LIBERTY PAPER SET

STD. 12 : Physics

Full Solution

Time : 3 Hours **ASSIGNTMENT PAPER 3**

Section A

1. (B) **2.** (C) **3.** (A) **4.** (D) **5.** (B) **6.** (D) **7.** (C) **8.** (C) **9.** (B) **10.** (B) **11.** (D) **12.** (B) **13.** (C) **14.** (A)
15. (D) **16.** (B) **17.** (B) **18.** (C) **19.** (D) **20.** (C) **21.** (A) **22.** (B) **23.** (D) **24.** (A) **25.** (B) **26.** (A) **27.** (D)
28. (C) **29.** (A) **30.** (D) **31.** (B) **32.** (C) **33.** (A) **34.** (A) **35.** (C) **36.** (C) **37.** (D) **38.** (C) **39.** (B) **40.** (C)
41. (C) **42.** (B) **43.** (B) **44.** (A) **45.** (B) **46.** (A) **47.** (D) **48.** (A) **49.** (D) **50.** (D)

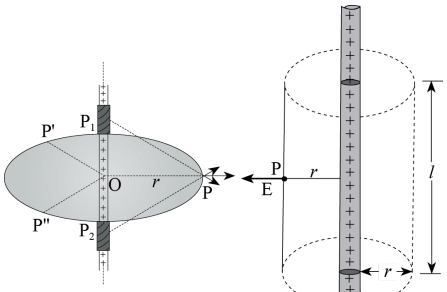
Liberty

Section A

➢ **Write the answer of the following questions : (Each carries 2 Mark)**

1.

➥



➥ Consider an infinitely long thin straight wire with uniform linear charge density λ.

➥ Suppose we take the radial vector from O to P and rotate it around the wire. The points P, P', P" so obtained are completely equivalent with respect to the charged wire.

➥ This implies that the electric field must have the same magnitude at these points.

➥ The direction of electric field at every point must be radial (outward if $\lambda > 0$, inward if $\lambda < 0$).

➥ Consider a pair of line elements P_1 and P_2 of the wire, as shown in Fig. (a)

➥ The electric fields produced by the two elements of the pair when summed, give a resultant electric field which is radial (the components normal to the radial vector cancel).

➥ This is true for any such pair and hence the total field at any point P is radial.

➥ The electric field is everywhere radial in the plane cutting the wire normally, and its magnitude depends only on the radial distance *r*.

➥ To calculate the field, imagine a cylindrical Gaussian surface, as shown in the Fig. (b).

➥ Since the field is everywhere radial, flux through the two ends of the cylindrical Gaussian surface is zero.

φ = Flux through the curved surface of the cylinder

$\therefore \varphi = \vec{E} \cdot \vec{S}$

$\therefore \varphi = ES \cos 0 \ (\vec{E} \parallel \vec{S})$

$\therefore \varphi = E(2\pi rl)$ (S - area of curved surface) ... (1)

➥ As per Gauss's law, $\varphi = \frac{q}{\varepsilon_0}$

but $q = \lambda l$ (electric charge surrounded by Gaussian surface)

$\therefore \varphi = \frac{\lambda l}{\varepsilon_0}$ ... (2)

➥ Comparing equation (1) and equation (2),

$E(2\pi rl) = \frac{\lambda l}{\varepsilon_0}$

$E = \frac{1}{2\pi\varepsilon_0} \cdot \frac{\lambda}{r}$

➥ Electric field in vector form,

$\vec{E} = \frac{1}{2\pi\varepsilon_0} \cdot \frac{\lambda}{r} \hat{n}$

Where, $\hat{n}$ is unit vector in the direction of electric field.

OR

$\vec{E} = \frac{2k\lambda}{r} \hat{n} \left[\text{where } k = \frac{1}{4\pi\varepsilon_o}\right]$

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2.

➥ $R_0 = 100\ \Omega \quad R = 134\ \Omega \quad \alpha = 1.70 \times 10^{-4}\ °C^{-1}$
$T_0 = 27\ °C \quad T = ?$

$$R = R_0[1 + \alpha (T - T_0)],$$
$$\therefore \quad 134 = 100[1 + 1.70 \times 10^{-4} (T - 27)]$$
$$\therefore \quad 1.34 = 1 + 1.70 \times 10^{-4} (T - 27)$$
$$\therefore \quad 1.34 - 1 = 1.70 \times 10^{-4} (T - 27)$$
$$\therefore \quad \frac{0.34}{1.7 \times 10^{-4}} = T - 27$$
$$\therefore \quad 2000 = T - 27$$
$$\therefore \quad T = 2027\ °C$$

3.

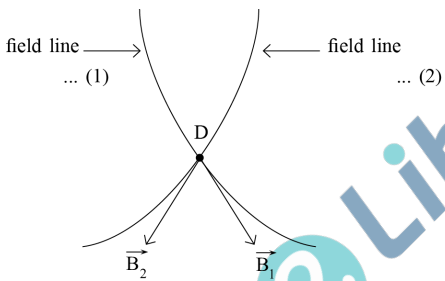
➥ Characteristics of magnetic field lines are as follows :

(i) The magnetic field lines form continuous closed loops. In the region outside a magnet, the magnetic field lines are from N to S, whereas in the region inside the magnet, the field lines are from S to N.

(ii) The tangent to the field line at a given point represents the direction of the magnetic field ($\vec{B}$) at that point.

(iii) The larger the number of field lines crossing per unit area, the stronger is the magnitude of the magnetic field $\vec{B}$.

(iv) Two magnetic field lines do not intersect each other. Because if they do, at the point of intersection, the magnetic field would have two directions, which is not possible.



4.

➥ (I) $\varepsilon_2 = -M_{21} \frac{dI_1}{dt}$

If $\frac{dI_1}{dt} = 1\ \frac{A}{S}$

so, $\varepsilon_2 = -M_{21}$

➥ *"In a system consisting of two windings; if the rate of change of current in one winding is unity, the* emf *induced in the other winding is called mutual inductance of the two winding system."*

➥ (II) $\varphi_2 = M_{21} I_1$

➥ If $I_1 = 1$ A thus $\varphi_2 = M_{21}$

➥ *"In a system consisting of two windings; when the current through one winding is unity the magnetic flux associated with the other winding is called the mutual inductance of the system of two winding.*

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Mutual inductance depends on the following factors :

(1) shape of coil

(2) their dimensions

(3) Number of turns

(4) Magnetic properties of the medium between the coil

(5) Their relative bowing

(6) Their relative distance.

➥ Unit : H, $\frac{Wb}{A}$, $\frac{Vs}{A}$

➥ Dimensional Formula : $M^1L^2T^{-2}A^{-2}$

5.

➥ Voltage applied to the AC circuit $\upsilon = \upsilon_m \sin \omega t$

➥ Current passing through the circuit containing only resistor,

$i = i_m \sin \omega t$

Where, $i_m = \frac{\upsilon_m}{R}$

i_m = Current amplitude (/amplitude of current)

➥ Necessary graphs of voltage and current are shown in the figure.

➥ Values of both, applied voltage and current vary sinusoidally and have corresponding positive and negative values during each cycle.

➥ Thus, the sum of the instantaneous current values over one complete cycle is zero and the average current is zero.

➥ The fact that the average current is zero, does not mean that the average power consumed is zero and that there is no dissipation of electrical energy.

➥ As we know, joule heating is given by $i^2 Rt$ and depends on i^2. Which is always positive (whether i is positive or negative), So, the dissipated power is not zero.

➥ The instantaneous power dissipated in the resistor is,

$\therefore p = i^2 R$

$\therefore p = i^2_m R \sin^2 \omega t$

➥ The average value of p over a cycle is

$\overline{p} = < i^2_m R \sin^2 \omega t >$

$\therefore \overline{p} = i^2_m R < \sin^2 \omega t > \ldots (1)$

➥ $< \sin^2 \omega t > = \left\langle \frac{1 - \cos 2\omega t}{2} \right\rangle$

$= \left\langle \frac{1}{2} \right\rangle - \left\langle \frac{\cos 2\omega t}{2} \right\rangle$

But $\left\langle \frac{1}{2} \right\rangle = \frac{1}{2}$

and $\left\langle \frac{\cos 2\omega t}{2} \right\rangle = 0$

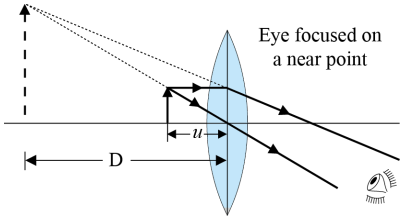
$\therefore < \sin^2 \omega t > = \frac{1}{2}$

➥ From equation (1),

$< P > = \overline{p} = \frac{i_m^2 R}{2}$

➥ There is maximum power dissipation in an AC circuit containing only resistive component.

6.



- A simple microscope is a converging lens of small focal length.
- As shown in figure in order to use such a lens as microscope, the lens is held near the object, one focal length away or less, and eye is positioned close to the lens on the other side.
- Here the object is placed in front of the lens in such a way that an erect, magnified and virtual image can be viewed at a near point. (see figure.)
- For simple microscope magnification

$$m = \frac{\upsilon}{u} \ldots (1)$$

- Applying lens formula,

$$\frac{1}{\upsilon} - \frac{1}{u} = \frac{1}{f}$$

$$\therefore \frac{1}{u} = \frac{1}{\upsilon} - \frac{1}{f} \ldots (2)$$

- Substituting value of equation (2) in equation (1),

$$\text{magnification } m = \upsilon\left(\frac{1}{\upsilon} - \frac{1}{f}\right)$$

$$\therefore m = 1 - \frac{\upsilon}{f}$$

- but from sign convention we get $\upsilon = -D$.

$$\therefore m = 1 + \frac{D}{f}$$

7.

- $$\text{Nuclear matter density} = \frac{\text{mass}}{\text{Volume}}$$

$$\therefore \rho = \frac{m}{V} \ldots (1)$$

- Nucleus is in the form of sphere so volume of nucleus $V = \frac{4}{3}\pi R^3$ (R is radius)
- Let average mass of the nucleus be m and mass no. of nucleus be A.

  Mass of nucleus $M = mA$
- Substituting this values in equation (1),

$$\therefore \rho = \frac{mA}{\frac{4}{3}\pi R^3}$$

$$\text{but } R = R_0 A^{\frac{1}{3}}$$

$$\therefore \rho = \frac{mA}{\frac{4}{3}\pi R_0^3 A}$$

$$\therefore \rho = \frac{m}{\frac{4}{3}\pi R_0^3} = \text{constant}$$

- Thus, the nuclear matter density is constant. Hence, nuclear density is independent of the atomic mass number.

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8.

	p - type semiconductor	*n* - type semiconductor
1.	Trivalent impurity is added in pure semiconductor.	Pentavalent impurity is added in pure semiconductor.
2.	Exa. Boron, A*l*, I*n*.	Exa. Phosphorous, Antimony, Arsenic etc.
3.	Holes are majority charge carriers and free electrons are the minority carriers.	Free electrons are the majority charge carriers and holes are the minority carriers.
4.	$n_h >> n_e$	$n_e >> n_h$
5.	Electricity conduction primarily occurs due to holes.	Electricity conduction primarily occurs due to motion of electrons.

9.

(i) Gauss's law is true for any closed surface, no matter what its shape or size is.

As per Gauss's law, $\varphi = \int \vec{E} \cdot \vec{dS} = \frac{\sum q}{\varepsilon_0}$ ... (1)

(ii) The term q on the right side of Gauss's law, Eq. (1), includes the sum of all charges enclosed by the surface. The charges may be located anywhere inside the surface.

(iii) In the situation when the surface is so chosen that there are some charges inside and some outside, the electric field [whose flux appears on the left side of Eq. (1)] is due to all the charges, both inside and outside S. The term q on the right side of Gauss's law, however, represents only the total charge inside S.

(iv) The surface that we choose for the application of Gauss's law is called the Gaussian surface.

You may choose any Gaussian surface and apply Gauss's law.

(v) Gauss's law is often useful towards a much easier calculation of the electrostatic field when the system has some symmetry. This is facilitated by the choice of a suitable Gaussian surface.

(vi) Finally, Gauss's law is based on the inverse square dependence on distance contained in the Coulomb's law.

10.

(1) $\oint \vec{E} \cdot \vec{dA} = \frac{Q}{\varepsilon_o}$ (Gauss's Law for electricity)

(2) $\oint \vec{B} \cdot \vec{dA} = 0$ (Gauss's Law for magnetism)

(3) $\oint \vec{E} \cdot \vec{dl} = \frac{-d\phi_B}{dt}$ (Faraday's Law)

(4) $\oint \vec{B} \cdot \vec{dl} = \propto_0 i_c + \propto_0 \varepsilon_0 \frac{d\phi_E}{dt}$

(Ampere – Maxwell Law)

11.

"When electron in a metal possessing sufficient energy, the phenomenon of electrons leaving the metal is called electron emission."

Types of Electron Emission :

The energy required to eject an electron from a metal can be given in different ways. There are three types of electron emission based on it.

➥ (i) Thermionic emission :

➥ Properly heating the metal gives thermal energy to the electrons in it. By absorbing this energy, electrons can escape from the metal.

➥ (ii) Field emission :

➥ Applying a very strong electric field (of the order of 10^8 Vm^{-1}) to the metal can pull electrons out of the metal.

➥ (iii) Photo electric emission :

➥ When light of sufficient frequency is incident on a metal surface, electrons are emitted from the metal. This phenomenon is called photoelectric effect and the emitted electrons are called photo-electrons.

12.

➥ According to the third postulate of Bohr's model, when an atom makes a transition from the higher energy state with quantum number n_i to the lower energy state with quantum number n_f ($n_f < n_i$), the difference of energy is carried away by a photon of frequency v_{if} such that

$$h\,v_{if} = E_{ni} - E_{nf}$$

➥ Since both n_f and n_i are integers, this shows that in transitions between different atomic levels, light is radiated in various discrete frequencies.

➥ The various lines in the atomic spectra are produced when electrons jump from higher energy state to a lower energy state and photons are emitted. These spectral lines are called emission lines.

➥ On the other hand, when an atom absorbs a photon that has the same energy needed by the electron in a lower energy state to make transitions to a higher energy state, the process is called absorption.

➥ Thus, if photons with a continuous range of frequencies pass through a rarefied gas and then are analysed with a spectrometer, a series of dark spectral absorption lines appear in the continuous spectrum. The dark lines indicate the frequencies that have been absorbed by the atoms of the gas.

Section B

➢ **Write the answer of the following questions : (Each carries 3 Mark)**

13.

➥ $T_0 = 0\ °C$ | $R_0 = 5\ \Omega$
$T_1 = 100\ °C$ | $R_1 = 5.23\ \Omega$
$T_2 = ?$ | $R_2 = 5.795\ \Omega$

➥ from equation

$$R = R_0[1 + \alpha(T - T_0)]$$

But, $T_0 = 0\ °C$

$$R = R_0(1 + \alpha T)$$

$$\therefore R = R_0 + R_0\,\alpha T$$

$$\therefore R - R_0 = R_0\alpha T$$

from above equation

➥ $R_1 - R_0 = R_0\alpha T_1$ ... (1)

and $R_2 - R_0 = R_0\alpha T_2$ ... (2)

➥ Taking ratio of equation (2) and (1)

$$\frac{R_2 - R_0}{R_1 - R_0} = \frac{R_0\alpha\, T_2}{R_0\alpha\, T_1}$$

$$\frac{5.795 - 5}{5.23 - 5} = \frac{T_2}{100}$$

$$\therefore T_2 = \frac{0.795 \times 100}{0.23}$$

$$= 345.65\ °C$$

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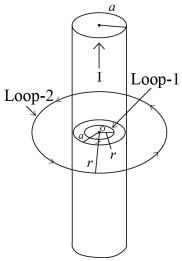
14.

➥ (i) For a point outside the wire ($r > a$)

➠ As shown in the figure, assume the Amperian loop labelled as '2' is a circle concentric with the cross-section.



➠ For this loop,

$L = 2\pi r$

➠ Current enclosed by loop $I_e = I$

➠ From Ampere's circuital law

$BL = \propto_0 I_e$

$\therefore B(2\pi r) = \propto_0 I$

$\therefore B = \frac{\mu_0 I}{2\pi r}$

$\therefore B \alpha \frac{1}{r}$ $(r \geq a)$

(ii) For a point inside the wire ($r < a$)

➠ As shown in the figure consider an Amperian loop indicated as '1' is a circle concentric with the cross-section.

➠ For this loop, $L = 2\pi r$

➠ Current enclosed by loop,

Area Current

$\pi a^2 \rightarrow I$

πr^2 (?)

$\therefore I_e = \frac{\pi r^2}{\pi a^2} \cdot I$

$\therefore I_e = \frac{r^2}{a^2} \cdot I$

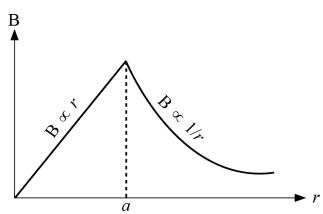
➠ From Ampere's circuit law,

$BL = \propto_0 I_e$

$\therefore B(2\pi r) = \propto_0 \frac{r^2}{a^2} \cdot I$

$\therefore B = \frac{\mu_0 I}{2\pi a^2} \cdot r$

$\therefore B \alpha r$ $(r \leq a)$



➥ Figure shows the graph of magnetic field versus distance from the centre of the wire.

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15.

➥ $\lambda_1 = 650$ nm, $\lambda_2 = 520$ nm

➥ (a) $n = 3$ (bright fringe)

$D = 90$ cm, $d = 0.15$ cm

➥ path difference for constructive

interference = $n\lambda$ where, $n = 0, 1, 2, 3 \ldots$

but path difference = $\frac{xd}{D}$

$\therefore \frac{xd}{D} = n\lambda_1$

$\therefore x = \frac{n\lambda_1 D}{d}$

$\therefore x = \frac{3 \times 650 \times 10^{-9} \times 90 \times 10^{-2}}{0.15 \times 10^{-2}}$

$\therefore x = 1170000 \times 10^{-9}$

$\therefore x = 1.17 \times 10^{-3}$ m

$\therefore x = 1.17$ mm

➥ (b) Suppose, at some minimum distance x on the screen, from its central bright (central maximum) fringe, the n_1^{th} order bright fringe of light with wavelength $\lambda_1 = 650$ nm superposes on the n_2^{th} order bright fringe of light with wavelength $\lambda_2 = 520$ nm.

➥ Hence, the path difference for both is same.

$\therefore n_1\lambda_1 = n_2\lambda_2$

$\therefore \frac{n_1}{n_2} = \frac{\lambda_2}{\lambda_1} = \frac{520}{650}$

$\therefore \frac{n_1}{n_2} = \frac{4}{5}$ ... (1)

since, $\frac{n_1}{n_2} = \frac{4}{5}$, to find the minimum.

(/ least) distance, we must take the values of n_1 and n_2 minimum, which must satisfy the above equation.

Thus, we get $n_1 = 4$ and $n_2 = 5$.

➥ Now, for the light having wavelength λ_1,

Path difference = $n_1\lambda_1 = \frac{xd}{D}$

$x = \frac{n_1\lambda_1 D}{d}$

$\therefore x = \frac{4 \times 650 \times 10^{-9} \times 90 \times 10^{-2}}{0.15 \times 10^{-2}}$

$\therefore x = 1560000 \times 10^{-9}$

$\therefore x = 1.56 \times 10^{-3}$ m

$\therefore x = 1.56$ mm

➥ Thus, both the bright fringes will superpose on each other at distance 1.56 mm from the central maximum.

16.

➥ $\varphi_0 = 2.14$ eV

$V_0 = 0.60$ V

$v_0 = ?$

$\lambda = ?$

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➥ (a) The cut off or threshold frequency

$\varphi_0 = hv_0$

$\therefore v_0 = \frac{\phi_0}{h}$

$= \frac{2.14 \times 1.6 \times 10^{-19}}{6.625 \times 10^{-34}}$

$v_0 = 0.5163 \times 10^{15}$ Hz

$v_0 = 5.16 \times 10^{14}$ Hz

➥ (b) Einstein's photoelectric equation is

$K_{max} = hv - \varphi_0$

but $K_{max} = eV_0$

$\therefore eV_0 = \frac{hc}{\lambda} - \varphi_0 \; (C = v\lambda)$

$\therefore \frac{hc}{\lambda} = eV_0 + \varphi_0$

$\therefore \frac{hc}{\lambda} = (1.6 \times 10^{-19} \times 0.60) + (2.14 \times 1.6 \times 10^{-19})$

$\therefore \frac{hc}{\lambda} = 1.6 \times 10^{-19} \; (0.60 + 2.14)$

$\therefore \frac{hc}{\lambda} = 4.384 \times 10^{-19}$

$\therefore \lambda = \frac{6.625 \times 10^{-34} \times 3 \times 10^{8}}{4.384 \times 10^{-19}}$

$\therefore \lambda = 4.54 \times 10^{-7}$ m

$= 454 \times 10^{-9}$ m

$\lambda = 454$ nm

17.

➥ n = Number of turns per unit length

$n = 15 \; \frac{\text{turns}}{\text{cm}}$

$= 1500 \; \frac{\text{turns}}{\text{m}}$

➥ $A = 2 \text{ cm}^2$

$= 2 \times 10^{-4} \text{ m}^2$

$I_1 = 2A$

$I_2 = 4A$

$\Delta t = 0.1$ sec

➥ Induced *emf*

$|\varepsilon| = \frac{\Delta\phi}{\Delta t}$

$\therefore |\varepsilon| = \frac{\phi_2 - \phi_1}{\Delta t}$

$\therefore |\varepsilon| = \frac{B_2 A - B_1 A}{\Delta t}$

$\therefore |\varepsilon| = \frac{\mu_0 n I_2 A - \mu_0 n I_1 A}{\Delta t}$

$\therefore |\varepsilon| = \frac{\mu_0 n A (I_2 - I_1)}{\Delta t}$

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$$\therefore |\varepsilon| = \frac{4\pi \times 10^{-7} \times 1500 \times 2 \times 10^{-4}(4-2)}{0.1}$$

$$\therefore |\varepsilon| = 753600 \times 10^{-11}$$

$$\therefore |\varepsilon| = 7.54 \times 10^{-6} \text{ V}$$

$$\therefore |\varepsilon| = 7.54 \propto \text{V}$$

18.

➥ $V = 220$ V

$\upsilon = 50$ Hz

$C = 15\ \mu F$

(i) Capacitive reactance (X_C)

$$X_C = \frac{1}{\omega C}$$

$$= \frac{1}{2\pi \upsilon C}$$

$$\therefore X_C = \frac{1}{2 \times 3.14 \times 50 \times 15 \times 10^{-6}}$$

$$\therefore X_C = \frac{1000000}{4710}$$

$$\therefore X_C = 212.3\ \Omega$$

(ii) rms value of the electric current,

$$I = \frac{V}{X_C}$$

$$= \frac{220}{212.3}$$

$$\therefore I = 1.04 \text{ A}$$

(iii) Amplitude (maximum value) of electric current,

$$I_m = \sqrt{2}\ I$$

$$= 1.414 \times 1.04$$

$$I_m = 1.47 \text{ A}$$

(iv) If the frequency is doubled, the capactive reactance X_C becomes half as per formula :

$$X_C = \frac{1}{\omega C}$$

$$= \frac{1}{2\pi f C}$$

➥ Since X_C becomes half, current I becomes double as per $I = \frac{V}{X_C}$.

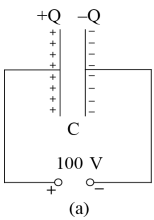
19.

➥ (a) Energy stored in capacitor,

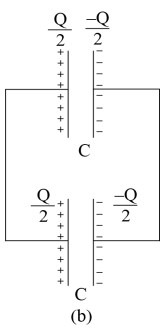
$$U = \frac{1}{2} CV^2$$

$$U = \frac{1}{2} \times 900 \times 10^{-12} \times (100)^2$$

$$\therefore U = 4.5 \times 10^{-6} \text{ J}$$



(a)



(b)

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➠ Charge on the capacitor

$Q = CV$

$Q = 900 \times 10^{-12} \times 100$

$Q = 9 \times 10^{-8}$ C

(b) As shown in fig. (b), if battery is removed and instead of that, another capacitor (having no charge) whose capacitance is 900 *p*F is connected, charge is distributed equally on both the capacitors.

Therefore the charge on each capacitor will be $\frac{Q}{2}$ but total charge Q remains constant.

➠ For the parallel connection shown in fig. (b), equivalent capacitance will be C' = 2C

Total P.E. stored by the system will be :

$$U' = \frac{Q^2}{2C'}$$

$$\therefore U' = \frac{Q^2}{2(2C)}$$

$$\therefore U' = \frac{(9 \times 10^{-8})^2}{2 \times 2 \times 900 \times 10^{-12}}$$

$\therefore U' = 2.25 \times 10^{-6}$ J

Remember

In doing the given connection, electric charge remains constant yet the energy stored becomes half compared to the initial energy. Because, there is some transient period before the system settles down to situation (b). During this, a transient current flows from the first capacitor to the second.

Energy is lost during this time in the form of heat and electro magnetic radiation.

20.

➠ (i) When prism is in air,

$D_m = 40°$ $A = 60°$ $n_a = n_1 = 1$

$n_2 = n_g = ?$

➠ refractive index of prism w.r.t. air,

$$n_{ga} = \frac{\sin\left(\frac{D_m + A}{2}\right)}{\sin\frac{A}{2}}$$

$$\therefore \frac{n_g}{n_a} = \frac{\sin\left(\frac{40+60}{2}\right)}{\sin\left(\frac{60}{2}\right)}$$

$$\therefore n_g = \frac{\sin 50}{\sin 30}$$

$\therefore n_g = 2 \times 0.7660$

$\therefore n_g = 1.532$

➠ (ii) When the prism is placed in water,

$D_m' = (?)$ $A = 60°$ $n_1 = n_w = 1.33$

$n_2 = n_g = 1.532$

➠ Index of prism w.r.t.,

$$n_{gw} = \frac{\sin\left(\frac{D_m' + A}{2}\right)}{\sin\frac{A}{2}}$$

$$\therefore \frac{n_g}{n_w} = \frac{\sin\left(\frac{D_m' + 60}{2}\right)}{\sin\left(\frac{60}{2}\right)}$$

$$\therefore \frac{1.532}{1.33} = \frac{\sin\left(\frac{D_m' + 60}{2}\right)}{\sin 30}$$

Liberty

$\therefore 1.1518 = 2 \times sin\left(\frac{D_m' + 60}{2}\right)$

$\therefore 0.5759 = sin\left(\frac{D_m' + 60}{2}\right)$

$\therefore \frac{D_m' + 60}{2} = 35°10'$

$\therefore D_m' + 60° = 70°20'$

$\therefore D_m' = 10°20'$

21.

➥ $r = 1.5 \times 10^{11}$ m

$\upsilon = 3 \times 10^4$ m/s

$m = 6 \times 10^{24}$ kg

$n = ?$

➥ According to Bohr hypothesis, angular momentum

$L = \frac{nh}{2\pi}$

$\therefore m\upsilon r = \frac{nh}{2\pi}$ ($\because L = mvr$)

$\therefore n = \frac{2\pi m\upsilon r}{h}$

$\therefore n = \frac{2 \times 3.14 \times 6 \times 10^{24} \times 3 \times 10^4 \times 1.5 \times 10^{11}}{6.625 \times 10^{-34}}$

$\therefore n = 25.59 \times 10^{73}$

$\therefore n = 2.6 \times 10^{74}$

Liberty

Section C

➢ **Write the answer of the following questions : (Each carries 4 Mark)**

22.

➥ $A = 90\ cm^2 = 90 \times 10^{-4}\ m^2$

$d = 2.5\ mm = 2.5 \times 10^{-3}$ m

$V = 400$ V

Potential energy $U = \frac{1}{2} CV^2$

for capacitance C is $C = \varepsilon_0 \cdot \frac{A}{d}$

$\varepsilon_0 = 8.85 \times 10^{-12}$ F/m

A = area of the plate (m^2)

d = distance between plate

capacitance $C = (8.85 \times 10^{-12}) \cdot \frac{90 \times 10^{-4}}{2.5 \times 10^{-3}}$

$= (8.85 \times 10^{-12}) \cdot 3.6 \times 10^{-2}$

$C = 3.186 \times 10^{-3}$ F

for Potential energy $U = \frac{1}{2} \times (3.186 \times 10^{-13})\ (400)^2$

$= \frac{1}{2} (3.186 \times 10^{-13})\ 160000$

$U = 2.5488 \times 10^{-8}$ J

$= 2.55 \times 10^{-8}$ J

$= 2.55\ \mu J$