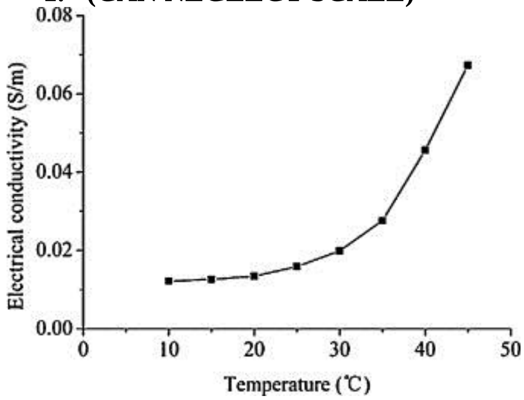
Marking Scheme Practice Question Paper-2

12th Standard Physics

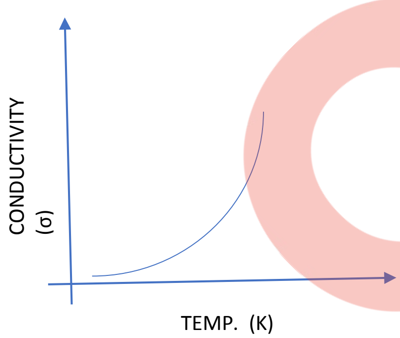
ANSWERS OF SAMPLE PAPER

Session (2020-21)

1. **(CAN NEGLECT SCALE)**



OR



2.Change in flux(φ= BA cosωt)

3. Coefficient of **Self inductance(L= $\mu_0\mu_r n^2 A\ell$)** is directly proportional to square of **number of turns per unit length in coil**, hence on **doubling** the **number of turns**. Coefficient of **Self inductance** becomes four times.

OR

Reading of voltmeter :220V, and ammeter : 2.2A

4. Microwaves are **electromagnetic waves** with **wavelengths** ranging from as long as one meter to as short as one millimeter,
wavelengthat frequency 300 MHz (0.3 GHz)
$\lambda = c/f = (3 \times 10^8) / (300 \times 10^6) = 100m$

5. $(Eg)_C > (Eg)_{Si} > (Eg)_{Ge}$.

OR

What is meant by minority carrier injection?

Ans. When the diode is forward biased, electrons are sent from n → p (where they are minority carriers) and holes are sent from p → n (where they are minority carriers). At the junction boundary the concentration of minority carriers increases compared to the equilibrium concentration (i.e., when there is no bias). This is known as minority carrier injection.

6. I R Radiation

7. As $R \propto A^{1/3}$, so $(R_1/R_2)^3 = A_1/A_2$

$(R_1/R_2)^3 = 8/1$

$R_1/R_2 = 2/1$

8. $using\ \lambda = \frac{h}{\sqrt{2mE}}$

mE = constant so m α 1/E

hence $E_2 < E_3 < E_1$

OR

When radiation 5.6eV is incident on a metal surface, Photoelectron are ejected with kinetic energy 4eV, determine stopping potential.
$K = eV_0$ (e x stopping potential) =4 eV so stopping potential = 4 V

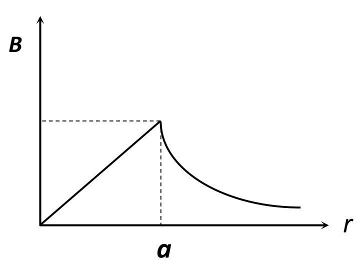
9. $E = 12.4\ keV = 12.4 \times 10^3\ eV = hc/\lambda$, so $\lambda\ (nm) = hc/E(eV) = 1240/(12.4 \times 10^3)$
$= 10^{-1} nm$

$\lambda = 10^{-10} m$

hence emw is X-rays

10.For (III) $U = -MB\cos\theta$; where θ =Angle between normal to the plane of the coil and direction of magnetic field. As in dia.III θ minimum so U is minimum.

OR



11. (b) By the formula capacitance of a capacitor

$C_1 = \varepsilon_0 \times \frac{KA}{d} \propto \frac{K}{d}$

Hence, $\frac{C_1}{C_2} = \frac{K_1}{d_1} \times \frac{d_2}{K_2} = \frac{K_1}{K_2} \times \frac{d/2}{3K} = \frac{1}{6}$ or $C_2 = 6C_1$

12. (a)When current flows through a conductor it always remains uncharged, hence no electric field is produced outside it.

13. -(d)In a non-uniform magnetic field, both a torque and a net force acts on the dipole. If magnetic field were uniform, net force on dipole would be zero.

14. (b)Self-inductance of a coil is its property virtue of which the coil opposes any change in the current flowing through it.

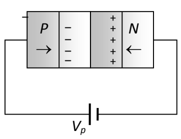
15.1 ans. (a)3.4 mA

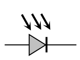
As net V= 8-0.5 = 7.5V, R=2.2kΩ, I= V/R= 3.4 mA

15.2.

(a) The current in the reverse biased condition is generally very small

15.3. (c)



15.4 (c) 

15.5(b) A photo diode is reverse biased and an LED is forward biased

16.1(d)A decrease in the energy of the system unless $Q_1R_2 = Q_2R_1$

16.2 (d) zero

16.3. (a)By using $U = 9 \times 10^9 \frac{Q_1Q_2}{r}$

$\Rightarrow U = 9 \times 10^9 \times \frac{10^{-6} \times 10^{-6}}{1} = 9 \times 10^{-3} J$

16.4 (c)$F_A = F_B$

16.5(d)No work is done

17. When a changing magnetic flux is applied to a bulk piece of conducting material then circulating currents called eddy currents are induced in the material.
Disadvantage-) The production of eddy currents in a metallic block leads to the loss of electric energy/power in the form of heat.

OR

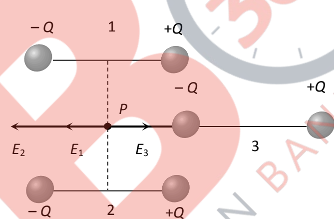
The magnetic flux linked with a coil varies with time as $\phi = 3t^2 + 4t + 9$ weber. What is the induced emf at t = 2 s?

$$e = -\frac{d\varphi}{dt}$$

lel =6t+4= 16V (at t=2sec)

18. Point P lies at equatorial positions of dipole 1 and 2 and axial position of dipole 3.

Hence field at P
due to dipole 1
$E_1 = \frac{k.p}{x^3}$ (towards left)
due to dipole 2
$E_2 = \frac{k.p}{x^2}$ (towards left)
due to dipole 3 $E_3 = \frac{k.(2p)}{x^3}$ (towards right)
So net field at P will be zero.



OR

Two metal spheres of radii R_1 and R_2 are charged to the same potential. Determine the ratio of charges and electric field on the spheres.
Here $V_1 = V_2$
So $kQ_1/R_1 = kQ_2/R_2$
$Q_1/Q_2 = R_1/R_2$
For $E = kQ/R^2$, $E_1/E_2 = Q_1R_2^2/Q_2R_1^2$
$= Q_1R_2^2/Q_2R_1^2$
$= R_2/R_1$

19. In the Rutherford scattering experiment the distance of the closest approach for an α particle is d_0. If particle is replaced by a proton, how much K.E in comparison to α particle will it require to have the same distance of closest approach d_0?

$\frac{1}{4\pi\varepsilon_o}.\frac{(Ze)(2e)}{d} = K$, for same $d=d_0$, K α charge, so Kfor proton $K_p=K/2$

as charge of proton =1/2 charge of alpha particle

20. Any two

(i) Low operational voltage and less power (ii) Fast action and no warm-up time required.
(iii) The bandwidth of emitted light is 100Å to 500 Å (Eg=hc/λ) or, in other words, it is nearly (but not exactly) monochromatic (iv) Long life and ruggedness (v) Fast on-off switching capability

OR

Distinguish between 'P type' and 'N type' semi-conductors

Distinction between n-type and p-type semiconductors

	n-type semiconductors		p-type semiconductors
1	It is an extrinsic semiconductors which is obtained by doping the impurity atoms of Vth group of periodic table to the pure germanium or silicon semiconductor.	1	It is an intrinsic semiconductors which is obtained by doping the impurity atoms of III group of periodic table to the pure germanium or silicon semiconductor.
2	The impurity atoms added, provide extra electrons in the structure, and are called donor atoms.	2	The impurity atoms added, create vacancies of electrons (i.e. holes) in the structure and are called acceptor atoms.
3	The electrons are majority carriers and holes are minority carriers.	3	The holes are majority carriers and electrons are minority carriers.
4	The electron density (ne) is much greater than the hole density (nh)i.e. ne>>(nh)	4	The hole density (ne) is much greater than the electron density (nh)i.e. nh>> ne
5	The donor energy level is close to the conduction band and far away from valence band.	5	The acceptor energy level is close to valence band and is far away from the conduction band.
6	The Fermi energy level lies in between the donor energy level and conduction band.	6	The Fermi energy level lies in between the acceptor energy level and valence band.

21. (1) **Emf of cell (*E*) :** The potential difference across the terminals of a cell when it is not supplying any current is called it's emf.

(2) **Potential difference (V) :** The voltage across the terminals of a cell when it is supplying current to external resistance is called potential difference or terminal voltage. Potential difference is equal to the product of current and resistance of that given part *i.e.* $V = iR$.

22.

Radius of orbit : For an electron around a stationary nucleus the electrostatics force of attraction provides the necessary centripetal force

$i.e. \frac{1}{4\pi\varepsilon_0}\frac{(e)e}{r^2} = \frac{mv^2}{r}$ .... (i) Also Bohr's postulate states,

$mvr = \frac{nh}{2\pi}$ ....(ii)

From equation (i) and (ii) radius of n^{th} orbit (replace r as r_n & v as v_n)

$r_n = \frac{n^2h^2\varepsilon_0}{\pi me^2} = 0.53Å(n = 1)$ $(k = \frac{1}{4\pi\varepsilon_0}) \Rightarrow$ $\mathbf{r_n \alpha\ n^2}$

23. if the respective position of briht and dark fringes remains unchanged with the passage of time then such an interference pattern is known as sustained interference.

(Any two)

1. The two sources must be coherent. The initial phase difference between the interfering waves must remain constant. Otherwise the interference will not be sustained.

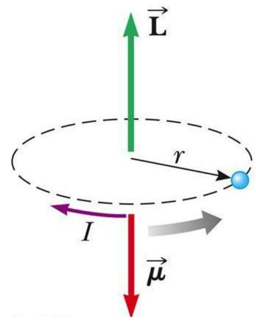
2 The two sources must be very close to each other and the pattern must be observed at a large distance to have sufficient width of the fringe, Otherwise due to small fringe width $\left(\beta \propto \frac{1}{d}\right)$ the eye can not resolve fringes resulting in uniform illumination.

3. The sources must be monochromatic. Otherwise, the fringes of different colours will overlap.

4. The two waves must be having same amplitude for better contrast between bright and dark fringes. This improves contrast with I_{max} and I_{min}

24.

- The electrons move in circular orbits
- The orbiting electron constitutes a tiny current loop
- The magnetic moment of the electron is associated with this orbital motion
- $\vec{L}$ is the angular momentum
- $\vec{\mu}$ is magnetic moment



magnetic dipole moment,

(μ)

$= IA$

$$= \left(\frac{e}{T}\right) \cdot \pi r^2 = \frac{e}{\left(\frac{2\pi r}{v}\right)} \cdot \pi r^2 = \frac{evr}{2}$$

Here L = mvr,

μ= eL/2m, In vector form μ = - (e/2m)L

$= -\frac{e}{2m_e}\vec{L}$

The negative sign proves that magnetic dipole moment is opposite in direction to angular momentum of electron.

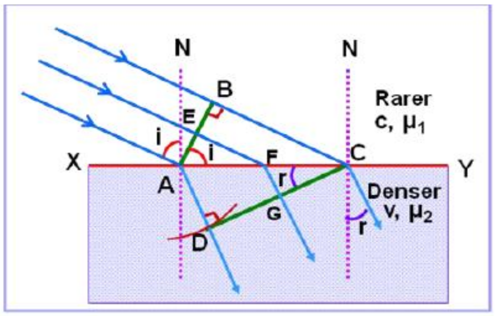
25. A beam of light of wavelength 420 nm, is used to obtain interference fringes in a Young's double-slit experiment. Find the distance of the third dark fringe on the screen from the central maxima. Take the separation between the slits as 4.2 mm and the distance between the screen and plane of the slits as 1.4 m.

As yn = (n-1/2)λD/d

the third dark fringe on the screen from the central maxima = y_3' = (3-1/2) λD/d

= 5x 420x 10^{-9} x 1.4(/2 x4.2 x10^{-3}) = 3.5 x 10^{-4}m

26. **Ans)(a) AB- INCIDENT PLANE WAVEFRONT**
DC- REFRACTED WAVEFRONT
XY- REFRACTING SURFACE



If c be the speed of light, t be the time taken by light to go from B to C or A to D or E to G through F, then

For rays of light from different parts on the incident wavefront, the values of AF are different. But light from different points of the incident wavefront should take the same time to reach the corresponding points on the refracted wavefront.

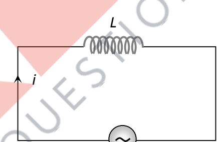
So, t should not depend upon AF. This is possible only

if $\frac{\sin i}{c} - \frac{\sin r}{v} = 0$ or $\frac{\sin i}{c} = \frac{\sin r}{v}$ or $\frac{\sin i}{\sin r} = \frac{c}{v} = \mu$

Or we have $BC = V_1 t$ $AD = V_2 t$, ANS $\sin i = BC/AC$, $\sin r = AD/AC$

SO $\sin i / \sin r = BC/AD = V_1/V_2 = \mu$ WHICH IS Snell's law of refraction

27. **Inductive Circuit (*L*-Circuit) : For** $V = V_0 \sin \omega t$



$V = V_0 \sin \omega t$

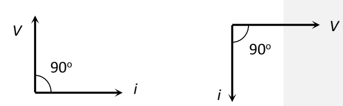
Aco. to KVL $V_L + V = 0 \rightarrow L di/dt = V_0 \sin \omega t$

di= $(V_0/L) \sin \omega t \, dt$ on integrating

$I = (V_0/\omega L)(-\cos \omega t) = -I_0 \cos \omega t$ $(I_0 = V_0/\omega L = V_0/X_L)$

(1) Current : $I = I_0 \sin\left(\omega t - \frac{\pi}{2}\right)$, X_L is inductive reactance

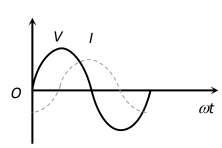
(2) Peak current : $i_0 = \frac{V_0}{X_L} = \frac{V_0}{\omega L} = \frac{V_0}{2\pi \nu L}$

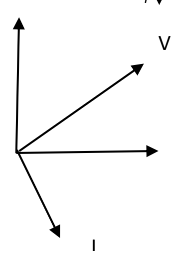


(3) Phase difference between voltage and current $\varphi = 90^o$ (or $+\frac{\pi}{2}$)

(4) Power factor : $\cos \varphi = 0$, (5) Power : $P = 0$

(6) Phasor diagram : the current lag Voltage by $\frac{\pi}{2}$





OR

A wheel with 8 metallic spokes each 50 cm long is rotated with a speed of 120 rev/min in a plane normal to the horizontal component of the Earth's magnetic field. The Earth's magnetic field at the place is 0.4 G and the angle of dip is 60°. Calculate the emf induced between the axle and the rim of the wheel. How will the value of emf be affected if the number of spokes were increased ?

N=8,l=.5m, f=120/60 rps=2rps,→$\omega=4\pi$, B_E= 0.4G=0.4 x10^{-4} T , I= 60^0

$B_H = B_E \cos I = 0.4 \times 10^{-4} \cos 60 = 0.2 \times 10^{-4}$

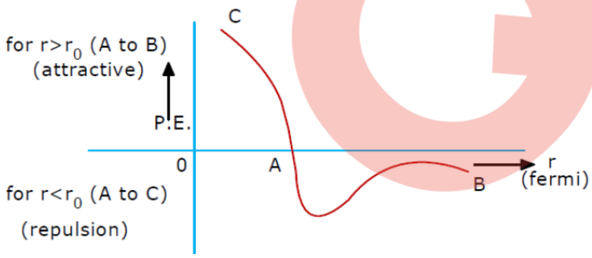
$e = B_H \omega L^2/2$

$= \pi \times 10^{-5} = 3.14 \times 10^{-5}$ V,

no change on changing no. of spokes as all spokes are connected in parallel.

28. **Nuclear Force-** Forces that keep the nucleons bound in the nucleus.

(1) Nuclear forces are short range forces. These do not exist at large distances greater than 10^{-15} *m*. (2) Nuclear forces are the strongest forces in nature. (3) These are attractive force and causes stability of the nucleus. (4) These forces are charge independent. (5) Nuclear forces are non-central force.



29. An optical instrument uses objective lens of power 50 D and eye- lens of power 16 D and has a tube length of 16.25 cm. Name the optical instrument , calculate its magnifying power if it forms the final image at infinity & draw proper ray diagram.

P_e =16D→fe= 1/ P_e = 6.25cm, P_o =50D→ f_o =,1/ P_o = 2cm L=16.25cm,D=25cm

the optical instrument is compound microscope as both fo and fe are small.

$$\boxed{M \approx \frac{-L}{f_o} \times \frac{D}{f_e}}$$

or M = - Po x Pe x L x D = -32.5 (- sign as final image is inverted)
(*no issue for not showing -sign)

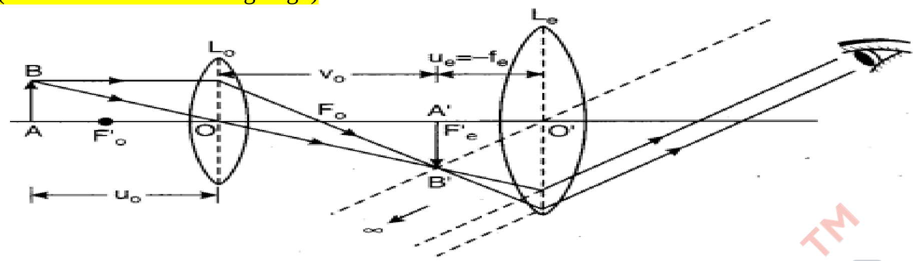


Fig. 11.66 : Compound microscope

OR

(a) For a ray of light travelling from a denser medium of refractive index n_1 to a rarer medium of refractive index n_2 , prove that n_1/n_2=1/sin c , where c is the critical angle for the media.

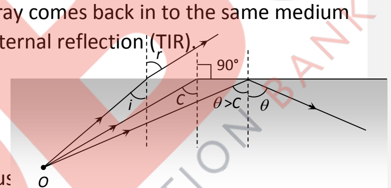
critical angle (C) = angle of incidence when angle of refraction becomes 90°

(**i.e. i= C if r= 90°**)

When Angle of incidence exceeds the critical angle than light ray comes back in to the same medium after reflection from interface. This phenomenon is called Total internal reflection (TIR).

From Snell's law

(1) $\mu = \frac{n1}{n2} = \frac{\sin 90}{\sin c} = \frac{1}{\sin C}$



(b) Explain with the help of a diagram, how the above principle is us
signals using optical fibres.

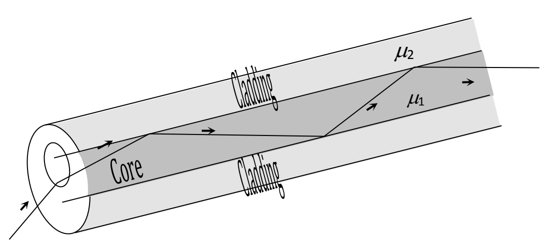
Optical fibres consist of many long high quality composite glass/quartz fibres. Each fibre consists of a core and cladding.

(i) The refractive index of the material of the core (μ_1) is higher than that of the cladding (μ_2).

(ii) When the light is incident on one end of the fibre at a small angle, the light passes inside, undergoes repeated total internal reflections along the fibre and finally comes out. The angle of incidence is always larger than the critical angle of the core material with respect to its cladding.

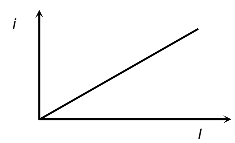
(iii) Even if the fibre is bent, the light can easily travel through along the fibre

(iv) A bundle of optical fibres can be used as a 'light pipe' in medical and optical examination. It can also be used for optical signal transmission. Optical fibres have also been used for transmitting and receiving electrical signals which are converted to light by suitable transducers.

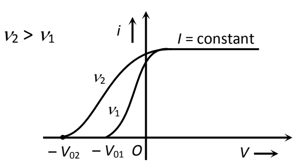


30. Light of intensity 'I' and frequency 'v' is incident on a photosensitive surface and causes photoelectric emission. What will be the effect on anode current when (i) the intensity of light is gradually increased, (ii) the frequency of incident radiation is increased, and (iii) the anode potential is increased ? In each case, all other factors remain the same. Explain, giving justification in each case.

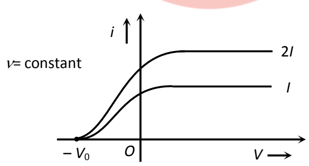
(i) the intensity of light is gradually increase →current(I) increases as I α intensity
Intensity ∝ no. of incident photon ∝ no. of emitted photoelectron per time ∝ photo current



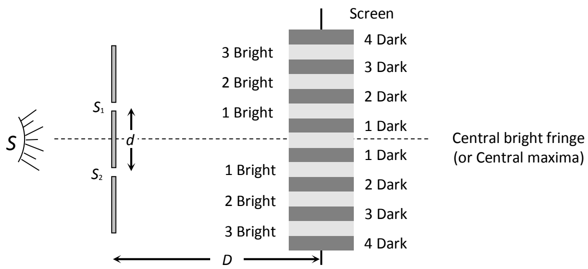
(ii) the frequency of incident radiation is increased,→ no change in saturation current as it is independent of frequency (actually KE α ν)

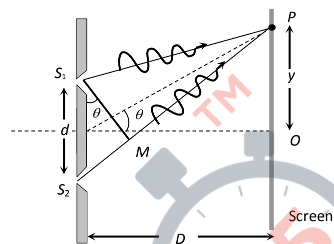


and (iii) the anode potential is increased current increases first then after certain potential no change in current.



31. Monochromatic light (single wavelength) falls on two narrow slits S_1 and S_2 which are very close together acts as two coherent sources, when waves coming from two coherent sources (S_1, S_2) superimposes on each other, an interference pattern is obtained on the screen. In YDSE alternate bright and dark bands obtained on the screen. These bands are called Fringes.





d = Distance between slits
D = Distance between slits and screen
λ = Wavelength of monochromatic light emitted from source

(1) Central fringe is always bright, because at central position $\varphi = 0^o$ or $\Delta x = 0$

(2) **Path difference at any point P on screen :** Path difference between the interfering waves meeting at a point P on the screen is given by

$\Delta x = S_2P - S_1P = (S_2M + MP) - S_1P = S_2M$ (as $MP = S_1P$)

$\Delta x = d\sin\theta = yd/D$ (as $\sin\theta$ approx = $\tan\theta = y/D$) where y is the position of point P from central maxima.

i.e., Path difference = $S_2P - S_1P$

i.e., Path difference = $S_2P - S_1P = S_2M$

$= d \sin\theta$

where, $S_1M \perp S_2P$

[$\because \angle S_2S_1M = \angle OCP$ (By geometry)

$\Rightarrow S_1P = PM \Rightarrow S_2P = S_2M$]

If θ is small, then $\sin\theta \approx \theta \approx \tan\theta$

$\therefore$ Path difference,

$S_2P - S_1P = S_2M = d\sin\theta \approx d\tan\theta$

$$\text{Path difference} = d\left(\frac{y_n}{D}\right) \qquad \ldots(i)$$

[$\because$ In ΔPCO, $\tan\theta = \frac{OP}{CO} = \frac{y_n}{D}$]

For constructive interference

Path difference = $n\lambda$, where, $n = 0, 1, 2, \ldots$

$$\frac{dy_n}{D} = n\lambda \qquad \text{[From Eq. (i)]}$$

$$\Rightarrow \quad y_n = \frac{Dn\lambda}{d}$$

$$\Rightarrow \quad y_{n+1} = \frac{D(n+1)\lambda}{d}$$

For destructive interference

Path difference = $(2n-1)\frac{\lambda}{2}$, where $n = 1, 2, 3, \ldots$

$$\Rightarrow \quad \frac{y'_n d}{D} = (2n-1)\frac{\lambda}{2} \qquad \text{[From Eq. (i)]}$$

$$\Rightarrow \quad y'_n = \frac{(2n-1)D\lambda}{2d}$$

where, y'_n is the separation of nth order dark fringe from central fringe.

$$\therefore \quad y'_{n+1} = (2n+1)\frac{D\lambda}{2d}$$

$\therefore$ Fringe width of bright fringe

= Separation between (n + 1)th and nth order dark fringe from centred fringe,

$\Rightarrow \beta = y'_{n+1} - y'_n$

or $\beta = \frac{(2n+1)D\lambda}{2d} - \frac{(2n-1)D\lambda}{2d}$

OR

Using glass prism derive relation between i, e, A and D where letters have their usual meaning and hence derive an expression for refractive index of glass prism.

Diagram shows section ABC of a prism taken by a vertical plane perpendicular to the edge. BC is base of the prism and AB & AC are its two refracting surfaces. PQ is incident ray, QR is refracted ray and RS is emergent ray.

In quadrilateral AQN_2R, $\angle AQN_2 + \angle ARN_2 = 180^\circ$ .... (1)

$\angle A + \angle QN_2R = 180^\circ$

In $\Delta\, QRN_2$, $\angle r_1 + \angle r_2 + \angle QN_2R = 180^\circ$ .... (2)

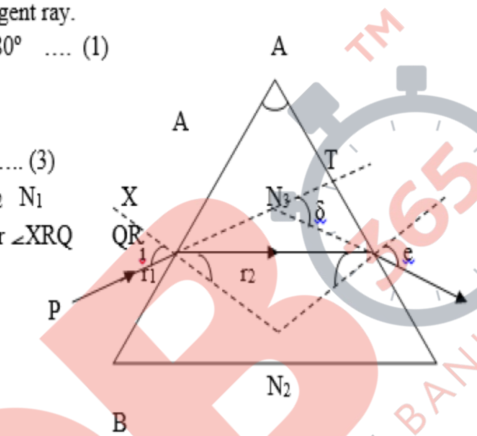
From equations (1) and (2), $\angle A = \angle r_1 + \angle r_2$ ..... (3)

In $\Delta\, XQR$, $\angle XQR = \angle i - \angle r_1$ & $\angle XRQ = \angle e - \angle r_2$

Since exterior $\angle TXR$ = interior $\angle XQR$ + interior $\angle XRQ$

$\therefore \angle\delta = (\angle i - \angle r_1) + (\angle e - \angle r_2)$

$= (\angle i + \angle e) - \angle A$



S

Or, $\angle A + \angle\delta = \angle i + \angle e$ .... (4)

A graph between $\angle i$ and $\angle\delta$ shows that,

C

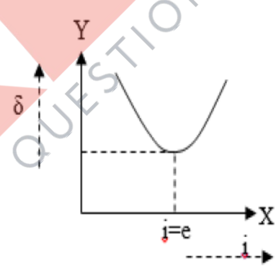
$\angle\delta$ is more when $\angle i$ is either small or large.

$\angle\delta$ is minimum for some intermediate value of $\angle i$.

From graph, when $\angle\delta = \angle\delta_m$, then $\angle i = \angle e$ & $\angle r_1 = \angle r_2$

Now, from equations (3) and (4), we get, δ_m

$\angle A = 2r \Rightarrow r = \frac{\angle A}{2}$ & $\angle A + \angle\delta_m = \angle i + \angle i \Rightarrow \angle i = \frac{\angle A + \delta m}{2}$



From Snell's law, $n = \dfrac{\sin\left(\frac{\angle A + \delta m}{2}\right)}{\sin\left(\frac{\angle A}{2}\right)}$ This is the required expression.

(i)For a glass prism $(\mu = \sqrt{3})$ the angle of minimum deviation is equal to the angle of the prism. Calculate the angle of the prism.

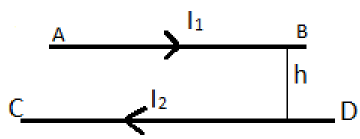
Here A=Dm, and for D=Dm → μ x sin(A/2)= sin (A+ Dm)/2= sinA

→μ= $\sqrt{3}$ = 2cos(A/2)→ 2cos(A/2) =$\sqrt{3}/2$ = cos π/6 → A/2 = π/6 → A = π/3

32. (a)condition v=E/B ($F_e = F_M$, qE=qvB)

When el.field is switched off ,the charge will revolve in circular path as only magnetic force will play role of centripetal force (mv^2/r)with r=mv/qB

(b) A horizontal wire AB of length ‘ℓ’ and mass ‘m’ carries a steady current I_1, free to move in vertical plane is in equilibrium at a height of ‘h’ over another parallel long wire CD carrying a steady current I_2, which is fixed in a horizontal plane as shown. Derive the expression for the force acting per unit length on the wire AB and write the condition for which wire AB is in equilibrium.



The force on a length *l* of each of two long, straight, parallel wires carrying currents i_1 and i_2 and separated by a distance *h* is

$$F = \frac{\mu_0}{4\pi} \cdot \frac{2 i_1 i_2}{h} \times l$$

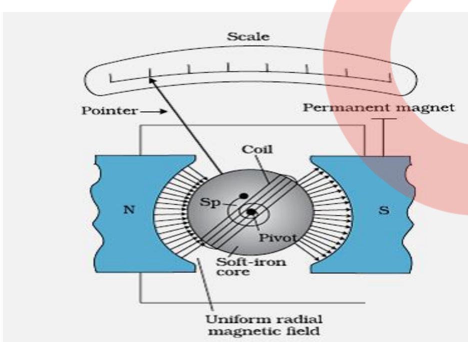
Hence force per unit length $\frac{F}{l} = \frac{\mu_0}{4\pi} \cdot \frac{2 i_1 i_2}{h}$ $\frac{F}{l} = \frac{2 i_1 i_2}{h}\left(\frac{dyne}{cm}\right)$

For AB equilibrium mg(downward)= F (upward)

→mg=$F = \frac{\mu_0}{4\pi} \cdot \frac{2 i_1 i_2}{h} \times l$

OR

Draw a labelled diagram of a moving coil galvanometer. State its working principle. Why is the magnetic field radial in a moving coil galvanometer ?



working principle - A current carrying coil placed in a uniform field experiences a torque which deflect it.

Torque is given by τ= ***NBiA* sin**θ. Vectorially $\vec{\tau} = \vec{M} \times \vec{B}$

Commented [ag1]:

Commented [ag2R1]:

Commented [ag3R1]:

In a moving coil galvanometer the coil is suspended between the pole pieces of a strong horse-shoe magnet. The pole pieces are made cylindrical and a soft iron cylindrical core is placed within the coil without touching it. This makes the field radial. In such a field the plane of the coil always remains parallel to the field. Therefore $\theta = 90^o$ and the deflecting torque always has the maximum value.

$\tau_{def} = NBiA$ ......(i)

Coil deflects, a restoring torque is set up in the suspension fibre. If α is the angle of twist, the restoring torque is

$\tau_{rest} = C\alpha$ .....(ii)

where *C* is the torsional constant of the fibre.

When the coil is in equilibrium *NBiA* = $C\alpha \Rightarrow i = K\alpha$,

where $K = \frac{C}{NBA}$ is the galvanometer constant. This linear relationship between *i* and α makes the moving coil galvanometer useful for current measurement and detection.

In Radial field the plane of the coil always remains parallel to the field. Therefore $\theta = 90^o$ and the deflecting torque always has the maximum value.

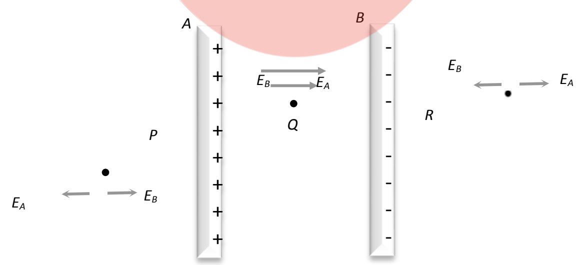
τ is maximum when $\theta = 90^o$, *i.e.*, the plane of the coil is parallel to the field $\tau_{max} = NBiA$

33. (a)Explain the underlying principle of working of a parallel plate capacitor. If two similar plates, each of area 'A' having surface charge densities '+ ***σ***' & '-***σ***' are separated by a distance 'd' in air, write expressions for (i) the electric field at points between the two plates, (ii) the capacity of the capacitor so formed.

underlying principle of working - **Charge given to a conductor increases it's potential *i.e.*,**

$Q \propto V \Rightarrow Q = CV$

Where *C* is a proportionality constant, called capacity or capacitance of conductor. Hence capacitance is the ability of conductor to hold the charge.(2) It's S.I. unit is $\frac{Coulomb}{Volt} = Farad\ (F$



At Q, $E_Q = (E_A + E_B) = \frac{1}{2\varepsilon_0}(\sigma + \sigma\ \ ) = \sigma/\varepsilon$

(i) Electric field between the plates : $E = \frac{\sigma}{\varepsilon_0} = \frac{Q}{A\varepsilon_0}$

(ii) Potential difference between the plates : $V = E \times d = \frac{\sigma d}{\varepsilon_0}$

(iii) Capacitance : $C = \frac{Q}{V} = \frac{\varepsilon_0 A}{d}$.

(i)no chane in potential difference between the plates as battery remains connected

(ii) energy stored in the capacitor. $U = \frac{1}{2}CV^2$, **) If a dielectric medium of dielectric constant K is filled completely between the plates then capacitance increases by K times *i.e.*** $C' = \frac{K\varepsilon_0 A}{d} \Rightarrow C' = KC$

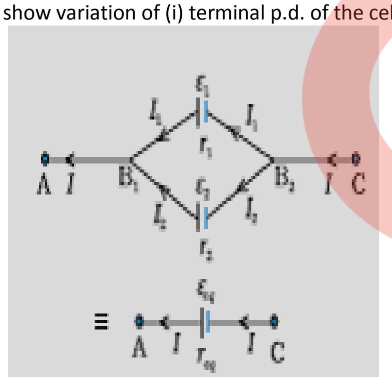
(iv) **as C increased by K times so $U'' = KU$**

(ii)electric field between the plates – no change as E= Vd and both remains same.

OR

Deduce an expression for effective emf when two primary cells of emf e_1 and e_2 & internal resistance r_1,and r_2, are connected in parallel.

A cell of emf (E) and internal resistance (r) is connected across a variable external resistance (R) Plot graphs to show variation of (i) terminal p.d. of the cell V with R (ii) I with R (iii) I with V



In parallel grouping all anodes are connected at one point and all cathode are connected together at other point.

$$V = V(B_1) - V(B_2) = \varepsilon_1 - I_1 r_1$$

$$V = V(B_1) - V(B_2) = \varepsilon_2 - I_2 r_2$$

$$I = I_1 + I_2$$

$$= \frac{\varepsilon_1 - V}{r_1} + \frac{\varepsilon_2 - V}{r_2} = \left(\frac{\varepsilon_1}{r_1} + \frac{\varepsilon_2}{r_2}\right) - V\left(\frac{1}{r_1} + \frac{1}{r_2}\right)$$

$$V = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2} - I\frac{r_1 r_2}{r_1 + r_2}$$

On comparing with

$$V = \varepsilon_{eq} - I\, r_{eq}$$

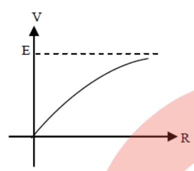
we get

$$\varepsilon_{eq} = \frac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$$

$$r_{eq} = \frac{r_1 r_2}{r_1 + r_2}$$

(i) V vs R:

$$V = \frac{ER}{R + r}$$



(ii) I vs R:

$$I = \frac{E}{R + r}$$