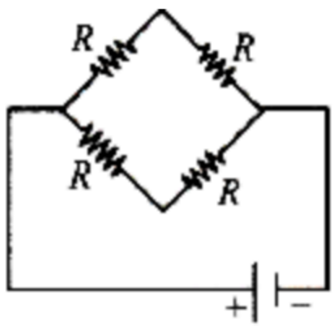
Pre-Board Examination : 2025-26
Sub : Physics

(The figures in the margin indicate full marks for the questions)

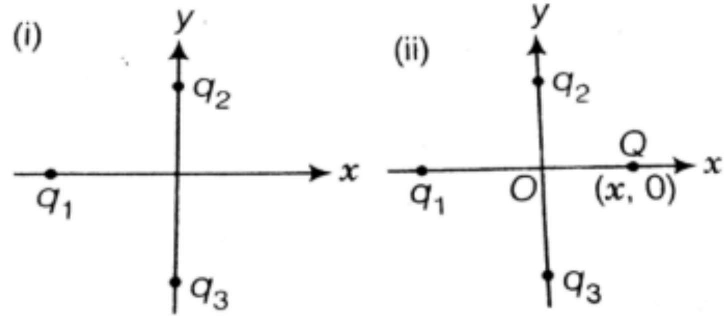
Time – 3 hours **Full marks-70**

Section A (Each question carries 1 mark)	
1	In a Wheatstone bridge, all the four arms have equal resistance R. if resistance of the galvanometer arm is also R, then equivalent resistance of the combination is (a) R (b) 2R (c) R/2 (d) R/4
Ans	In balance Wheatstone bridge, the galvanometer arm can be neglected so equivalent resistance = R 
2	When a ferromagnetic material is heated above the curie temperature it becomes: (a) Diamagnetic (b) Paramagnetic (c) Strongly charged (d) Non-Magnetic
Ans	(b) Paramagnetic
3	One requires 11 eV of energy to dissociate a

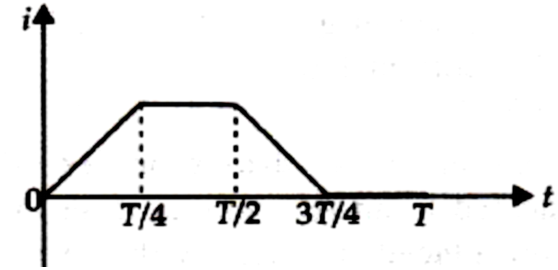
	carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in (a) visible region (b) infrared region (c) ultraviolet region (d) microwave region
Ans	One requires 11eV of energy to dissociate a carbon monoxide molecule into carbon and oxygen atoms. The minimum frequency of the appropriate electromagnetic radiation to achieve the dissociation lies in **ultraviolet region.** Explanation: Given energy required to dissociate a carbon monoxide molecule into carbon and oxygen atoms E = 11eV We know that E= hν, where h= 10^{-34}J-s v = frequency $\Rightarrow 11\ eV = h\nu$ $\Rightarrow v = \frac{11 \times 1.6 \times 10^{-19}}{6.62 \times 10^{-34}} J = 2.65 \times 10^{15}$ Hz This frequency radiation belongs to ultraviolet region.
4	In an experiment of single slit diffraction, the width of a slit 1.2μm and the angular width of centre maximum is observed to be equal to π/3 find the wavelength of light (a) 6 A° (b) 60 A° (c) 600A° (d) 6000A°

Ans	Given: Slit width $a = 1.2\mu m = 1.2 \times 10^{-6} m$ Angular width of central maximum $2\theta = \frac{\pi}{3}$ Half-angular width $\theta = \frac{\pi}{6} = 30°$ Using the condition for the first minimum: $a \sin\theta = \lambda$ $\lambda = (1.2 \times 10^{-6} m) \times \sin(30°)$ $\lambda = 0.6 \times 10^{-6} m = 6000Å$
5	A nucleus of mass number 189 splits into two nuclei having mass no125 and 64.the ratio of radius of daughter nuclei respective is (a) 25:16 (b) 1:1 (c) 4:5 (d) 5:4
Ans	Nuclear Radius : $R = R_0(A)^{1/3}$ $\frac{R(125)}{R(64)} = \frac{R_0(125)^{1/3}}{R_0(64)^{1/3}} = \frac{5}{4}$
6	The electrostatic potential on the surface of a charged conducting sphere is 100V. Two statements are made in this regard S_1 : at any point inside the sphere, electric intensity is zero. S_2 : at any point inside the sphere, the electrostatic potential is 100V. Which of the following is a correct statement?

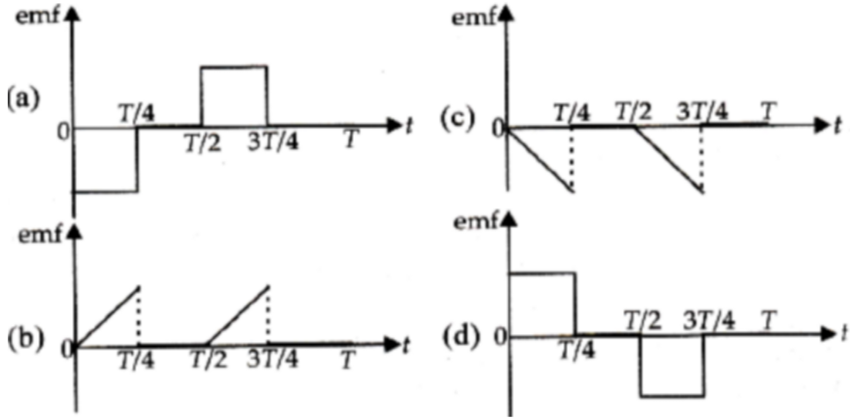
	(a) $S_1$is true but S_2 is false (b) Both S_1 and S_2 are false (c) S_1 is true,S_2 is also true, S_1 is the cause of S_2 (d) S_1 is true, S_2 is also true but the statements are independent
Ans	**The correct option is (c)** **S_1 (True):** Inside a charged conductor, the electric intensity (E) is zero. **S_2 (True):** The electrostatic potential (V) inside a conductor is uniform and equal to the surface potential (100V). **Cause/Effect:** Since $\vec{E} = -\frac{dV}{dr}$, if $\vec{E} = 0$ (S_1), then $\frac{dV}{dr} = 0$, meaning the potential V is constant throughout the interior, causing S_2.
7	In figure two positive charges q_2 and q_3 fixed along the y-axis, exert a net electric force in the +x-direction on a charge 4i, fixed along the x-axis. If a positive charge Q is added at (x, 0), the force on q_1

	 (a) shall increase along the positive x-axis (b) shall decrease along the positive x-axis (c) shall point along the negative x-axis (d) shall increase but the direction changes because of the intersection of Q with q_2 and q_3
Ans	(a) shall increase along the positive x-axis
8	A galvanometer coil has a resistance of 12 Ω and the metre shows full scale deflection for a current of 3 mA. How will you convert the metre into a voltmeter of range 0 to 18 V? (a) 5888 ohm in series (b) 5888 ohm in parallel (c) 5988 ohm in series (d) 5988 ohms in parallel
Ans	To convert a galvanometer into a voltmeter of range V, a high resistance R must be connected in **series** with the galvanometer coil. $R = \frac{V}{I_g} - G = \frac{18}{3 \times 10^{-3}} - 12 = 6000 - 12 = 5988\Omega$ (c) 5988 ohm in series
9	The current I in a coil varies with time as shown

in figure below.

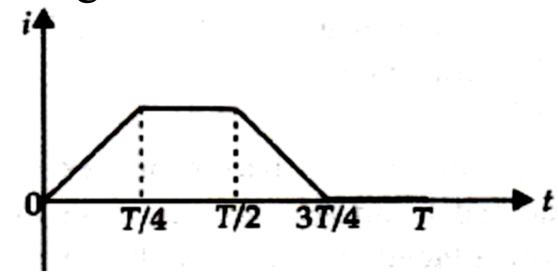


The variation of induced e.m.f. with time would be:



Ans

The current I in a coil varies with time as shown in figure below.



The variation of induced e.m.f. with time would be:

Induced emf, $e = -L\frac{di}{dt}$

For $0 \le t \le \frac{T}{4}$, *i-t* graph is a straight line with positive constant slope.

$\therefore \quad \frac{di}{dt} = \text{constant} \Rightarrow e = -\text{ve and constant}$

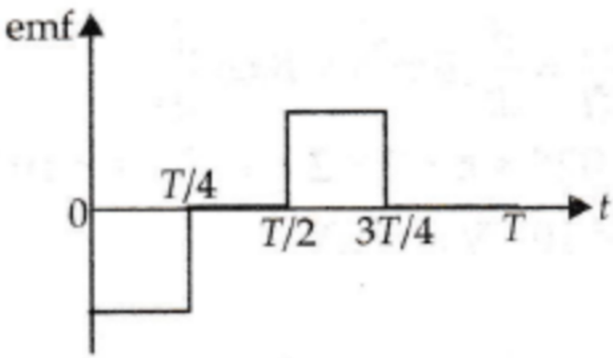
For $\frac{T}{4} \le t \le \frac{T}{2}$ $\quad i$ is constant

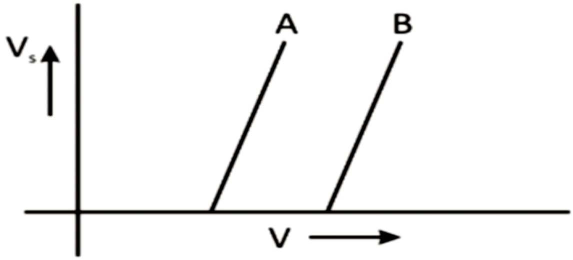
$\therefore \quad \frac{di}{dt} = 0 \quad \Rightarrow \quad e = 0$

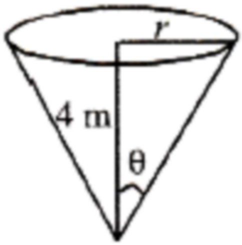
For $\frac{T}{2} \le t \le \frac{3T}{4}$ i-t graph is a straight line with negative constant slope.

$\therefore \quad \frac{di}{dt} = \text{constant} \quad \Rightarrow \quad e = +\text{ve and constant}$

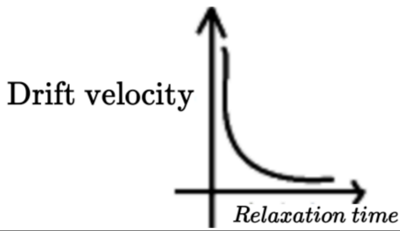
For $\frac{3T}{4} \le t \le T$, i is zero $\therefore \quad \frac{di}{dt} = 0 \Rightarrow e = 0$



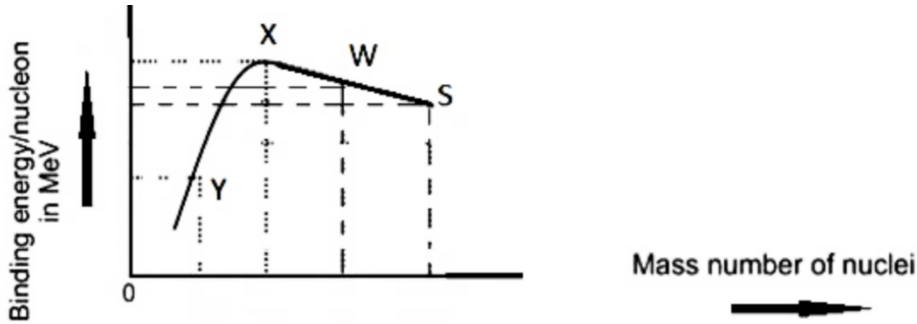
10	The stopping potential as a work function of frequency of incident radiation is plotted for two different photo electric surfaces A and B. The graphs show the work function of A is  (a) greater than that of B (b) smaller than that of B (c) same as that of B (d) no comparison can be done from given graph
Ans	(b) smaller than that of B. The formula for stopping potential is $eV_0=h\nu-\phi$ When $V_0=0$, $h\nu_0=\phi$ A lower threshold frequency (ν_0) corresponds to a lower work function.
11	In an interference pattern produced by two coherent sources of light, the position of the dark fringe corresponds to: (a) Zero path difference (b)Quarter wavelength path difference (c) Wavelength path difference

	(d) Odd multiple of half-wavelength path difference
Ans	(d) Odd multiple of half-wavelength path difference
12	If refractive index of water is 5/3. A light source is placed in water at a depth of 4 m. Then what must be the minimum radius of disc placed on water surface so that the light of source can be stopped? (a) 5m (b) 4m (c) 3m (d) Infinity
Ans	 θ is the critical angle. $\therefore \quad \theta = \sin^{-1}(1/\mu) = \sin^{-1}(3/5)$ or, $\sin\theta = 3/5$. $\therefore \quad \tan\theta = 3/4 = r/4$ or, $r = 3$ m.
13	**(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.** **(b) If both Assertion and Reason are true**

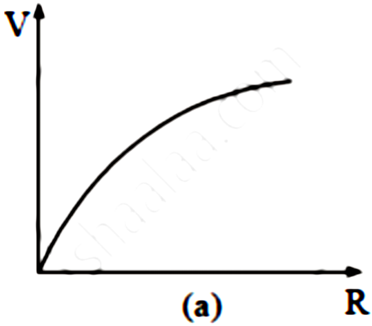
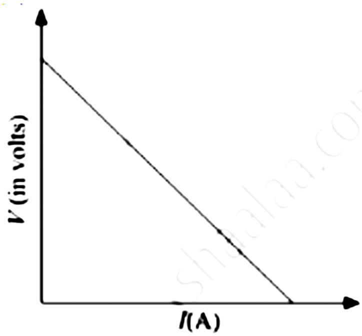
	but Reason is not the correct of Assertion. **(c) If Assertion is true but Reason is false.** **(d) If both Assertion and Reason are false**. **Assertion (A):** A charged capacitor is disconnected from a battery. Now, if its plates are separated further, the potential energy will fall. **Reason (R):** Energy stored in a capacitor is not equal to the work done in charging it
<u>Ans</u>	Both Assertion (A) and Reason (R) are false.
14	**Assertion (A):** A bulb connected in series with a solenoid is connected to ac source. If a soft iron core is introduced in the solenoid, the bulb will glow brighter. **Reason((R)** : On introducing soft iron core in the solenoid, the inductance decreases.
	(d) If both Assertion and Reason are false
15	**Assertion (A):** In Young's double-slit experiment, if one of the slits is covered, the interference pattern disappears. **Reason (R):** Interference occurs due to the superposition of waves from two coherent sources .
<u>Ans</u>	(a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.

16	**Assertion(A)**: The depletion layer in p-n junction under forward bias decreases. **Reason(R):** The electric field due to external voltage supports the electric field due to potential barrier.
Ans	(c) If Assertion is true but Reason is false.
Section B (Each question carries 2 marks)	
17	A cylindrical conductor of length L and cross-section area A is connected to a DC source. Under the influence of electric field set up due to source, the free electrons begin to drift in the opposite direction of the electric field. (I)Draw the curve showing the dependency of drift velocity on relaxation time. (II) If the DC source is replaced by a source whose current changes its magnitude with time such that $\mathbf{i = I_0 \sin 2\pi\nu t}$, where $\boldsymbol{\nu}$ is the frequency of variation of current, then determine the average drift velocity of the free electrons over one complete cycle.
Ans	(I) Drift velocity $\propto \frac{1}{Relaxation\ time}$ 

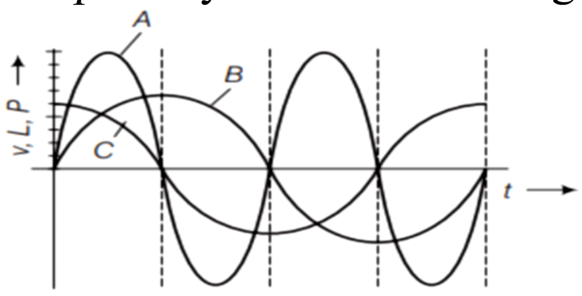
	(ii) Alternating current changes direction every half cycle. So average drift velocity is zero
18	Two long parallel straight wires X and Y separated by a distance of 5 cm in air carry current of 10 A and 5 A respectively in opposite directions. Calculate the magnitude and direction of the force on a 20 cm length of the wire Y.
<u>Ans</u>	Current in wire X (I_x): 10 A Current in wire Y (I_y): 5 A Distance between wires (d): 5 cm = 0.05 m Length of wire Y (L): 20 cm = 0.2 m Permeability of free space (μ_0): $4\pi \times 10^{-7}$ T · m/A The force F between two parallel current-carrying wires is given by the formula: $F = \frac{\mu_0 I_x I_y L}{2\pi d}$ $F = \frac{(4\pi \times 10^{-7}) \times 10 \times 5 \times 0.2}{2\pi \times 0.05} = 4 \times 10^{-5}$ N
19	A single slit of width 0.1 mm is illuminated by a parallel beam of light of wavelength 6000 Å and diffraction bands are observed on a screen

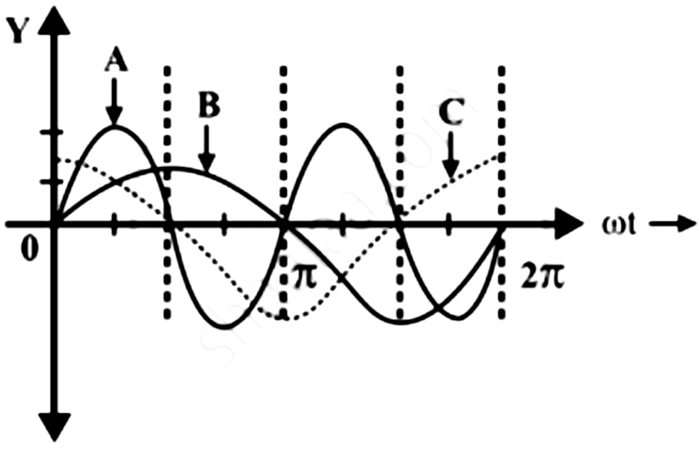
	0.5 m from the slit. Find the distance of the third dark band from the central bright band .
Ans	Slit width (a): 0.1 mm $= 1 \times 10^{-4}$ m Wavelength (λ): 6000 Å $= 6 \times 10^{-7}$ m Screen distance (D): 0.5 m Order of the dark band (n): 3 $y_n = \frac{n\lambda D}{a}$ $y_3 = \frac{3 \times (6 \times 10^{-7}\text{ m}) \times 0.5\text{ m}}{1 \times 10^{-4}\text{ m}} = \frac{9 \times 10^{-7}}{10^{-4}}\text{m}$ $y_3 = 9 \times 10^{-3}\text{ m} = 9\text{ mm}$
20	Binding energy per nucleon versus mass number curve is as shown. X, Y, W and S are four nuclei indicated on the curve.  Based on the graph (a) Arrange X, W and S in the increasing order of stability. (b) Explain why binding energy for heavy

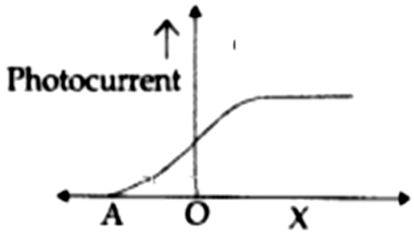
	nuclei is low.
Ans	(a) S,W,X (b) $Z = Z_1 + Z_2$ $A = A_1 + A_2$ (c) Reason for low binding energy: In heavier nuclei, the Colombian repulsive effects can increase considerably and can match/ offset the attractive effects of the nuclear forces. This can result in such nuclei being unstable.
21	Draw the circuit diagram of full wave rectifier and also draw its input and output wave forms. OR How is forward biasing different from reverse biasing in a p-n junction diode?
	Section C (Each question carries 3 marks)
22	(a) Use Gauss's theorem to find the electric field due to a uniformly charged infinitely large plane thin sheet with surface charge density (b) An infinitely large plane thin sheet has a uniform surface charge density. Obtain the expression for the amount of work done in bringing a point charge q from infinite to a point, distance d, in front of the charged plane sheet. OR State Gauss's theorem in electrostatics. Using

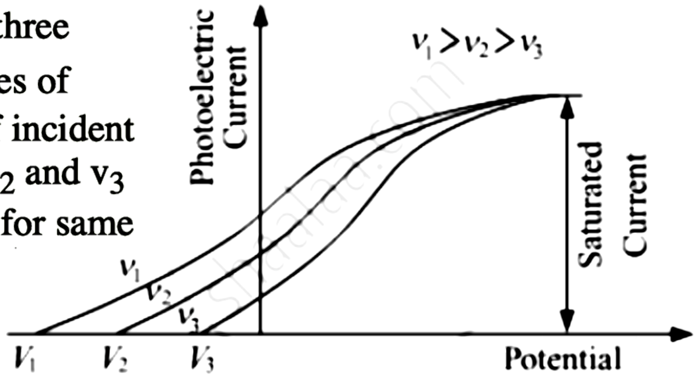
	this theorem, derive an expression for the electric field due to an infinitely long straight wire of linear charge density **λ** .
23	A cell of emf 'E' and internal resistance "r' is connected across a variable load resistor R. Draw the plots of the terminal voltage V versus (i) the current I. (iii) It is found that when R = 4 Ω , the current is 1A and when R is increased to 9 Ω , the current reduces to 0.5 A. Find the values of the emf E and internal resistance r.
Ans	**(i) Plot for V vs. R**  **(ii)** Graph between terminal voltage (*V*) and current (*I*) 

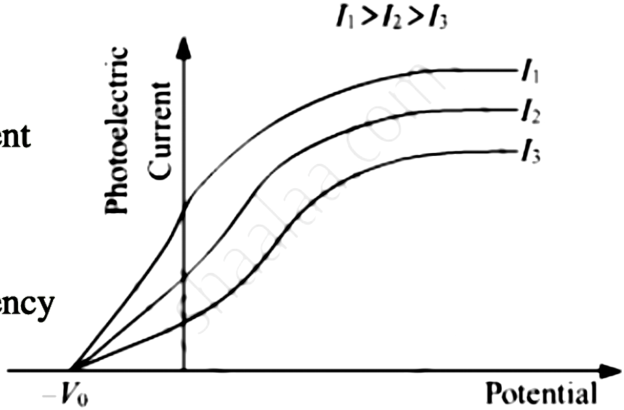
	When R = 4 Ω and I = 1 A We know Terminal voltage, V = E – Ir So, we have V = IR = 4 = E – Ir or E – r = 4 ..... (i) When R' = 9 Ω and I' = 0.5 A V = IR = 0.5 × 9 = E – 0.5r or E – 0.5r = 4.5 ..... (ii) Solving (i) and (ii), we get r = 1 Ω and E = 5 V
24	A bar magnet of magnetic moment 1.5 J/T lies aligned with the direction of a uniform magnetic field of 0.22 T (a) What is the torque on the magnet when magnetic moment aligned (i) Normal to the field direction (ii) Opposite to the field direction (b) Write the conditions for (i) stable equilibrium (ii) unstable equilibrium of magnet.
<u>Ans</u>	**(a)** Magnetic moment, $M = 1.5\ J\ T^{-1}$ Magnetic field strength, B = 0.22 T **(i)** Initial angle between the axis and the magnetic field, $\theta_1 = 0°$ Final angle between the axis and the magnetic field, $\theta_2 = 90°$ The work required to make the magnetic moment normal to the direction of the magnetic field is given as:

	$W = -MB(\cos\theta_2 - \cos\theta_1) = -1.5 \times 0.22(\cos 90° - 0°)$ $= -0.33(0-1) = 0.33$ J **(ii)** Initial angle between the axis and the magnetic field, $\theta_1 = 0°$ Final angle between the axis and the magnetic field, $\theta_2 = 180°$ The work required to make the magnetic moment opposite to the direction of the magnetic field is given as: $W = -MB(\cos\theta_2 - \cos\theta_1) = -1.5 \times 0.22(\cos 180° - 0°)$ $= -0.33(-1-1) = 0.66$ J **(b)** For case (i), $\theta = \theta_2 = 90°$ $\therefore$ Torque, $\tau = MB\sin\theta = 1.5 \times 0.22 \times \sin 90°$ Torque, $\tau = 0.33$ J For case (ii), $\theta = \theta_2 = 180°$ $\therefore$ Torque, $\tau = MB\sin\theta = MB\sin 180° = 0$ J
25	A device 'X' is connected to an AC source. The variation of voltage, current and power in one complete cycle is shown in figure.  (a) Which curve shows power consumption over a full cycle? (b) What is the average power consumption over a cycle?

	(c) Identify the device X.
Ans	(a) Power is the product of voltage and current (Power = P= VI). So, the curve of power will be having a maximum amplitude, equal to the product of amplitudes of voltage (V) and current (I) curve. Frequencies, of B and C are equal, therefore they represent V and I curves. So, curve A represents power. (b) The full cycle of the graph (as shown by the shaded area in the diagram) consists of one positive and one negative symmetrical area.  Hence, average power consumption over a cycle is zero. (c) Here phase difference between V and I is π /2 therefore, the device 'X' may be an inductor (L) or capacitor (C) or the series combination of L and C.
26	Name the e.m. waves in the wavelength range 10 nm to 10^{-3} nm. How are these waves generated? Write their two uses.

Ans	X-rays: They are generated by bombarding a target of high atomic number Z with a beam of fast moving electrons. Uses : (i) radio theapy for curing skin diseases. (ii) Medical diagnosis locating fracture TB etc.
27	Draw a ray diagram to show the formation of the image of an object placed on the axis of a convex refracting surface, of radius of curvature 'R', separating the two media of refractive indices 'n_1' and 'n_2' ($n_2 > n_1$). Use this diagram to deduce the relation, $-\frac{n_1}{u} + \frac{n_2}{v} = \frac{n_2 - n_1}{R}$ where u and v represent respectively the distance of the object and the image formed.
28	The given graph shows the variation of photo current for a photosensitive metal:  (a) Identify the variable X on the horizontal axis. (b) What does the point A on the horizontal axis

	represent? (c) Draw this graph for three different values of frequencies of incident radiation **v_1 ,v_2** and **v_3 (v_1 > v_2 > v_3)** for same intensity. (d) Draw this graph for three different values of intensities of incident radiation **I_1 ,I_2** and **I_3 (I_1 > I_2 > I_3)** having same frequency.
Ans	(a) Variable X is the accelerating potential applied across the photosensitive material. (b) A represents the stopping potential for the given photosensitive metal. Stopping potential is the minimum negative potential VO applied across the photosensitive material at which the photoelectric current becomes zero. **(c) Graph for three different values of frequencies of incident radiation v_1, v_2 and v_3 ($v_1 > v_2 > v_3$) for same intensity** 

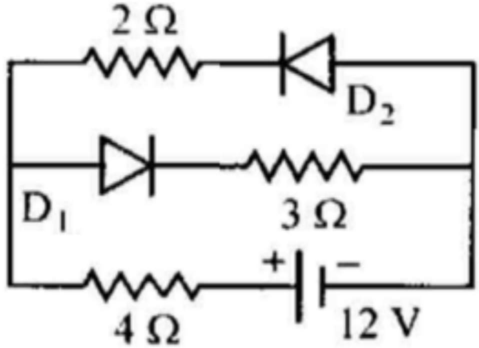
	(d) Graph for three different values of intensities of incident radiation I_1, I_2 and I_3 ($I_1 > I_2 > I_3$) having same frequency 
Section D (Each question carries 4 marks)	
29	**<u>Case Study Based Question:</u>** **<u>Semiconductor</u>** There are different techniques of fabrication of p-n junction. In one such technique, called fused junction techniques, an aluminum film is kept on the wafer of n-type semiconductor and the combination is then heated to a high temperature (about 600 °C). As a result, aluminum fused into silicon and produces p-type semiconductor and in this way p-n junction is formed. **(i) when a PN junction is reversed then how does the height of potential barrier change?** (a) no current flows.

(b) the depletion region is reduced
(c) height of potential barrier is decreased
(d) height of potential barrier is increased

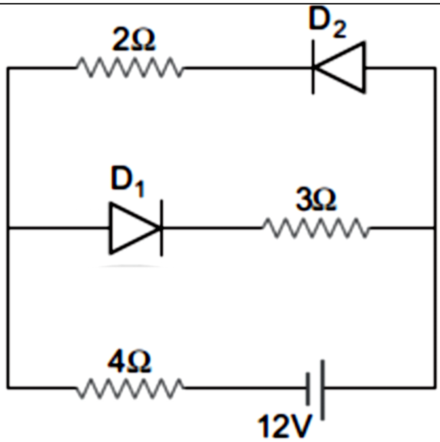
(ii) the cause of potential barrier in PN junction is:

(a) depletion of positive charges near the junction
(b) concentration of negative charges near the junction
(c) concentration of positive and negative charges near the junction
(d)depletion of negative charges near the junction

(iii) The circuit has two oppositely connected ideal diodes in parallel. What is the current flowing in the circuit?



	(a) 1.17 A (b) 2.0 A. (c) 1.71 A (d) 1A **(iv) Carbon, Germanium and silicon are 14 group elements:** (a) C and Ge are semiconductors (b) C and Si are semiconductor (c) all C, Ge and Si are semiconductors (d) Si and Ge are semiconductors Or **When a PN junction is forward biased then:** **(a)** only diffusion current flows. **(b)** only drift current flows **(c)** both diffusion current and drift current flow but diffusion current is more than drift current (d) both diffusion and drift current flow but drift current exceeds the diffusion current.
Ans	**(i)**(d) height of potential barrier is increased **(ii)(c)** concentration of positive and negative charges near the junction **(iii)** Diode D_1 is reverse biased, so it offers an infinite resistance. So no current flows in the branch of diode D_1. Diode D_2 is forward biased, and offers no resistance in the circuit. So current in the branch



$$I = \frac{V}{R_{eq}};$$

$$= \frac{12V}{2\Omega + 4\Omega}$$

$$= 2\ A$$

(iv)(d) Si and Ge are semiconductors.

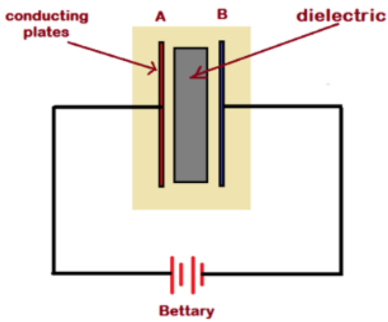
Or

c) both diffusion current and drift current flow but diffusion current is more than drift current.

30 **<u>Case Study Based Question: Electrostatics</u>**

An arrangement of two conductors separated by an insulating medium can be used to store electric charge and electric energy. Such a system is called a capacitor.

The more charge a capacitor can store, the greater is its capacitance. Usually, a capacitor consists of two conductors having equal and opposite charge +Q and -Q. Hence, there is a potential difference V between them. By the capacitance of a capacitor, we mean the ratio of the charge Q to the potential difference V. By the charge on a capacitor we mean only the charge Q on the positive plate. Total charge of the capacitor is zero. The capacitance of a capacitor is a constant and depends on geometric factors, such as the shapes, sizes and relative positions of the two conductors, and the nature of the medium between them. The unit of capacitance is farad (F), but the more convenient units are μF and pF. A commonly used capacitor consists of two long strips or metal foils, separated by two long strips of dielectrics, rolled up into a small cylinder. Common dielectric materials are plastics (such as polyesters and polycarbonates) and aluminium oxide. Capacitors are widely used in radio, television, computer, and other electric circuits.

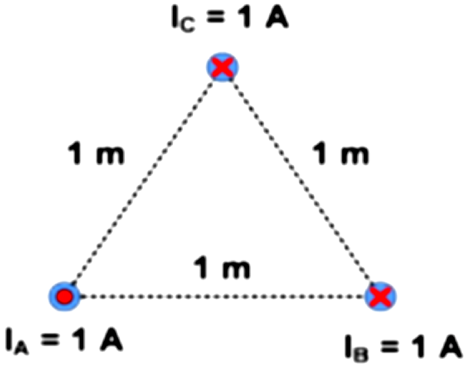


	1. A parallel plate capacitor C has a charge Q. The actual charge on its plates are (a) Q,Q (b) Q/2, Q/2 (c) Q,-Q (d) Q/2, -Q/2 2. A parallel plate capacitor is charged. If the plates are pulled apart . (a) the capacitance increases. (b) the potential difference increases (c) the total charge increases (d) the charge & potential difference remains the same **3.**Three capacitors of 2, 3 & 6 μF are connected in series to a 10 V source. The charge on the 3 μF capacitor is (a) 5**μ**C (b) 10**μ**C (c) 12**μ**C (d) 15**μ**C **4.** If n capacitors each of capacitance C are connected in series and then in parallel, then the ratio of equivalent capacitance of the series combination to parallel combination is (a) nC (b) n^2C (c) C/n (d) C/n^2 OR A parallel plate capacitor has two square plates

	with equal and opposite charges. The surface charge densities on the plates are $+\sigma$ and $-\sigma$ respectively. In the region between the plates the magnitude of the electric field is (a) σ/ε_0 (b) $\sigma/2\varepsilon_0$ (c) 0 (d) none of these
Ans	1. (c)The individual plates always hold equal and opposite charges +Q and −Q 2. (b) the potential difference increases 3. Net capacitance $= \dfrac{1}{\left(\frac{1}{2}+\frac{1}{3}+\frac{1}{6}\right)} = 1\mu F$ Total energy $= CV = 1\mu F \times 10V = 10\mu F$ Total charge on every capacitor in series system is same. So charge on $3\mu F$ is $10\mu C$. 4. When n capacitors, each of capacitance C, are connected in **series**, $\dfrac{1}{C_s} = \dfrac{1}{C} + \dfrac{1}{C} + \ldots + \text{n times} = \dfrac{n}{C}$ $C_s = \dfrac{C}{n}$ When n capacitors, each of capacitance C, are connected in **parallel**, the equivalent capacitance C_p is

	$C_p = C + C + \ldots + \text{n times} = nC$ To find the ratio of the series combination to the parallel combination, divide C_s by C_p: $\text{Ratio} = \frac{C_s}{C_p} = \frac{C/n}{nC} = \frac{C}{n \cdot nC} = \frac{1}{n^2}$ 0r (a) **σ/ ε0**

Section E (Each question carries 5 marks)

31	 (i) Three conductors form an equilateral triangle shown the figure below. The current direction of wire A is out of the plane of the figure, in B and C are into the plane of the figure. Find: (a) the magnetic force acts on conductor B in a length of 1 m (b) the direction of the force (ii) Write the mathematical expression for the force acting on a current carrying straight

	conductor kept in a magnetic field. Under what conditions is this force (i) zero and (ii) maximum? 3+2=5
Ans	1. Force from A (F_{BA}): Currents are in opposite directions (A is out, B is in), so B is repelled from A. This force acts along the line AB, pointing away from A. 2. Force from C (F_{BC}): Currents are in the same direction (both into the plane), so B is attracted to C. This force acts along the line BC, pointing toward C. Since the triangle is equilateral, the distance d = a for both pairs. The magnitudes of the individual forces per unit length are: $$f_{BA} = f_{BC} = \frac{\mu_0 I^2}{2\pi a}$$ The angle between these two force vectors at B is 120° (since the interior angle of the triangle is 60° and F_{BA} is directed outward). The net force F_{net} for a length L = 1 m is: $$F_{net} = \sqrt{f_{BA}^2 + f_{BC}^2 + 2 f_{BA} f_{BC} \cos(120^\circ)}$$ $$F_{net} = \sqrt{f^2 + f^2 - f^2} = f = \frac{\mu_0 I^2}{2\pi a}$$ Direction: The resultant force Fnet makes an angle of 30° with the side BC, pointing towards the interior of the triangle.

	Mathematical Expression: The force Fon a conductor of length L in a magnetic field B is: F= ILB sin(θ) where θ is the angle between the conductor and the magnetic field. • Conditions: 1. Zero Force: When the conductor is parallel or anti-parallel to the magnetic field (θ = 0° or 180°). 2. Maximum Force: When the conductor is perpendicular to the magnetic field (θ = 90°).
	OR With the help of a neat and labelled diagram, explain the underlying principle and working of a moving coil galvanometer. What is the function of (i) uniform radial field (ii) soft iron core in such a device? 1+1+1+1+1=5
32	(a)Draw a ray diagram to show refraction of a ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. (b) A convex lens has 20 cm focal length in air. What is focal length in water? (Refractive index of air-water = 1.33, refractive index for air-glass = 1.5.) 1+2+2=5

Ans	The focal length f of a lens is related to the refractive index of the lens material n_l and the surrounding medium n_m by the Lens Maker's Formula: $\frac{1}{f}=(\frac{n_l}{n_m}-1)(\frac{1}{R_1}-\frac{1}{R_2})$ $\implies \frac{1}{f_a}=(n_g-1)k$ Let $k=(\frac{1}{R_1}-\frac{1}{R_2})$ $\implies \frac{1}{20}=(1.5-1)k=0.5k$ $f_a=20$ cm $n_l=n_g=1.5$ $\implies k=\frac{1}{20\times 0.5}=\frac{1}{10}$ $n_m=n_a=1$ In water ($n_w=1.33$), the focal length is f_w: $\frac{1}{f_w}=(\frac{n_g}{n_w}-1)k$ $n_g=1.5$, $n_w=1.33$ $\implies \frac{1}{f_w}=(\frac{1.5}{1.33}-1)\times\frac{1}{10}$ $k=\frac{1}{10}$ $\implies \frac{1}{f_w}=(\frac{1.5-1.33}{1.33})\times\frac{1}{10}$ $\implies \frac{1}{f_w}=\frac{0.17}{13.3}$ $\implies f_w=\frac{13.3}{0.17}\approx 78.235$ cm
	OR (a) Draw a labelled ray diagram to obtain the

	real image formed by an astronomical telescope in normal adjustment position. Define its magnifying power. (b) You are given three lenses of power 0.5 D, 4 D and 10 D to design a telescope. (i) Which lenses should be used as objective and eyepiece? Justify your answer. (i)Why is the aperture of the objective preferred to be large? 5
Ans	(i) Lenses Selection & Justification: • Objective Lens (0.5 D): A telescope needs a large focal length for the objective to achieve high magnification. Since $Power(P) = \dfrac{1}{\text{Focal Length }(f)}$ The lowest power (0.5 D) corresponds to the longest focal length (f = 0.5 =2 m). •Eyepiece Lens (10 D): The eyepiece requires a short focal length to maximize magnification $(M = \dfrac{f_o}{f_e})$ The highest power (10 D) provides the shortest focal length (f =1/10 = 0.1 m). (ii) Why Large Aperture Objective? ○ Greater Light Gathering: A larger diameter allows more light to enter, forming a brighter image of distant, faint objects.

	○ Better Resolution: It enhances the resolving power, allowing the telescope to distinguish between fine details of distant objects.
33	(i)Using Bohr's postulates of the atomic model, derive the expression for radius of nth electron orbit. Hence obtain the expression for Bohr's radius. (ii) According to the classical electromagnetic theory, calculate the initial frequency of the light emitted by the electron revolving around a proton in hydrogen atom. 3+2=5
<u>Ans</u>	(ii)we know that velocity of electron moving around a proton in hydrogen atom in an orbit of radius 5.3×10^{-11} m is 2.2×10^{-6} m/s. Thus, the frequency of the electron moving around the proton is $v = \frac{v}{2\pi r} = \frac{2.2 \times 10^{6} ms^{-1}}{2\pi(5.3 \times 10^{-11m})}$ $\approx 6.6 \times 10^{15} Hz$. According to the classical electromagnetic theory we know that the frequency of the electromagnetic waves emitted by the revolving electrons is equal to the frequency of its revolution around the nucleus. Thus the initial frequency of the light emitted is 6.6×10^{15} Hz .
	OR

	(i) In Rutherford scattering experiment, draw the trajectory traced by a-particles in the Coulomb field of target nucleus and explain how this led to estimate the size of the nucleus. (ii) In a Geiger-Marsden experiment, what is the distance of closest approach to the nucleus of a 7.7MeV a-particle before it comes momentarily to rest and reverses its direction? 3+2=5
Ans	Already done