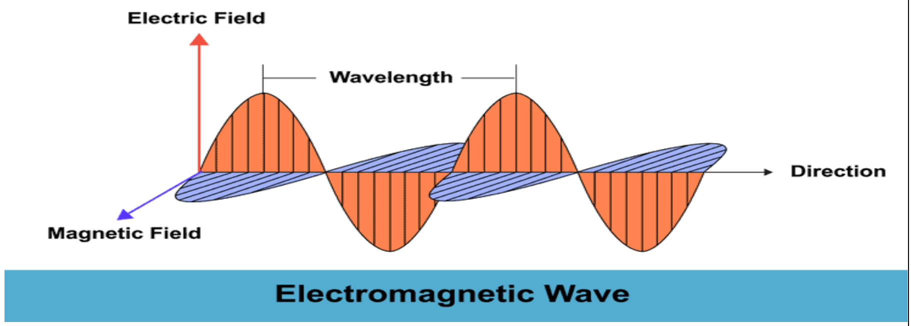
Class: XII

MODEL 1: 2023-2024

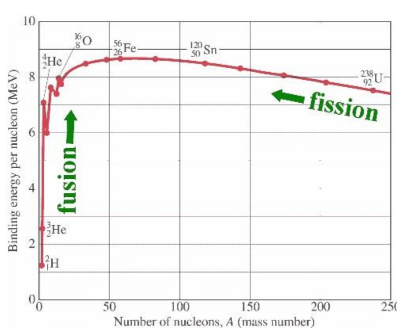
MARKING SCHEME

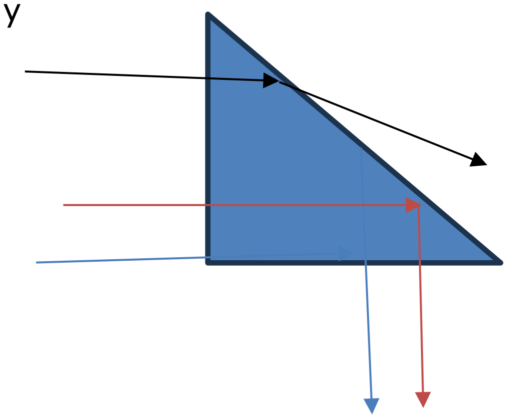
SUBJECT: PHYSICS

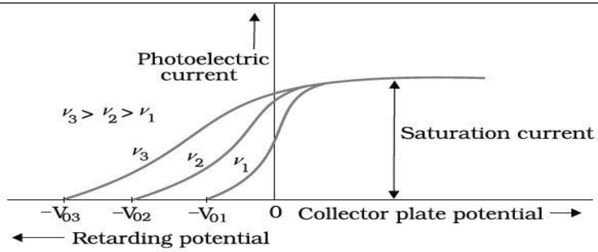
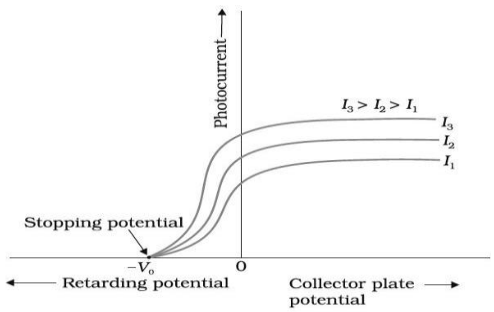
Q.no		Marks
	SECTION A	
1	(a)resistivity	1
2	(d) zero	1
3	©Decreases because charge moves along the field	1
4	(d) 6A in the clockwise direction	1
5	(c) 4:3	1
6	(a) decreases	1
7	(b) increase	1
8	(d) Both electric and magnetic field vectors are parallel to each other.	1
9	(c) lenz law	1
10	(d) 0.85	1
11	©3000 Ǻ	1
12	((c)Lenz law	1
13	(A) The nuclear force is much weaker than the Coulomb force .	1
14	(A) 30 V	1
15	(a)magnetic dipole moment	1
16	c) A is true but R is false	1
17	c) A is true but R is false	1
18	a) Both A and R are true and R is the correct explanation of A	1

	SECTION B	
19	 λ1 - Microwave λ2 - ultraviolet λ3- infrared Ascending order - λ2<λ3<λ1	
20	A - diamagnetic B- paramagneti c The magnetic susceptibility of A is small negative and that of B is small positive.	
21	From the relation $R = R_0A^{1/3}$, where R_0 is a constant and A is the mass number of a nucleus $R_{Fe}/R_{Al} = (A_{Fe}/A_{Al})^{1/3}$ $= (125/27)^{1/3}$ $R_{Fe} = 5/3\ R_{Al}$ $=5/3 \times 3.6$ = 6 fermi **OR** Given short wavelength limit of Lyman series	

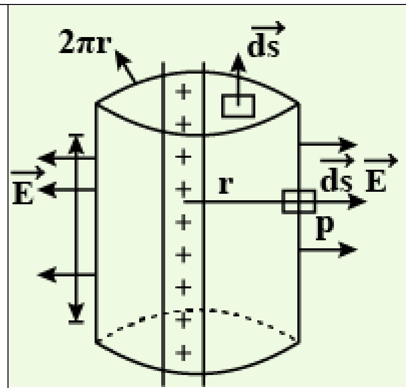
	$\frac{1}{\lambda_L} = R\left(\frac{1}{1^2} - \frac{1}{\infty}\right)$ $\frac{1}{913.4\ Å} = R\left(\frac{1}{1^2} - \frac{1}{\infty}\right)$ $\lambda_L = \frac{1}{R} = 913.4\ Å$ For the short wavelength limit of Balmer series $n_1=2,\ n_2 = \infty$ $\frac{1}{\lambda_B} = R\left(\frac{1}{2^2} - \frac{1}{\infty}\right)$ $\lambda_B = \frac{4}{R} = 4 \times 913.4\ Å$ $= 3653.6\ Å$	
22	$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $\frac{1}{f} = \left(\frac{\mu_m}{\mu_w} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$ $\frac{\mu_m}{\mu_w} = \frac{1.25}{1.33}$ $\frac{\mu_m}{\mu_w} = 0.98$ The value of (μ – 1) is negative and 'f' will be negative. So it will behave like diverging lens.	
23	To keep the reading of ammeter constant value of R should be **increased** as with the increase in temperature of a semiconductor, its resistance **decreases** and current tends to increase. **OR** B - reverse biased In the case of reverse biased diode the potential barrier becomes higher as the battery further raises the potential of the n side. C -forward biased Due to forward bias connection the potential of P side is raised and hence the height of the potential barrier decreases.	
24	Spherical cylindrical	

25	X_{C}=1/CW X_{L}=LW Z=$\sqrt{z2+(XL-XC)2)}$ V=I/Z	
	SECTION C	
26	Diagram Derivation The ampere is the value of that steady current which, when maintained in each of the two very long, straight, parallel conductors of negligible cross-section, and placed one metre apart in vacuum, would exert on each of these conductors a force equal to 2×10^{-7}newtons per metre of length.	
27		

28	N=1/SIN IC N=1/sin 45 N=1.41 Ray 1=refracted Rays 2,3=totally reflected 	
29	From the observations made (parts A and B) on the basis of Einstein's photoelectric equation, we can draw following conclusions: 1. For surface A, the threshold frequency is more than 10^{15} HZ, hence no photoemission is possible. 2. For surface B the threshold frequency is equal to the frequency of given radiation. Thus, photo-emission takes place but kinetic energy of photoelectrons is zero. 3. For surface C, the threshold frequency is less than 10^{15} Hz. So photoemission occurs and photoelectrons have some kinetic energy **OR**	
a)	A - cut off or stopping potential X - anode potential	

b) c)	 **FIGURE** Variation of photoelectric current with collector plate potential for different frequencies of incident radiation.  **FIGURE** Variation of photocurrent with collector plate potential for different intensity of incident radiation.	
30	For a transition from n=3 to n =1 state, the energy of the emitted photon, $h\nu = E_2 - E_1 = 13.6 \left[\frac{1}{1^2} - \frac{1}{3^2}\right]$ eV = 12.1 eV. From Einstein's photoelectric equation, $h\nu = K_{max} + W_0$ $\therefore W_0 = h\nu - K_{max}$ = 12.1 − 9 = 3.1 eV Threshold wavelength, $\lambda_{th} = \frac{hc}{W_0} = \frac{6.62\times10^{-34} \times 3\times10^{8}}{3.1\times1.6\times10^{-19}}$ = 4x10^{-7} m	
	SECTION D	
31(a)	Electric flux is defined as the measure of count of number of electric field lines crossing an area. Electric flux ϕ=EAcosθ SI unit of electric flux is Nm2/C ***∮ E.ds = q / ε₀*** The Gauss law states that electric flux passing through any	

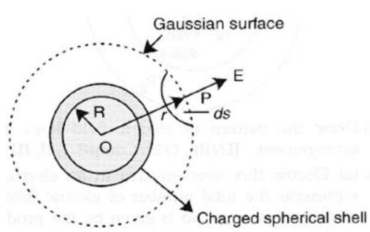
(b)	closed surface is equal to the charge enclosed by that surface divided by permittivity of vacuum. By symmetry, the magnitude of the electric field will be the same at all points on the curved surface of the cylinder and directed radially outward. $\vec{E}$ and $\vec{ds}$ are along the same direction. Now here we have the two surfaces, one curved and other the plane caps, First, the flux through the curved surface, $\oint \vec{E}\cdot\vec{ds}=q_{in}\epsilon_0$ $E(2\pi rl)=\lambda l/\epsilon_0$ $E=\lambda 2\pi r\epsilon_0$ Now due to the plane caps, The angle between $\vec{E}$ and $\vec{ds}$ is 90, so the flux through that part is zero so, Total flux through the closed surface is, $E=\lambda 2\pi r\epsilon_0$	



OR

(a) Electric field due to a uniformly charged thin spherical shell:

(b)



(i) When point P lies outside the spherical shell: Suppose that we have calculate field at the point P at a distance r (r>R) from its centre. Draw Gaussian surface through point P so as to enclose the charged spherical shell. Gaussian surface is a spherical surface of radius r and centre O.

Let $\vec{E}$ be the electric field at point P, then the electric flux through area element of area $\vec{ds}$ is given by

$$d\varphi = \vec{E}\cdot\vec{ds}$$

Since $\vec{ds}$ is also along normal to the surface

$$d\varphi = E\,dS$$

∴ Total electric flux through the Gaussian surface is given by

$$\varphi = \oint E ds = E \oint ds$$

Now, $\oint ds = 4\pi r^2$ ...(i)

$= E \times 4\pi r^2$

Since the charge enclosed by the Gaussian surface is q, according to the Gauss's theorem,

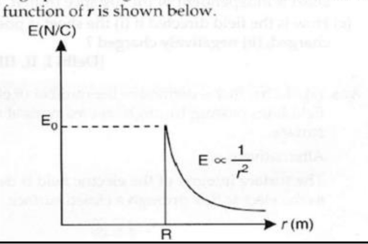
$$\varphi = \frac{q}{\epsilon_0} \text{...(ii)}$$

(ii) From equation (i) and (ii) we obtain

$$E \times 4\pi r^2 = \frac{q}{\epsilon_0}$$

$$E = \frac{1}{4\pi\epsilon_0} \cdot \frac{q}{r^2} \text{ (for r>R)}$$

A graph showing the variation of electric field as a function of *r* is shown below.



32(a)

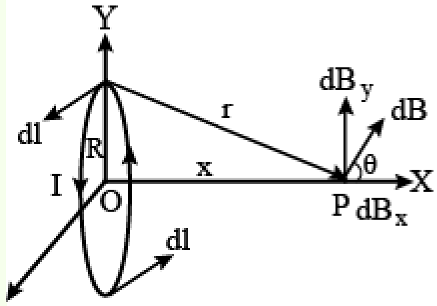
(b)

$$\frac{\mu_0}{4\pi} \frac{I d\vec{l} \times \vec{r}}{r^3}$$

Imagine a circular coil of radius R with center O.Let the current flowing through

(a)

the circular loop be I. suppose P is any point on the axis at a distance of r from the centre 0. Let the circular coil be made up of a large number of small elements of current, each having a length of



dl.

According to Biot-Savart's law, the magnetic field at Point P will be

$dB=\frac{\mu_0 I}{4\pi}\times\frac{|dl\times r|}{r^3}$

where, $r^2=x^2+R^2$

$|dl\times r|=rdl$ [∵ Both are perpendicular]

Here, r is the position vector of point O from the current element.

dB has two components i.e.,dBx and dBy.

dBy is cancelled out and only the x-component remains.

$\therefore dB_x=dB\cos\theta$

$\cos\theta=\frac{R}{\sqrt{x^2+R^2}}$

$dB_x=\frac{\mu_0 I dl}{4\pi}.\frac{R}{(x^2+R^2)^{\frac{3}{2}}}$

But, $\int dl=2\pi R$

So, $B=\frac{\mu_0 IR\times 2\pi R}{4\pi(x^2+R^2)^{\frac{3}{2}}}$

For n turns in the circular loop,

$dB_x = dB \cos\theta$

$\cos\theta = \dfrac{R}{(x^2 + R^2)^{1/2}}$

$\therefore dB_x = \dfrac{\mu_0 I\, dl}{4\pi} \cdot \dfrac{R}{(x^2 + R^2)^{3/2}}$

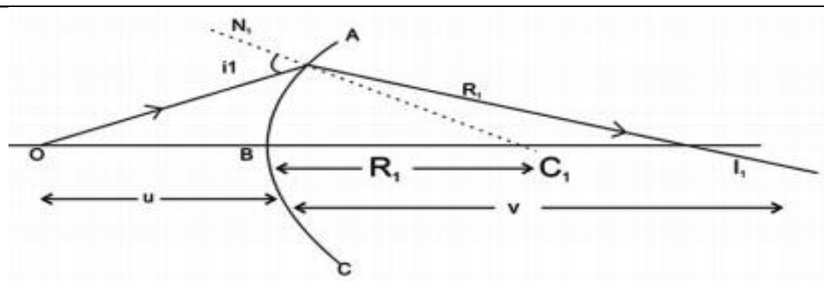
OR

Junction rule: At any junction, the sum of the currents entering the junction is equal to the sum of currents leaving the junction

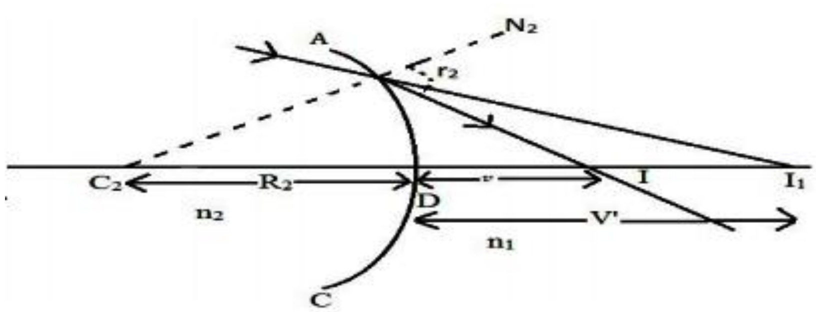
Loop rule: The algebraic sum of changes in potential around any closed loop involving resistors and cells in the loop is zero

Derivation

33(a)



(b)



n2v1−n1u=n2−n1R1.......(1) 1)

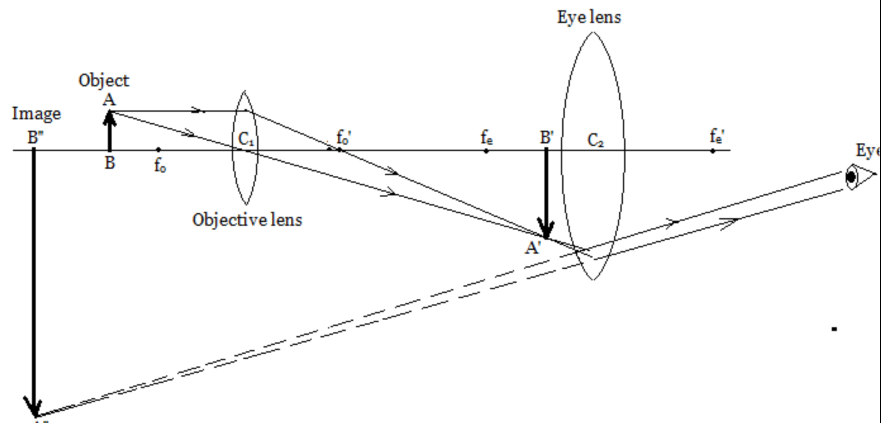
Similarly, for the second surface,

n1v−n2v1=n1−n2R2.......(2).......(2)

Now, by adding the above two equations, we get,

n1v−n1u=(n2−n1)[1R1−1R2]

On further simplifying, we get,

(a)	$1/v-1/u=(n2n1-1)[1R1-1R2]$ When $u=\infty=\infty$ and $v=f$ $1/f=(n2n1-1)[1R1-1R2]$ $1/f=(\mu-1)[1R1-1R2]$ *OR*	
(b)	Magnifying power, $M=me\times mo$ where me and mo are the individual magnifying powers o objective and eye lens. $M=v0/u0(1+D/fe)$--------- (1) when the final image is at near point. $M=v0u0\times Dfe$-----------(2) when the final image is at the infinity. 10D-Objective 2D eyepiece  Compund microscope	
	SECTION E	
34(i) **(ii)** **(iii)** **(iii)**	When the image is formed at infinity, we can see it with minimum strain in the ciliary muscles of the eye. The multi-component lenses are used for both objective and the eyepiece to improve image quality by minimising various optical aberrations in lenses. (a) The compound microscope is used to observe minute nearby objects whereas the telescope is used to observe distant objects. (b) In compound microscope the focal length of the objective is lesser than that of the eyepiece whereas in telescope the focal length of the	

	objective is larger than that of the eyepiece. **OR** (a) The image formed by reflecting type telescope is brighter than that formed by refracting telescope. (b) The image formed by the reflecting type telescope is more magnified than that formed by the refracting type telescope.	
35(i)	LEDs are made up of compound semiconductors and not by the elemental conductor because the band gap in the elemental conductor has a value that can detect the light of a wavelength which lies in the infrared (IR) region.	
(ii)	1.8 eV to 3 eV	
(iii)	LED is reversed biased that is why it is not glowing. **OR** V-I Characteristic curves of pn junction diode in forward biasing and reverse biasing.	