केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली
सीनियर स्कूल सर्टिफिकेट परीक्षा (कक्षा बारहवीं)
परीक्षार्थी प्रवेश–पत्र के अनुसार भरे

PHYSICS(042)

Date of Examination: 05·03·2013 Tuesday

Medium of answering the paper: English

Code No. as written on the top of question paper: 55/2

No. of supplementary answer-book(s) used: NIL

If physically challenged, tick the category

B D H S C

B = Blind, D = Deaf & Dumb, H = Physically Handicapped, S = Spastic, C = Dyslexic

Whether writer provided: हां / नहीं Yes / No: NO

*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का नाम 24 अक्षरों से अधिक है, तो केवल नाम के प्रथम 24 अक्षर ही लिखें।

Each letter be written in one box and one box be left blank between each part of the name. In case Candidate's Name exceeds 24 letters, write first 24 letters.

Space for office use

सीनियर स्कूल सर्टिफिकेट परीक्षा (कक्षा बारहवीं) केन्द्रीय माध्यमिक शिक्षा बोर्ड, दिल्ली

SENIOR S HOOL CERTIFICATE EXAMINATION (CLASS XII) CENTRAL BOARD OF SECONDARY EDUCATION, DELHI

प्रमाणित किया जा ा है कि मैंने / हमने इस उत्तर–पुस्तिका का मूल्यांकन प्रश्न पत्र के समुचित सेट के अनुसार और पूर्ण रूप से मूल्यांकन पद्धति के अनुसार किया है।

Certified that I/we have evaluated this answer book according to the correct set of question paper and stric as per the marking scheme.

	संख्या	हस्ताक्षर
परीक्ष **Exa**		
समन् **Co-**		
मुख्य **Heac (if ch**		

1. (i) if distance increased, Mutual inductance decreases

(ii) No of turns increased. Mutual inductance increases

2. $\lambda = \frac{h}{P}$

$\lambda = \frac{h}{\sqrt{2m(K.E)}} = \frac{h}{\sqrt{2mqV}}$

3. Net emf = E. Hence current = $\frac{E}{R}$

4. Flux = $\frac{-3Q + 2Q}{\varepsilon_0} = \frac{-Q}{\varepsilon_0}$

5. $r = \frac{\Delta V}{\Delta I}$ Hence resistance $-ve$ in BC

As $\Delta V > 0$ $\Delta I < 0$

(6) The ~~radio~~ radiation is Ultraviolet rays.
frequency : 400nm — ~~1nm~~

~~8×10~~ 75×10^{13} Hz — ~~3×10^{17}~~ Hz

$\frac{3 \times 10^{9} \times 10^{8}}{4\,\cancel{00}}$

0.75×10^{15}

75×10^{13} Hz

$\frac{3 \times 10^{17}}{3 \times 10^{1}}$

10^{-9}

(7) When The electromagnet is switched on The disc experiences a sudden change in magnetic flux. Thus following Lenz's Law. The current induced due to The changing flux produces the motion in a magnetic ~~flux~~ field. The disc jumps To increase The distance from The coil & hence oppose The changing flux

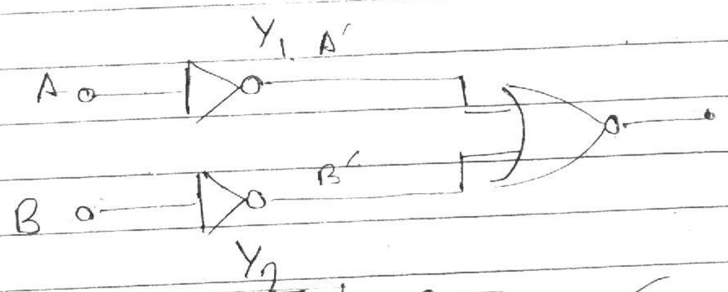
(8) Activity of radioactive substance is The number of ~~ra~~ radioactive nuclei of that substance disintegrating per unit time.

~~Its S.I unit is~~ Bq ~~(becquerel)~~ (bequrel)

$r = -\frac{dN}{dt}$. Its S.I unit is Bq (becqurel)

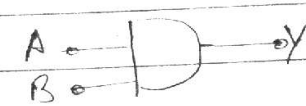
$1\ Bq = 1$ disinegration per second $(1\ s^{-1})$

(9)



$Y = (A' + B')' = A \cdot B$

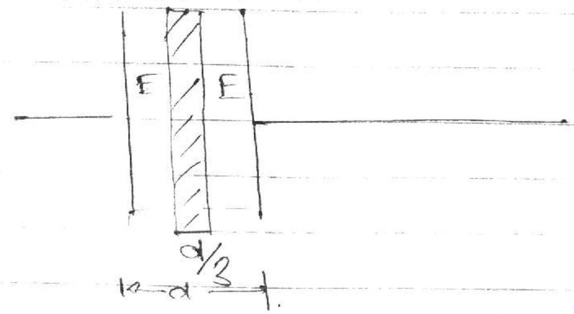
It is $\boxed{AND}$ Gate



Truth Table :-

A	B	$Y = A \cdot B$
1	0	0
0	0	0
0	1	0
1	1	1

(16)



Now potential between The plates must be const.

if E be The electric field, A The area of The plate ~~Then~~ & V The potential difference Then.

$$V = E\,\frac{2d}{3} + \frac{E}{K}\cdot\frac{d}{3}$$

$$= \frac{Ed}{3}\cdot\left(2 + \frac{1}{K}\right)$$

But $E = \dfrac{Q}{A\,\varepsilon_0}$ $\quad Q$ = Charge on ~~Capaction~~ Capacitor

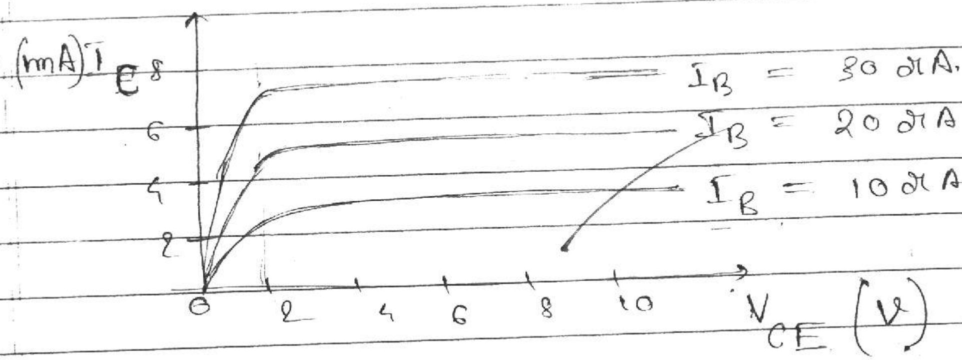
$$V = \frac{Q\,d}{A\,\varepsilon_0}\left(\frac{2}{3} + \frac{1}{3K}\right)$$

But $Q = CV$ Where $C =$ Capacitance.

$\therefore C = \dfrac{\varepsilon_0 A}{d\left(\frac{2}{3} + \frac{1}{3K}\right)}$

$= 8\,\varepsilon_0 \varepsilon_r A$

(1c)



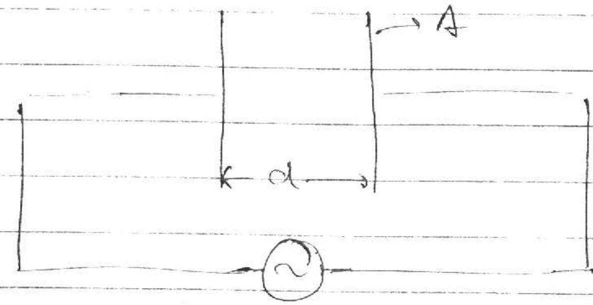
Output resistance is given by $\left(\dfrac{\Delta V_{CE}}{\Delta I_C}\right)_{I_B}$

The portion of graph which is linear gives us (r_o) output resistance.

In the straight portion (// to X axis) $\Delta I_E \to 0$

Hence $R_{output} \to \infty$ (very High $10^5\ \Omega$) as the Collector Base junction is reverse biased in this region.

(12)



$i = i_0 \sin\omega t$, $v = v_0 \sin\omega t$.

The charge is given by $q = C.V$

$= C v_0 \sin\omega t$.

Now $i_C = v_0 \omega C \sin\left(\omega t + \frac{\pi}{2}\right) = v_0 \omega C \cos\omega t$.

As $X_C = 1/\omega C$. phase diff $= \pi/2$.

8

$\therefore$ ~~E~~

Electric field $= \dfrac{Q}{A\varepsilon_0} = $

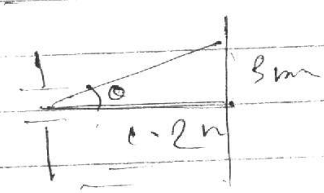
$\therefore i_d = \varepsilon_0 \dfrac{d\Phi_E}{dt} = \dfrac{\varepsilon_0 A\, dQ}{A\varepsilon_0\, dt} = \dfrac{dQ}{dt}$

$= V_0 C\omega \cos\omega t$

$= i_C$

(13) ~~$a\theta = \lambda$ for first minima~~

~~$\theta = \left(\dfrac{\lambda}{a}\right)$~~



for first minima

$a \sin\theta = \lambda$

$$a \frac{8 \times 10^{-3}}{+2, 0.4} = 600 \times 10^{-9}.$$

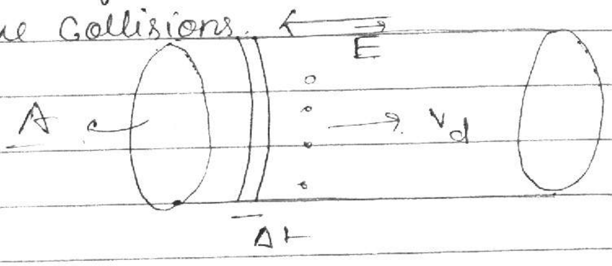
$$a = 240 \times 10^{-6} \, m = 2.4 \times 10^{-4} \, m$$

(14) A $\rightarrow$ Square Law device :— Squares the wave and produces an out-put of the form $\rightarrow B\,x(t) + C\,x(t)^2$.

B $\rightarrow$ Band Pass filter :— It is centred at ω_c meaning it allows only the components with frequency ω_c, $\omega_c + \omega_m$ & $\omega_c - \omega_m$ to pass through it. Other frequencies & D.C components are blocked.

(15) Drift velocity (V_D) is the uniform Average velocity with

which the electrons move ~~the~~ path ~~in a conduc~~ in a conductor under an applied external electric field in the conductor, between two successive collisions.



Let A be area of cross ~~section~~ ~~in the~~ section

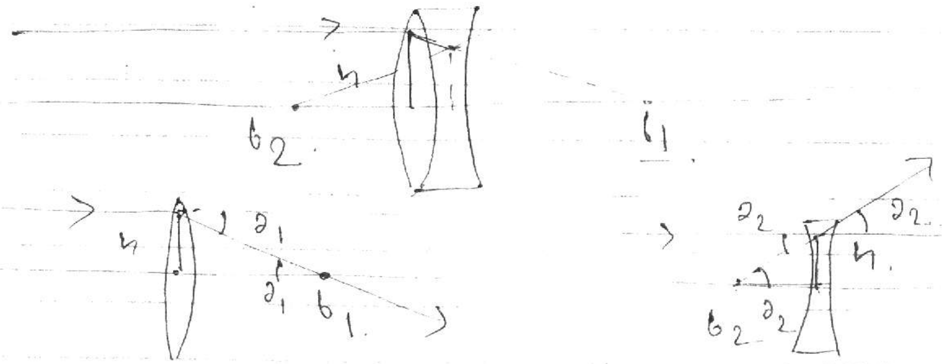
$n \to$ no. of electrons per unit volume, i = current,

Then.

$$i = \frac{\Delta Q}{\Delta t} \qquad \Delta Q = \text{charge crossing a unit area.}$$

$$= \frac{nAe\,V_d\,\Delta t}{\Delta t} \Rightarrow \boxed{i = nAeV_d}$$

(16)



Now As can be seen let a parallel ray be incident. Then deviation produced by The Convex lens alone is $\delta_1 = \frac{h}{f_1}$

& by Concave lens is $\delta_2 = -\frac{h}{f_2}$ as in opposite direction

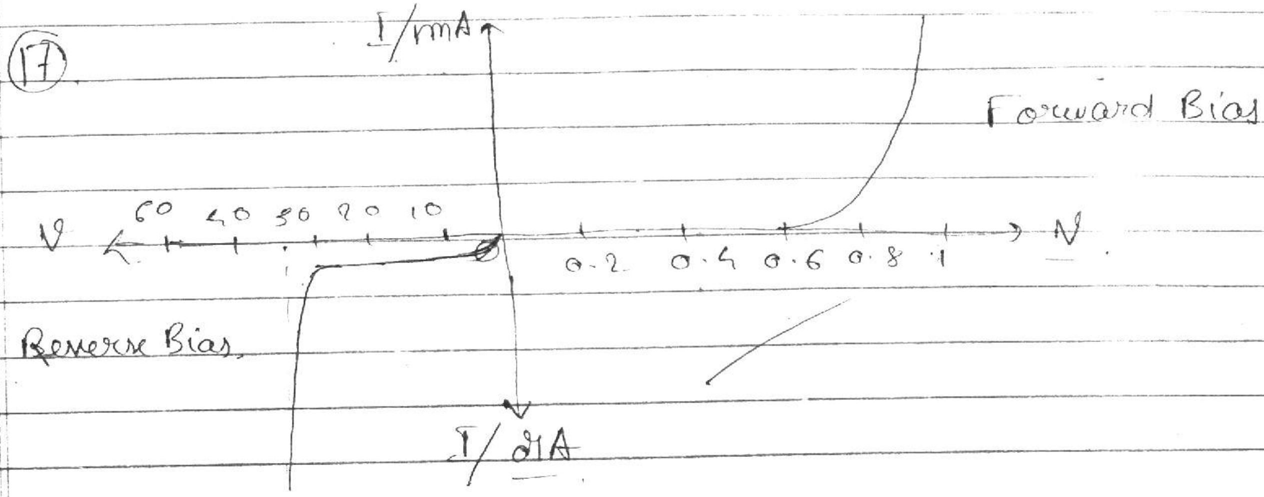
Then deviation by Equivalent Lens is $\delta = \frac{h}{f}$

$$\delta = \frac{h}{f} = \delta_1 + \delta_2 = \frac{h}{f_1} - \frac{h}{f_2}$$

$$\frac{1}{f} = \frac{1}{f_1} - \frac{1}{f_2} \Rightarrow \cancel{f = f_2 - f_1}$$

$f = \cancel{f_1 f_2}$ $f_1 f_2$ → Ans

(17)



(i) Reverse Bias current is limited upto a certain ~~volo~~ voltage as at this stage all the minority carriers ~~respont~~ responsible for reverse current is used and no further minority carrier is available. That is it is saturated.

(ii) At the critical voltage called Breakdown Voltage field ionisation takes place that is ~~cted~~

electrons are ripped apart from host atoms by strong ~~of~~ electric field and accelarated from p- side to N- side leading to a ~~surge~~ ~~in~~ steep rise in the current.

Such a device is Zener diode.

(18) The deflection produced per unit current is called current sensitivity of Galvanometer. (θ/I). S.I unit is ~~am~~ ~~A^{-1} (per a~~

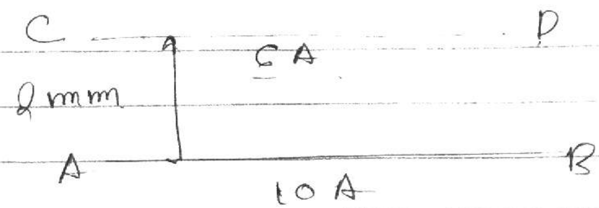
S.I unit is A^{-1} (θ per ampere.)

For first. $\frac{\cancel{2}4}{R_1} = \frac{\cancel{6}2}{\cancel{9}3} \Rightarrow R_1 = 6\,\Omega$

For Second :— $\frac{\cancel{6}}{\cancel{12}2} = \frac{R_2}{\cancel{8}4} \Rightarrow R_2 = 4\,\Omega$

Hence $R_1/R_2 = 6/4 = 3/2$

(19)



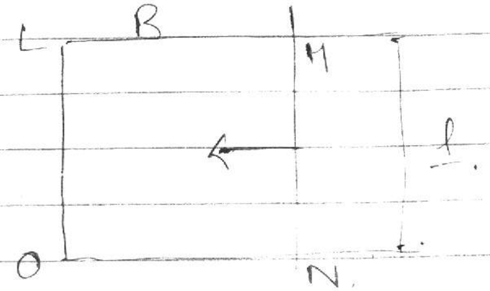
Force per unit length $= \frac{\mu_0}{4\pi}\,\frac{2 i_1 i_2}{r} = \lambda g$

$$\frac{10^{-7}\times 2\times 6\times 10}{2\times 10^{-3}} = \lambda \times 10$$

$$\lambda = 6\times 10^{-4}\ \text{Kg/m}$$

The force must act upward hence ~~the~~ it is repulsive. Therefore current in CD is opposite to that in A.

(20).



in a time Δt, the change in length of arm ON & LM $= v\Delta t$.

Now $\phi = \vec{B}\cdot\vec{A} = BA\cdot\cos 0^\circ = B\cdot A$

$$\therefore \frac{d\phi}{dt} = -\mathcal{E} = B\cdot\frac{dA}{dt} = \frac{B\,l\,v\,dt}{dt}$$

As $A = l \times ON$

$\Delta A = l \times \Delta ON = l\,v\,dt$

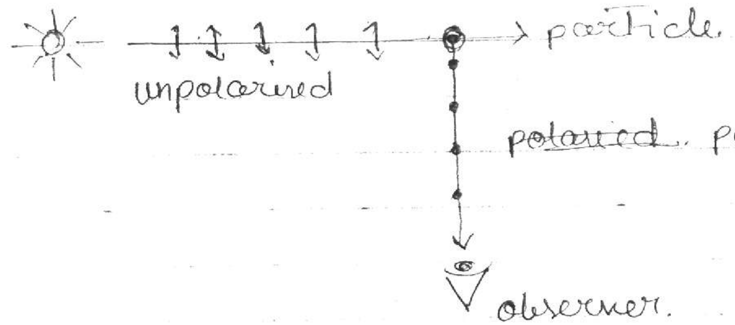
$= B l v$

$\therefore |\mathcal{E}| = 10 \times 0.5 \times 20 \times 10^{-2}$

$= 1\ V$

$i = \mathcal{E}/R = \frac{1}{5}\ A = 0.2\ A$

(21) Linearly polarised Light means the ~~particles are~~ Electric field of the wave. is ~~vibration~~ vibrating along any one axis. ~~oscilliting~~ oscillating along any one axis.



The sunlight (unpolarised) undergoes diffraction ~~wet~~ by the particles of atmosphere. it it clear that if diffracted by 90° then The vibration along the observer are cancelled hence only the oscillations of electric field perpendicular to the plane of the page would survive. The above shown unpolarized wave after diffraction has been polarized in a direction perpendicular to the plane of this page.

(ii) ~~The~~ After first polarisation the intensity would be reduced by half. However when the polaroid is rotated no further change in intensity will be there.

(22) The Eqn is :-

$$h\nu = eV_0 + \Phi$$

where Φ = work function of metal

ν = frequency of Light

V_0 = Stopping potential

(i) Energy of photon is solely ~~depends~~ depends on the frequency ~~of~~ of the light.

(ii) Intensity of the light merely

determines the ~~max.~~ no. of photons crossing per unit area with each photon having equal energy. Energy of photon is quantised meaning photons can be absorbed only in multiples of $h\nu$.

Three observed features are:–

(i) Emission is observed only above a particular frequency of light for each metal.

Clearly $eV_0 = K_{max} > 0 \Rightarrow h\nu > \phi$

hence $\nu_{Threshold} > \phi/h$.

(ii) The stopping potential is dependent on frequency & not intensity.

$eV_0 = h\nu - \phi.$

Clearly as kinetic energy depends on frequency stopping potential must depend on frequency.

(iii) Saturation current varries with Intensity. As more Intensity means more photons available Hence more electrons will be released by absorption of photons. However for lights of different ~~intensities~~ intensities but same frequency max K.E will be same.

(23). ~~Sky~~ Space waves used for L.O.S communication

Range of frequencies is above 40 MHz

$$d_m = \sqrt{2Rh_T} + \sqrt{2Rh_R}$$

h_T & h_R height of antennaes. R = radius of earth.

$$= \sqrt{2 \times 8 \times 64 \times 10^6} + \sqrt{9 \times 64 \times 10^6}$$

$$(4+3)\,8 \times 10^3 = \underline{56\ Km}$$

(2b) $i = i_m \sin \omega t$

$v = i_m R \sin \omega t$

$\therefore P_{inst} = i_m^2 R \sin^2 \omega t$

$$\int_0^T P \cdot dt = \int_0^T i_m^2 R \sin^2 \omega t \, dt$$

~~$P_{avg} \cdot T =$~~

$$\text{Work done} = \int_0^T \frac{i_m^2 R}{2} (1 - \cos 2\omega t) \Big|_0^T$$

$$= \frac{i_m^2 R \cdot T}{2}$$

$$P_{avg} = \frac{\text{Work Done}}{\text{Time}} = \frac{i_m^2 R}{2}$$

(b) $P = \dfrac{V^2_{max}}{R} \Rightarrow R = \dfrac{240 \times 240 \times 2}{120}$

Here $V_{max} = V_{rms}\sqrt{2}$

(b) $P = \dfrac{V^2}{2R} \Rightarrow R = \dfrac{240 \times 240}{2 \times 120}$

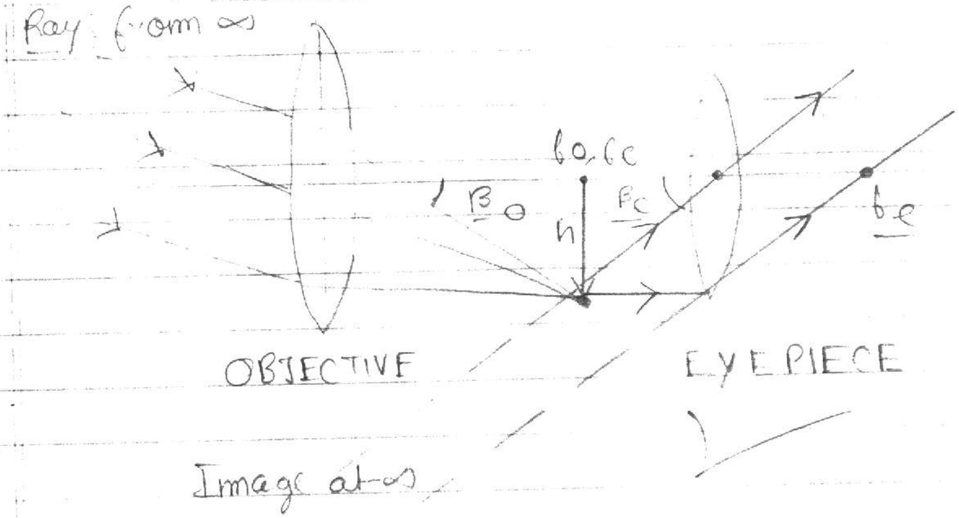
$= 240\ \Omega$

(b) $P = \dfrac{V^2_{rms}}{R} \Rightarrow R = \dfrac{240 \times 240}{120}$

$= 480\ \Omega$ Ans

(7b)

25 (20)



The magnification m for a telescope is the ratio of angle ~~substen~~ subtended by the image of the objective ~~at the~~ ~~to~~ the ~~ang~~ at the pole of the eyepiece to the angle subtended at the pole of the objective.

$$\therefore \; m = \frac{\beta_e}{\beta_o} = \frac{\tan \beta_e}{\tan \beta_o} = \frac{h}{f_e} \times \frac{f_o}{h} = \frac{f_o}{f_e}$$

f_o = focal length of objective, $f_e \rightarrow$ eyepiece

(25) two important limitations are:—

(i) Refracting lenses of large aperture are difficult to manufacture and handle. Also chromatic aberration is present.

(ii) ~~Spe~~ For large aperture intensity of image is high but spherical aberration also takes place. ~~Spe~~ Spherical aberration in mirrors can be removed by ~~use~~ using parabolic mirror.

(26). (a) principle of Total internal reflection. of optic fibres

(b). The values are concern ~~fo~~ for ~~fo~~ student & care of poor people.

(c) The doctor is righteous & helpful towards poor

(27) Let Us consider the electron revolving in a given energy state with radius r_n, energy E_n & velocity v_n.

Then. Potential energy of electron is.

$$E_p = -\frac{g_0}{4\pi}\frac{e^2}{r_n} \quad \& \quad E_K = \frac{1}{2} m v_n^2$$

By Bohrs postulate

$$m v_n r_n = \frac{nh}{2\pi}$$ ~~pripal~~

n = Principal quantum No

$$v_n^2 = \frac{n^2 h^2}{4\pi^2 m^2 r_n^2} \quad \text{---(1)}$$

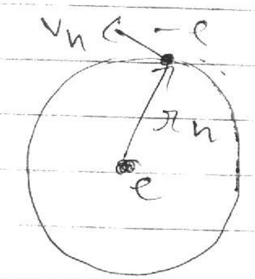


Fig.

Further $\frac{m v_n^2}{r} = -\frac{\mu_0}{4\pi} \cdot \frac{e^2}{r_n^2}$

~~Puth~~ putting value of v_n^2 from (1)

$$\frac{\cancel{m}\, n^2 h^2}{4\pi^2 m^2 r_n^2} = -\frac{\mu_0}{4\pi} \frac{e^2}{r_n}$$

$$\Rightarrow r_n = n^2 \left(\frac{4\pi}{\mu_0} \times \frac{h^2}{4\pi^2 m\, e^2} \right)$$

Now putting this value in Exp for P.E

& ~~Substitutima~~ substituting values of constants as

$m_e = 9.1 \times 10^{-31}$ Kg ; $e = 1.6 \times 10^{-19}$

~~we get~~ $h = 6.6 \times 10^{-34}$ $\mu_0 = 4\pi \times 10^{-7}$

we get $E_p = -\frac{27.2}{n^2}$ & $E_K = \frac{13.6}{n^2}$

$\therefore$ total Energy of electron is n^{th} orbit is.

$$E_T = E_K + E_P$$

$$= -\frac{13 \cdot 6}{n^2} \quad \text{As, } n^2 > 0$$

$E_T < 0$ implies The electron is bound.

Now, When an electron makes a transition The energy difference between two states is equal to the energy of The photon emitted.

$$E_i - E_f = 13 \cdot 6 \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

$$\Rightarrow h\nu = 13 \cdot 6 \left(\frac{1}{n_f^2} - \frac{1}{n_i^2} \right)$$

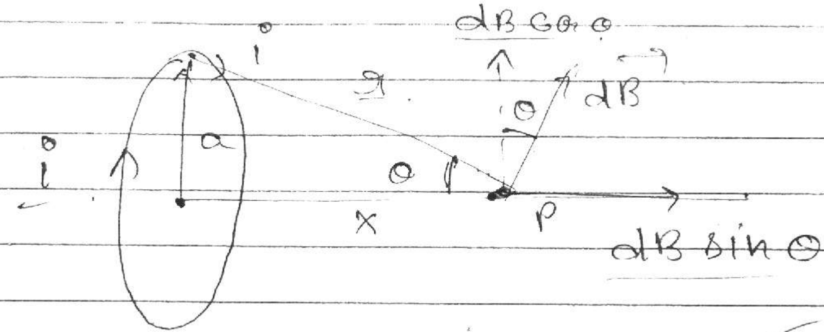
$$\Rightarrow \nu = \frac{13.6}{h}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$$

$4 \to 1$: Lymann series

$4 - 2$: Balmer series

$4 - 3$: Paschen series

(28)



$$|\vec{dB}| = \frac{\mu_0}{4\pi} \frac{i \cdot dl}{r^2}$$

clearly component dB cos θ cancels out over the whole Loop.

Then.

$$dB\sin\theta = \frac{\mu_0}{4\pi} \cdot \frac{a\,i\,dl}{(x^2+a^2)^{3/2}}$$

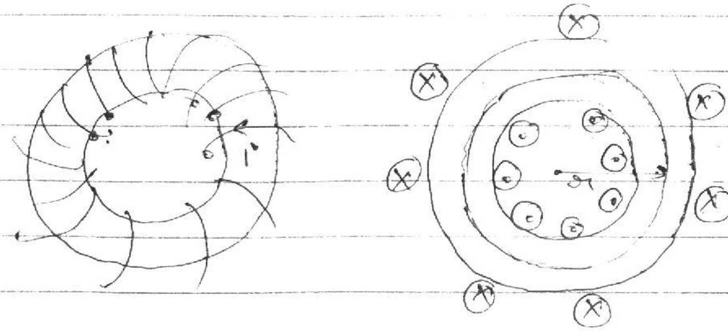
$$B = \frac{\mu_0 a i}{4\pi} \int_0^{2\pi a} \frac{dl}{(x^2+a^2)^{3/2}}$$

$$= \frac{\mu_0}{4\pi} \frac{2\pi a^2 i}{(x^2+a^2)^{3/2}}.$$

if n no. of turns are present:

$$B = \frac{\mu_0}{4\pi} \frac{2\pi a^2 i n}{(x^2+a^2)^{3/2}}$$

(b) A Toroid is solenoid of several turns of wire joined end to end.



Let us consider a amperian loop of radius r within the Toroid.

∴ From amperes Law.

$$\oint B \cdot dl = \mu_0 N I \quad ; \quad N = \text{no. of turns}$$

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

in the ~~mag~~ open space $\oint B \cdot dl = 0$ no current

Hence $B = 0$

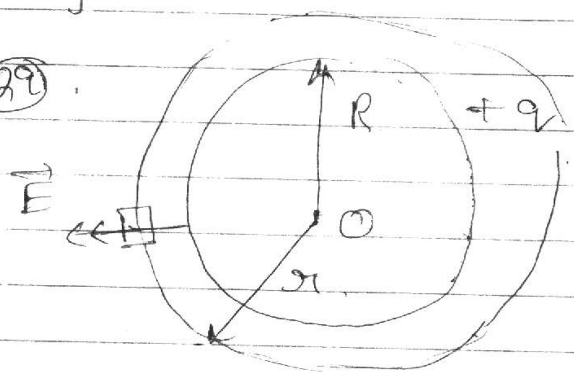
~~For~~ Outside the torroid

net current = 0 as current going into plane = current coming out of it,

hence

$$\oint B \cdot dl = 0 \Rightarrow B = 0$$

(29).



Let us consider a gaussian surface of radius r. ~~enclosio~~ enclosing the sphere ~~with~~ ~~Cente~~ which is concentric with the sphere.

As. By symmetry Electric field at

each point points in ~~same direction~~ is same and is along the area vector at that point

$\therefore$ From gauss's Law.

$$\oint E.\Delta S = q/\varepsilon_0$$

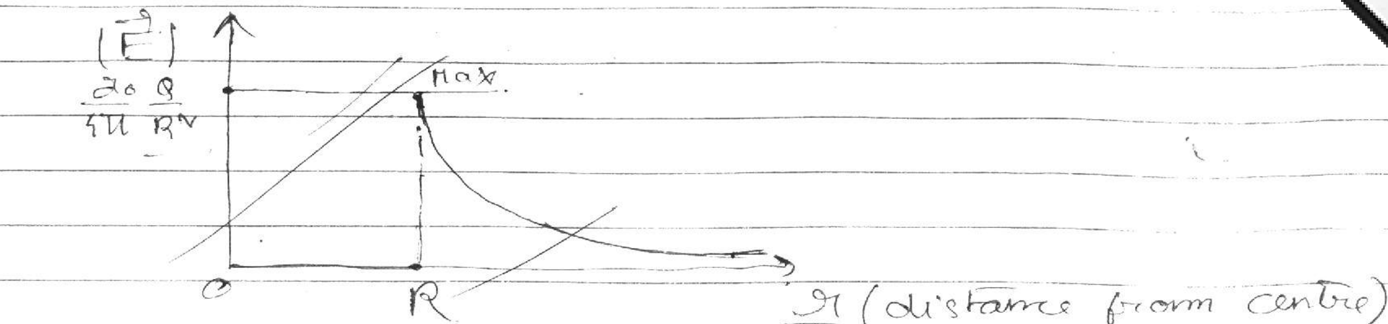
q = charge of sphere

$$E \times 4\pi r^2 = \frac{q}{\varepsilon_0}$$

$$E = \frac{q}{4\pi\varepsilon_0 r^2}$$

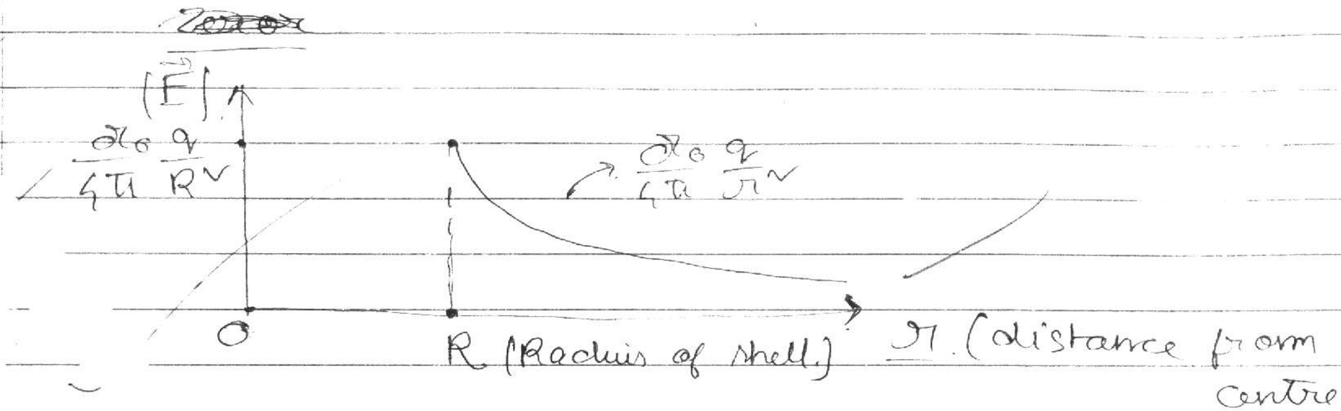
If Gaussian surface lies within the shell then charge enclosed by the surface must be 0 as charge lies on the surface of a Conductor.

hence $\oint E.\Delta S = 0 \Rightarrow E = 0$



$|\vec{E}|$
$\frac{1}{4\pi\epsilon_0}\frac{q}{R^2}$
Max
O
R
r (distance from centre)

E 2013



~~Zero~~
$|\vec{E}|$
$\frac{1}{4\pi\epsilon_0}\frac{q}{R^2}$
$\frac{1}{4\pi\epsilon_0}\frac{q}{r^2}$
O
R (Radius of shell)
r (distance from centre)