ANSWER KEY1 REHEARSAL-2-2023-24
CLASS 12-PHYSICS
SET-1

SL.NO	ANSWER KEY-SECTION A	
1.	(c) 2.4×10^{-5} J	1
2.	(a) 30 cm from 9e	1
3.	(b) $\frac{C_1 V_1 + C_2 V_2}{C_1 + C_2}$	1
4.	(c)360 Ω	1
5.	(b) shape of loop	1
6.	(a) 64 T	1
7.	(b) sm^{-1}	1
8.	(d)Option (a) and (b)	1
9.	(c)Through 1 clockwise and through 2 anticlockwise as the induced current wants to decrease the change in magnetic flux.	1
10.	(b)The bulb glows brighter.	1
11.	(d) Violet	1
12.	(b) electron is bound to the nucleus.	1
13.	a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.	1
14.	d) If both Assertion and Reason are false.	1
15.	a) If both Assertion and Reason are true and Reason is correct explanation of	1

	Assertion.	
16.	d) If both Assertion and Reason are false.	1
	SECTION B	
17.	Definition of conductivity. SI unit is mho m^{-1} A= constant, as mentioned in the question So G is inversely proportional to l. l is halved then G becomes double. OR Resistance R of a wire of length l and cross sectional area A (thickness) is given by , $R = \rho l/A$ where ρ = specific resistance of wire for copper wire $R = \rho_c l/A_c$, for manganin wire $R = \rho_m l/A_m$ or $\rho_c/A_c = \rho_m/A_m$ or $A_c/A_m = \rho_c/\rho_m$ we know $\rho_m > \rho_c$ (as manganin is an alloy) therefore $A_c < A_m$ Hence manganin wire is thicker.	1/2 1/2 1/2 ½ 1/2 ½ ½ 1/2

18.	The internal resistance of battery is given by $r=\left(\frac{E}{V}-1\right)R=\left(\frac{40}{30}-1\right)\times 9=\frac{9\times 10}{30}=3\Omega$	1 ½ + ½
19.	Using $\frac{1}{f_a}=({}^a\mu_g-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$ Here, $f_a=0.2m, {}^a\mu_g=1.50$ $\therefore \frac{1}{0.2}=(1.50-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)\Rightarrow \frac{1}{R_1}-\frac{1}{R_2}=10$ Consider f_w be the focal length of the lens , when immersed in water. ${}^w\mu_g=\frac{{}^a\mu_g}{{}^a\mu_w}=\frac{1.50}{1.33}=1.128$ Now, $\frac{1}{f_w}=({}^w\mu_g-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)=(1.28-1)\times 10=1.28$ or $f_w=\frac{1}{1.28}=0.78$ Hence, change in forcal length of the lens is $f_w-f_a=0.78-0.2=0.58m$	½ ½ ½ ½
20.	The distance from the nucleus at which velocity of the alpha particle becomes zero is known as the distance of closest approach. Distance of closest approach is given by the formula. $r_0=\frac{1}{4\pi\in_0}.\frac{2Ze^2}{K}$, where K = initial value of the kinetic energy of alpha-particle. Thus, $r_0\propto\frac{1}{k}$. Hence, if kinetic energy of a-particle is doubled to 2K, the distance of the closest approach is reduced to $r_0/2$.	1 ½ ½
21.	Doping can increase the conductivity of the semiconductor, making it more suitable for use in electronic components.	1

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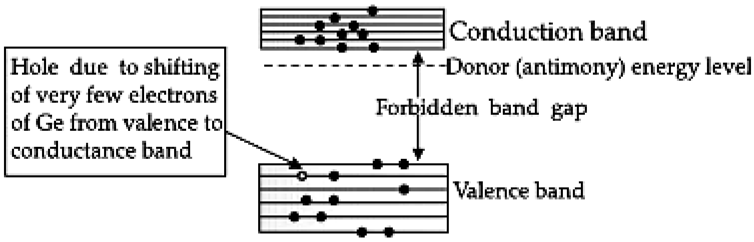
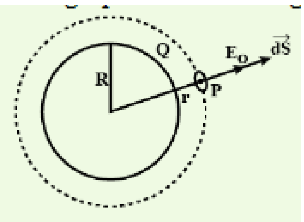
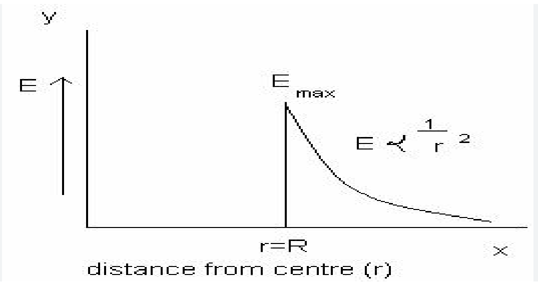
<tr><td></td><td>

This is an n-type extrinsic semiconductor. Majority charge carriers are electrons.</td><td>1</td></tr>
<tr><td></td><td>SECTION C</td><td></td></tr>
<tr><td>22.</td><td>

Proof

</td><td>Diagram-1/2
1 1/2
1</td></tr>
<tr><td></td><td>OR</td><td></td></tr>
<tr><td></td><td>Electric Dipole Moment The strength of an electric dipole is measured by a vector quantity known as electric dipole moment . p It is the product of the charge q and separation between the charges 2l.</td><td>1
½</td></tr>
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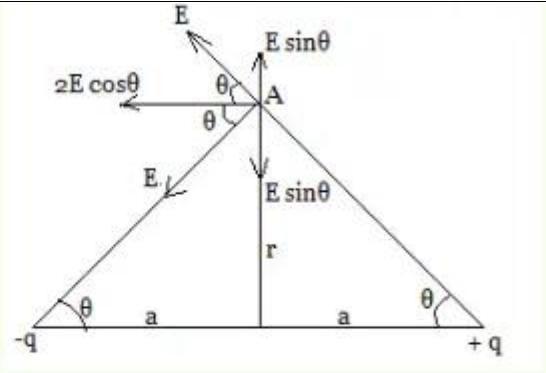
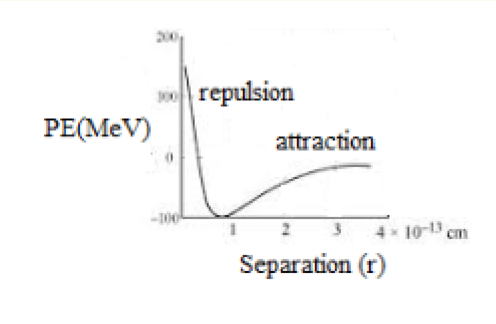
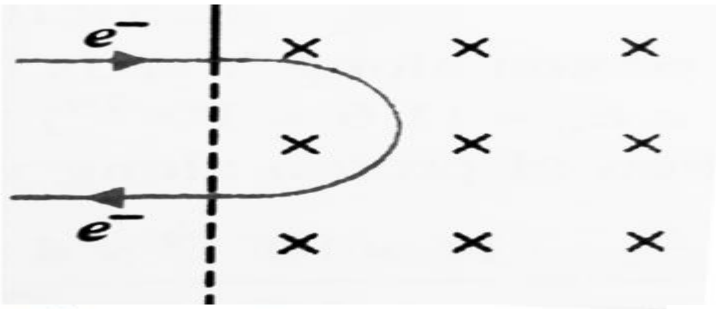
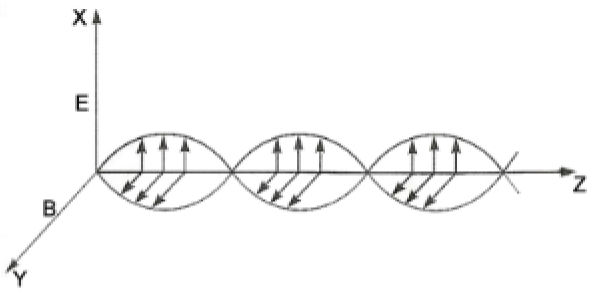
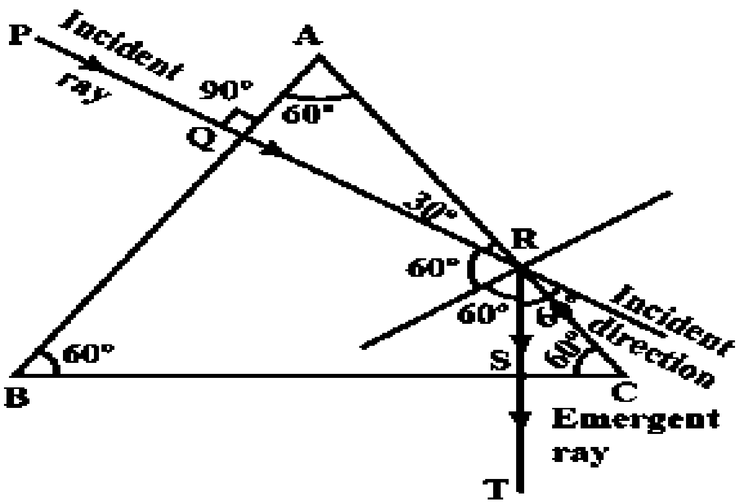
<tr><td></td><td>

Electric field at point A $E_A = 2E\cos\theta$
Where
$E = 2E\cos\Theta$
we get $E_A = \frac{2q}{4\pi\epsilon_{o(r^2+a^2)}}\cos\Theta$
$\cos\Theta = \frac{a}{\sqrt{a^2+r^2}}$
on putting the value
$E_A = \frac{2qa}{4\pi\epsilon_o(r^2+a^2)^{\frac{3}{2}}}$
we know the dipole moment p=2qa
hence $E_A = \frac{p}{4\pi\epsilon_o(r^2+a^2)^{\frac{3}{2}}}$
For a<<r, we can neglect a^2 **compared to** r^2
Hence final answer is $E_A = \frac{p}{4\pi\epsilon_o x^3}$</td><td>½
½
½</td></tr>
<tr><td>23</td><td>(a) Mutual inductance of two coils is equal to the emf induced in one coil when the rate of change of the current through the other coil is unity or it is equal to the amount of magnetic flux linked with one coil when unit current flow through the other coil.
Its SI unit is Henry
Total number of turns in solenoid $N = nl$
Magnetic field inside the long solenoid $B = \mu_0 ni$
Flux through one turn $\phi_1 = BA = \mu_0 niA$
Thus total flux through N turns $\phi_t = N\phi_1 = nl \times \mu_0 niA = \mu_0 n^2 lAi$
Using $\phi_t = Li$ where L is the self inductance of the coil
$\therefore \mu_0 n^2 lAi = Li \implies L = \mu_0 n^2 Al$</td><td>1
1/2
1/2
1/2
1/2</td></tr>
</table>

24.	A fission reaction is splitting up of a large atom or a molecule into two or more smaller ones. Fusion is the process of combination of two or more lighter atoms or molecules into larger ones. b) The potential energy (PE) vs separation graph is shown in the figure.  The conclusions drawn from the graph are - i) The nuclear force is a short-range force. ii) The nuclear force is repulsive when the separation is less 1 fm (1fermi=10^{-15}m) and it is attractive when the separation is greater than 1 fm.	½ ½ Diagram ½ + ½ ½ ½

25.	 $\frac{mv^2}{r} = qvB$ or $r = \frac{mv}{qB}$ $\therefore r = \frac{(9\cdot 1 \times 10^{-31}) \times (4 \times 10^4)}{(1\cdot 6 \times 10^{-19}) \times 10^{-5}}$ $= 22\cdot 75 \times 10^{-3} m$ Time taken to come out of the region of magnetic field is $t = \frac{\pi r}{v} = \frac{(22/7) \times (22\cdot 75 \times 10^{-3})}{4 \times 10^4}$ $= 1\cdot 8 \times 10^{-6} s$	1 ½ ½ ½ ½
26.	$\vec{E} = E_0 \sin(kz - \omega t)\hat{i}$ $\vec{B} = B_0 \sin(kz - \omega t)\hat{j}$ 	½ 1/2 DIAGRAM 1

	(b) ∵ wavelength of electromagnetic wave is $\lambda = \frac{c}{\nu}$ here, c is speed of light .e.g.,c = 3 × 10^8 m/s v is the frequency .e.g., v = 2 × 10^10 Hz so, λ=3 × 10^8/2 × 10^10 = 1.5 × 10^-2 m = 1.5 cm	½ ½
27.	(a) At the face $AB, i = 0^0$ and at the face $AC, i = 60^0$ (b) At the face AB – refraction, At the face AC – total internal reflection, At the face BC – refraction.  	½ 1/2 ½ 1/2 1/2 1/2

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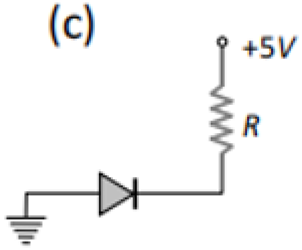
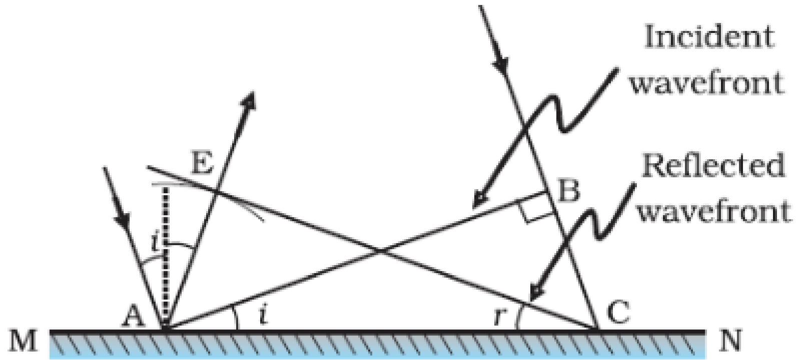
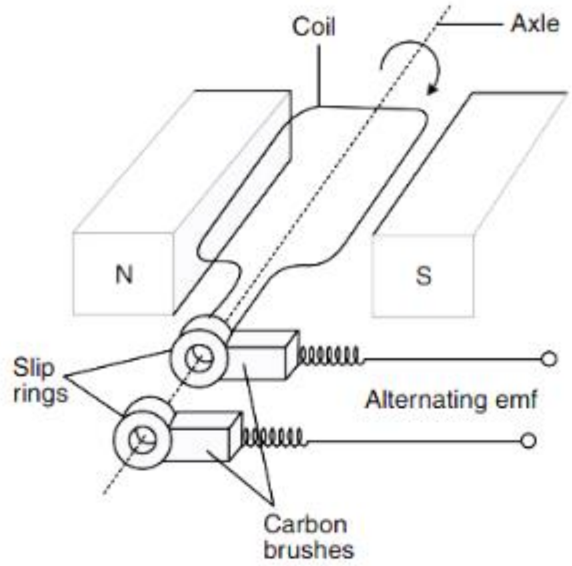
28.	Derivation of $r_n = \frac{\varepsilon_0 n^2 h^2}{\pi m Z e^2}$ Derivation of vn T = 2πr/v $T = 4\varepsilon_0^2 n^3 h^3/me^4$	1 1 1
	SECTION D	
29.	(I) (d) 30 mA (II) (c)  (iii) (c) non ohmic device OR (b) in the circuits (2) and (3) (iv) (d) 10^{-6}	1 1 1 1
30.	(i) (c) decreases (ii) (c)0.5D (iii) b)20cm OR (a) –10 D (iv) **(d)**Microscope will decrease but that of telescope will increase	1 1 1 1
	SECTION E	
31.	(a) Every point on a wavefront is in itself the source of spherical wavelets which spread out in the forward direction at the speed of light. (b)	1

	Here , $\lambda = 600nm = 6 \times 10^{-7}m$ $a = 0.2mm = 2 \times 10^{-4}m, \theta = ?$ Angular width of central maxima, $\theta = \frac{2\lambda}{a} = \frac{2 \times 6 \times 10^{-7}}{2 \times 10^{-4}} = 6 \times 10^{-3}$rad  Derivation of i = r	½ ½ ½ + 1/2 1- diagram 1
	OR (a) Explanation of Young's double slit experiment with diagram. (b) Conditions of constructive and destructive interference Given: Distance between slits = d = 0.8 mm = 0.8 x 10^{-3} m = 8 x 10^{-4} m. Distance between slit and screen = D = 1.2 m, Fringe width = X = 0.75 mm = 0.75 x 10^{-3} m = 7.5 x 10^{-4} m. To Find: Wavelength of light used = λ =? Solution: The fringe width is given by X = λD/d ∴ λ = Xd/D = (7.5 x 10^{-4} x 8 x 10^{-4})/1.2 = 5 x 10^{-7} m = 5000 x 10^{-10} m = 5000 Å Ans: Wavelength of light used is 5000 Å	1 1 + 1 ½ ½ ½ ½
32.	The AC Generator works on the principle of electromagnetic induction. when the magnetic flux through a coil changes, an emf is induced in it. As the coil rotates in magnetic field the effective	1

area of the loop, (i.e. A cosθ) exposed to the magnetic field keeps on changing, hence magnetic



1

flux changes and an emf is induced. 1

When a coil is rotated with a constant angular speed 'ω ', the angle 'θ' between the magnetic field vector B and the area vector A , of the coil at any instant 't' equals ωt; (assuming θ = 0° at t = 0) As a result, the effective area of the coil exposed to the magnetic field changes with time ; The flux at any instant 't' is given by

$$\phi_B = NBA\cos\theta = NBA\cos\omega t$$ 1

The induced emf $e = -N\dfrac{d\phi}{dt}$ 1

$$= -NBA\frac{d\phi}{dt}(\cos\omega t)$$

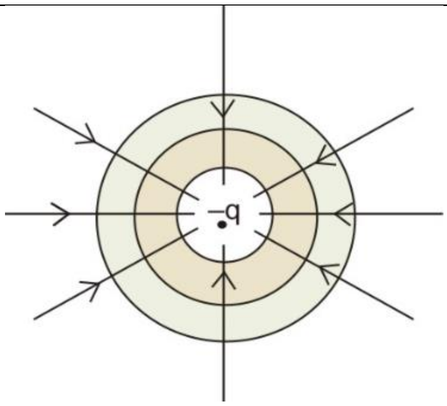
$$e = NBA\omega\sin\omega t$$

(ii) Peak Value is defined as the maximum value that the alternating quantity (current or voltage) reaches in one cycle (either positive or negative). RMS value (root mean square) stands for the square root of means of squares of instantaneous values.

OR

(i)Phasor diagram for series LCR circuit 1

	$\Rightarrow \vec{V_{eff}} = \hat{i}V_R + \hat{j}(V_L - V_C)$ $\Rightarrow \lvert V_{eff}\rvert = \sqrt{\lvert V_R\rvert^2 + (V_L - V_C)^2}$ $\Rightarrow I_{eff}\,Z = \sqrt{(I_{eff}R)^2 + (I_{eff}X_L - I_{eff}X_C)^2}$ $\Rightarrow \lvert Z\rvert = \sqrt{R^2 + (X_L - X_C)^2}$ Effective current flow $I_{eff} = \frac{E_{eff}}{Z} = \frac{E_{eff}}{\sqrt{R^2 + (X_L - X_C)^2}}$ Definition of electrical resonance Resonance condition Xc = XL $\omega_r = \frac{1}{\sqrt{LC}}$	1 1 1 1
33.	**(a)** Charge remains same, as after disconnecting capacitor no transfer of charge take place. Electric field, E = $\frac{\sigma}{\varepsilon_0} = \frac{q}{\varepsilon_0 A}$ remain same, as there is no change in charge. ∴ Energy stored $= \frac{q^2}{2C}$ $= \frac{q^2}{2\left(\frac{\varepsilon_0 A}{d}\right)} = \frac{q^2 d}{2\varepsilon_0 A}$ Energy will be doubled as separation between the plates (d) is doubled. (b)	1/2 1/2 1

	 (c) Capacitance of the parallel plate capacitor is given by: $C_i = \frac{A \epsilon_0}{d} \ldots (1)$ Step 2: Capacitance after inserting dielectric Let k be the dielectric constant. $C_f = \frac{kA \epsilon_0}{d'}$ As the distance between plates is reduced to half, new distance is $d' = \frac{d}{2}$ $\therefore C_f = \frac{2kA \epsilon_0}{d} = 2kC_i = 2 \times 6 \times 8pF = 96pF$	1 ½ 1/2 ½ + ½
	OR	
	(a)Capacitance is the ability of a component or circuit to collect and store energy in the form of an electrical charge. (b)principle of a parallel plate capacitor with diagram.	1 1

	C)	
	Electrostatic energy stored in C1 is given by,	½
	$E_1 = \frac{1}{2}C_1V_1^2$	
	$= \frac{1}{2}\times 4 \times 10^{-6} \times (200)^2$	½
	$= 8 \times 10^{-2}\,J$	
	Capacitance of an uncharged capacitor, $C_2 = 2\mu F = 2 \times 10^{-6}F$	
	When C_2 is connected to the circuit, the potential acquired by it is V_2.	
	According to the conservation of charge, initial charge on capacitor C_1 is equal to the final charge on capacitors, C_1 and C_2	
	$\therefore V_2(C_1 + C_2) = C_1V_1$	½
	$V_2 \times (4+2) \times 10^{-6} = 4 \times 10^{-6} \times 200$	
	$V_2 = \frac{400}{3}V$	
	Electrostatic energy for the combination of two capacitors is given by,	½
	$E_2 = \frac{1}{2}(C_1 + C_2)V_2^2$	
	$= \frac{1}{2}(2+4) \times 10^{-6} \times \left(\frac{400}{3}\right)^2$	½
	$= 5.33 \times 10^{-2}\,J$	
	Hence, amount of electrostatic energy lost by capacitor C_1	
	$= E_1 - E_2$	
	$= 0.08 - 0.0533 = 0.0267$	
	$= 2.67 \times 10^{-2}\,J$	½

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