(5) $K_{max} = \frac{hc}{\lambda} - \phi_0$

$= \frac{6.626\times10^{-34}\times3\times10^{8}}{330\times10^{-9}} - (3.55\times1.6\times10^{-19})$

$\boxed{K_{max} = 0.32\times10^{-19} J}$

$\lambda_e = \frac{h}{\sqrt{2mK_{max}}}$

$\lambda_e = \frac{6.626\times10^{-34}}{\sqrt{2\times9.1\times10^{-31}\times0.32\times10^{-19}}}$

$\boxed{\lambda_e = 2.746\times10^{-9}\, m}$

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(8) $h\nu = \phi_0 + \frac{1}{2}mv^2$

$v = \sqrt{\frac{2(h\nu - \phi_0)}{m}}$

$\frac{v_1}{v_2} = \sqrt{\frac{h\nu_1 - \phi_{01}}{h\nu_2 - \phi_{02}}} = \sqrt{\frac{0.9-0.6}{3.3-0.6}}$

$= \sqrt{\frac{0.3}{2.7}} = \sqrt{\frac{1}{9}} = \boxed{\frac{1}{3}}$

$\boxed{v_1 : v_2 = 1:3}$

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(9) $E = nh\nu = \frac{nhc}{\lambda}$

$P = \frac{E}{t} = \frac{nhc}{\lambda}$; $P \propto \frac{n}{\lambda}$

$\therefore \frac{P_2}{P_1} = \frac{n_2\lambda_1}{n_1\lambda_2}$

$= \frac{1.38\times10^{15}\times520\times10^{-9}}{1.04\times10^{15}\times460\times10^{-9}}$

$\boxed{\frac{P_2}{P_1} = 1.5}$

(10) $E = \frac{nhc}{\lambda}$, $P = \frac{E}{t} = \frac{nhc}{\lambda t}$

$\therefore n = \frac{P\lambda t}{hc} = \frac{3.8 \times 10^{-26} \times 550 \times 10^{-9} \times 1}{1.986 \times 10^{-25}}$

$\boxed{n = 1.052 \times 10^{45}}$

(11) $\phi_0 = \frac{hc}{\lambda_0}$

$\lambda_0 = \frac{hc}{\phi_0} = \frac{6.626 \times 10^{-34} \times 3 \times 10^{8}}{3.313 \times 1.6 \times 10^{-19}}$

$\boxed{\lambda_0 = 3750\ A^0}$

(12) $K_{max} = h\nu - \phi_0 = \frac{hc}{\lambda} - \phi_0$

$= \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{500 \times 10^{-9}} - (1.235 \times 1.6 \times 10^{-19})$

$= 1.984 \times 10^{-19} J$

$K_{max} = \frac{1.984 \times 10^{-19}}{1.6 \times 10^{-19}} = \boxed{1.24 eV}$

L.NO. 9

(2) $L = n\hbar$, $n = 4$

$L = 4\hbar = 4 \frac{h}{2\pi} = \boxed{\frac{2h}{\pi}}$

(3) $V_{ion} = \frac{13.6}{n^2} z^2$

$122.4 = \frac{13.6}{n^2} z^2$, $n = 1$

$z^2 = \frac{122.4 \times 1}{13.6} = 9$

$\boxed{z = 3}$

(4) $r_n \propto n^2$

$\boxed{r_1 : r_2 : r_3 = 1 : 4 : 9}$

(6) $\frac{e}{m} = \frac{E}{B^2 R} \Rightarrow B^2 = m\left[\frac{E}{eR}\right]$

$\therefore B \propto \sqrt{m}$

$B \propto \sqrt{208} = \boxed{14.4}$

(7) $\lambda \propto \frac{1}{z^2}$

$\lambda_{Li} : \lambda_{He} : \lambda_H = \frac{1}{9} : \frac{1}{4} : \frac{1}{1}$

$\boxed{\lambda_{Li} : \lambda_{He} : \lambda_H = 4 : 9 : 36}$

(9) $\frac{R_{Cu}}{R_{Al}} = \frac{R_0 (64)^{1/3}}{R_0 (27)^{1/3}} = \frac{4}{3}$

$\frac{R_{Cu}}{R_{Al}} = \frac{4}{3} \Rightarrow R_{Cu} = \frac{4}{3} R_{Al}$

$= 3.6 \times \frac{4}{3} = \boxed{4.8}$

(10) $\Delta m = 0.0424$

$1u = 931\ meV$

$B.E = 0.042 \times 931$

$= 39.102\ meV$

$\frac{BE}{A} = \frac{39.102}{7} = \boxed{5.6\ meV}$