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

विषय Subject : PHYSICS

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : MONDAY 05|03|2012

उत्तर देने का माध्यम
Medium of answering the paper : ENGLISH

प्रश्न पत्र के ऊपर लिखे कोड को दर्शाए
Write Code No. as written on the top of Question Paper : 55/2/3

अतिरिक्त उत्तर–पुस्तिका (ओ) की संख्या
No. of Supplementary answer-book(s) used: 01 (one)

किसी शारीरिक अक्षमता के प्रभावित हो तो संबंधित वर्ग में ✓ का निशान लगाएं।
If Physically challenged, tick the category

| B | D | H | S | C |

B = दृष्टिहीन, D = मूक एवं बधिर, H = शारीरिक रुप से विकलांग, S = स्फस्टिक, C = डिस्लेक्सिक
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क्या लेखन – लिपिक उपलब्ध करवाया गया : हाँ / नहीं
Whether writer provided : Yes / No — No

*एक खाने में एक अक्षर लिखें। नाम के प्रत्येक भाग के बीच एक खाना रिक्त छोड 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.

कार्यालय उपयोग के लिए
Space for office use

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

where $\lambda$ is de-Broglie wavelength
$h$ is Planck's constant
$m$ is mass of $e^-$
$E$ is kinetic energy.

2. Isotopes are atoms of the same element, that have same Atomic number $Z$ but different Mass Numbers $A$, due to difference in number of neutrons.
eg: ${}_6C^{12}$ and ${}_6C^{14}$

3. Focal length of a lens decreases when red light is replaced with violet light.
Reason:
Using Lens Maker's Formula.

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

As $\lambda_R > \lambda_V$ and $\mu \propto \frac{1}{\lambda}$

$\mu_V > \mu_R$

As $\frac{1}{f} \propto \mu$

$\therefore f_R > f_V$

$\therefore$ Focal length decreases on using violet light.

4. Dipole moment of an Electric Dipole is defined as the product of charge of one of the charges of dipole and distance between the two charges.

$$\vec{P} = q \times (2\vec{l})$$

where,

$\vec{P}$ is electric dipole moment

$q$ is charge of dipole

$2\vec{l}$ is distance between charges of dipole.

It is a vector quantity

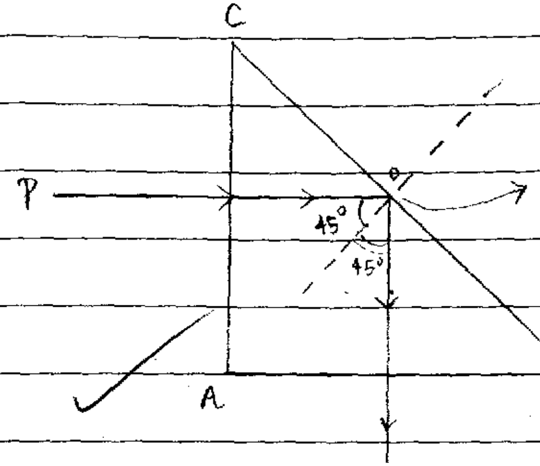
5. At the poles, the magnet will be vertical.
Reason:
For magnet to be vertical, $B = B_V$
$$\Rightarrow B = B \sin \delta$$
$$\Rightarrow \sin \delta = 1$$
$$\Rightarrow \delta = 90^\circ, \text{ at poles}$$

6. Direction of induced current is Anticlockwise i.e. PSRQP
Reason:
Using Lenz's law, induced current is set up in the direction, so as to oppose the cause responsible for it.

7. Equipotential surfaces never intersect each other because if they do, then two directions of electric field will be present at the point of intersection, which is not possible in the case of a uniform electric field, as equipotential surfaces are always perpendicular to electric field direction.

8. (i) Infrared radiation (IR)
(ii) Microwaves

9.




$i > i_c \Rightarrow$ Total Internal Reflection at O

10. Let $N_A^0$ and $N_B^0$ be the initial amount of A and B present

$$\Rightarrow \frac{N_A^0}{N_B^0} = \frac{4}{1}$$

Given, half-life periods are $T_A = 20$ years

$T_B = 40$ years

Let $N_A$ and $N_B$ be the final amounts of A & B, Given $N_A = N_B$

$$N_A^{\circ}\left(\frac{1}{2}\right)^{n_A} = N_B^{\circ}\left(\frac{1}{2}\right)^{n_B} \qquad \left[\text{as } \frac{N}{N_0} = \left(\frac{1}{2}\right)^{n}\right]$$

$$4\left(\frac{1}{2}\right)^{n_A} = 1\left(\frac{1}{2}\right)^{n_B}$$

$$\left(\frac{1}{2}\right)^{n_A} = \frac{1}{2^2} \times \left(\frac{1}{2}\right)^{n_B}$$

$$\left(\frac{1}{2}\right)^{n_A} = \left(\frac{1}{2}\right)^{n_B + 2}$$

$$\Rightarrow n_A = n_B + 2 \qquad \left[\text{as } n = \frac{t}{T}\right]$$

$$\frac{t}{T_A} = \frac{t}{T_B} + 2$$

$$t\left(\frac{1}{20} - \frac{1}{40}\right) = 2$$

$$t\left(\frac{40 - 20}{800}\right) = 2$$

$$\Rightarrow t = \frac{80\cancel{0} \times 2}{\cancel{2}\cancel{0}} = 80 \text{ years}$$

$\therefore$ After $\boxed{80 \text{ years,}}$ amounts of A & B become equal.

11. $M = 0.5\ J/T$

$\theta = 30^\circ$

$B = 0.1\ T$

(i) $|\vec{\tau}| = MB\sin\theta$

$= \frac{1}{2} \times \frac{1}{10} \times \sin 30 = \frac{1}{2} \times \frac{1}{10} \times \frac{1}{2} = \frac{1}{40}$

$= 0.025\ TAm^2$

(ii) $\vec{\tau}$ acts in a direction perpendicular to both $\vec{M}$ and $\vec{B}$, ie perpendicular to plane containing $\vec{M}$ and $\vec{B}$. Its direction is given by Maxwell's Screw Rule.

12. X → Amplitude Modulator

It modulates the message signal by changing the characteristics of the carrier signal according to the amplitude of message signal.

$\frac{J}{T}$ $U = MB$ $J =$ $0.05$ $Am^2\ \frac{MB}{T}$

Y $\longrightarrow$ Power Amplifier
It amplifies the modulated signal before sending it to transmit through transmitting antenna.

13. $\longrightarrow$ An LED works by emitting light when a biasing voltage is applied as a result of recombination of $e^-$s and holes and thus release of light energy.

$\longrightarrow$ Advantages :
(i) Low power consumption
(ii) Long life

14. (i) As $|\vec{V_d}| = \frac{e}{m}\left(\frac{V}{l}\right)\tau$

As $l' = 2l$ and $V_d \propto 1/l$
Drift velocity becomes half of previous value.

(ii) As $R = \frac{\rho l}{A}$

and $l' = 2l$ , $A' = A/2$ , ∴ $R' = 4R$

∴ The resistance of the conductor becomes 4 times original value.

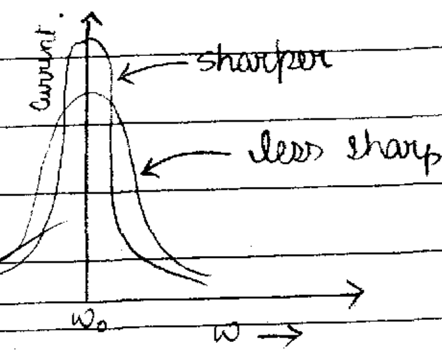
15. As $Q = \frac{1}{R}\sqrt{\frac{L}{C}}$

$$= \frac{1}{20}\sqrt{\frac{4}{4 \times 10^{-6}}} = \frac{1}{20 \times \sqrt{10^{-6}}} = \frac{1}{20 \times 10^{-3}}$$

$$= \frac{1}{2 \times 10^{-2}} = \frac{100}{2} = 50$$

Significance:

Quality factor gives the sharpness of an LCR circuit at resonance - higher Q value, sharper the resonance.



16. → Production of EM waves :

EM waves are produced due to oscillating charges, which set up alternating magnetic fields, which in turn sets up alternating electric fields, and so on.

→ Frequency of em waves produced is equal to the frequency of oscillations of the oscillating charge.

17. (i) Null point shifts towards end B.

Reason:

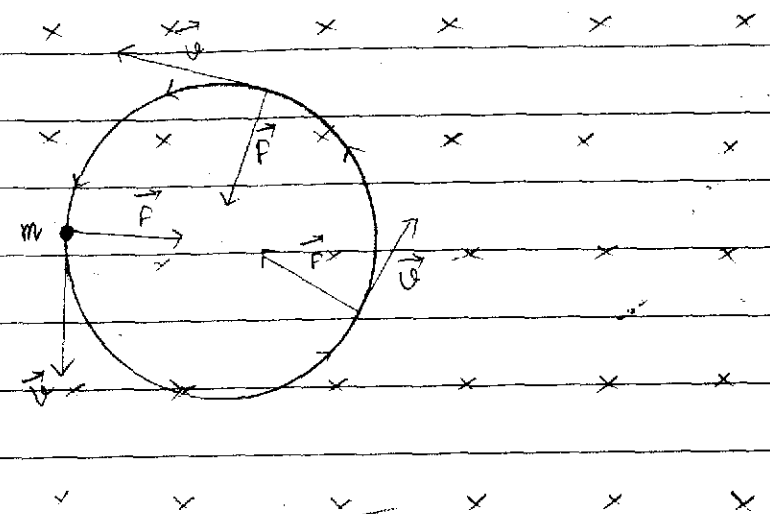
As value of R increases, voltage drop across AB decreases, thus the same voltage is now dropped at a larger length.

(ii) No change in position of nullpoint

Reason:

Key $K_2$ remains open, thus the branch contains resistance S is to be neglected and any change in S has no effect on null point.

18.




Explanation for circular path :

As the charged particle enters mgnetic field B, it experiences a Lorentz force given by

$$\vec{F} = q(\vec{v} \times \vec{B})$$

This force acts at every point on its path and provides the necessary centripetal force which makes the particle move in a circular path.

As Magnetic Lorentz Force = Centripetal force

$$Bqv \sin 90 = \frac{mv^2}{r}$$

$$Bqv = \frac{mv^2}{r}$$

$$\Rightarrow r = \frac{mv^2}{Bqv}$$

$$\Rightarrow \boxed{r = \frac{mv}{Bq}}$$

This is the expression for radius where,

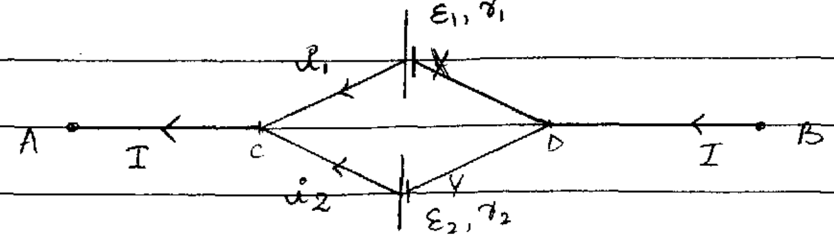
$m \rightarrow$ mass of particle

$v \rightarrow$ velocity of particle

$B \rightarrow$ magnetic field strength

$q \rightarrow$ charge of particle

19.




Let $i_1$ and $i_2$ be the currents in branches CXD and CYD respectively.

For branch CXD, $V = \varepsilon_1 - i_1 r_1$ —— (1)
For branch CYD, $V = \varepsilon_2 - i_2 r_2$ —— (2)

(1) $\Rightarrow$ $i_1 = \dfrac{\varepsilon_1 - V}{r_1}$

(2) $\Rightarrow$ $i_2 = \dfrac{\varepsilon_2 - V}{r_2}$

From circuit, using Kirchoff's junction Rule
$I = i_1 + i_2$

$\Rightarrow$

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

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

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

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

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

Comparing with,

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

(i) $\varepsilon_{eq} = \dfrac{\varepsilon_1 r_2 + \varepsilon_2 r_1}{r_1 + r_2}$

(ii) $r_{eq} = \dfrac{r_1 r_2}{r_1 + r_2}$

(iii) Also, potential difference between points A & B

$$V = E_{eq} - I\cdot r_{eq}$$

$$\Rightarrow V = \frac{E_1 r_2 + E_2 r_1}{r_1 + r_2} - I\left(\frac{r_1 r_2}{r_1 + r_2}\right)$$

20.

Potential energy, $U = -\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n}$ —— I

As Centripetal force = Electrostatic force

$$\frac{mv_n^2}{r} = \frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n^2}$$

$$mv_n^2 = \frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n} \quad \text{—— (1)}$$

As Kinetic energy $= \frac{1}{2} m v_n^2$

From ①,

$$K = \frac{1}{2}\left(\frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n}\right)$$

$$\Rightarrow K = \frac{1}{8\pi\varepsilon_0}\frac{Ze^2}{r_n} \quad \text{——— ②}$$

Total energy, $E = K + U$

$$= \frac{1}{8\pi\varepsilon_0}\frac{Ze^2}{r_n} - \frac{1}{4\pi\varepsilon_0}\frac{Ze^2}{r_n}$$

$$\Rightarrow E = \left(\frac{1}{8} - \frac{1}{4}\right)\frac{1}{\pi\varepsilon_0}\frac{Ze^2}{r_n}$$

$$\Rightarrow E = \frac{-1}{8\pi\varepsilon_0}\frac{Ze^2}{r_n} \quad \text{——— ③}$$

~~Clearly, (from ① and ②)~~ $\cancel{K = -\frac{U}{2}}$

Clearly from I and (2).

$$K = -2U$$

∴ Total energy in $n^{th}$ energy level,

$$E = \frac{-1}{8\pi\varepsilon_0} \frac{Ze^2}{r_n} \quad \text{—— (II)}$$

But for Bohr's Quantization principle,

$$mv_n r_n = \frac{nh}{2\pi}$$

$$\Rightarrow r_n = \frac{nh}{2\pi m v_n} \quad \text{—— (4)}$$

(4) in (1) $\Rightarrow$

$$m\left(\frac{nh}{2\pi m r_n}\right)^2 = \frac{1}{4\pi\varepsilon_0} \frac{Ze^2}{r_n}$$

$$m \frac{n^2h^2}{4\pi^2 m^2 r_n^2} = \frac{1}{4\pi\varepsilon_0} \frac{Ze^2}{r_n}$$

$$\Rightarrow r_n = \frac{n^2h^2\varepsilon_0}{\pi m Ze^2} \quad \text{—— (5)}$$

(5) in II $\Longrightarrow$

$$E = -\frac{1}{8\cancel{\pi}\varepsilon_0} \frac{\cancel{Z}e^2}{n^2h^2\varepsilon_0} \times \cancel{\pi} m \cancel{Z} e^2$$

$$E = -\frac{m e^4 Z^2}{8 \varepsilon_0^2 n^2 h^2}$$

$$\Rightarrow E = -\frac{me^4}{8\varepsilon_0^2 h^2}\left(\frac{Z^2}{n^2}\right)$$

For hydrogen atom, $Z = 1$

∴ Total energy in $n^{th}$ energy level of hydrogen atom,

$$E = -\frac{me^4}{8\varepsilon_0^2 h^2} \times \left(\frac{1}{n^2}\right)$$

Substituting values, $E = \frac{-13.6}{n^2}$ eV

21. → Modulation Index is defined as the ratio of amplitudes of message signal and carrier wave.

→ $\boxed{m = \frac{E_S}{E_C}}$

~~Given~~

→ It defines how clearly a message signal can be retrieved from a carrier wave.
Generally, $m < 1$ to avoid distortion.

→ $E_{max} = 8\ V$
$E_{min} = 4\ V$

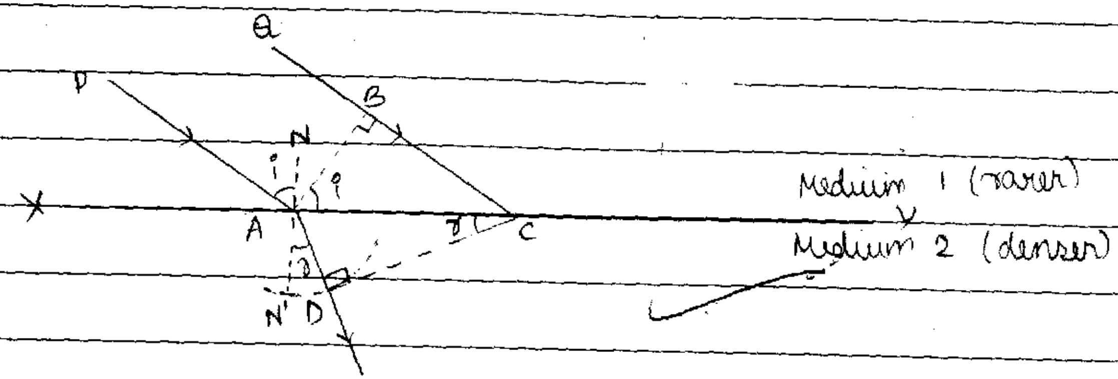
As modulation index, $\mu = \frac{E_{max} - E_{min}}{E_{max} + E_{min}}$

$\mu = \frac{8-4}{8+4} = \frac{4}{12} = \frac{1}{3}$

$\Rightarrow \boxed{\mu = \frac{1}{3}}$

22. → Wavefront is defined as the locus of all points on a wave that propagates with the same phase.

→ Using Huygen's Principle :




PA & QC - Incident rays
AB - Incident wavefront
DC - Refracted wavefront
AD - Refracted ray
NN' - Normal at A
XY - Surface separating media 1 & 2

## Snell's Law of Refraction

(i) PA and QC are incident on surface XY

(ii) As PA reaches point A, QC has reached point B.

(iii) As speed in Medium 2 is $c_2$, in 2nd medium, PA travels distance $AD = c_2 t$

(iv) In same time $t$, as speed in medium 1 is $c_1$, QB travels distance $BC = c_1 t$

(v) In $\Delta ABC$ and $\Delta ADC$

$\angle B = \angle D = 90^\circ$ (from constructed wavefronts)

AC is common

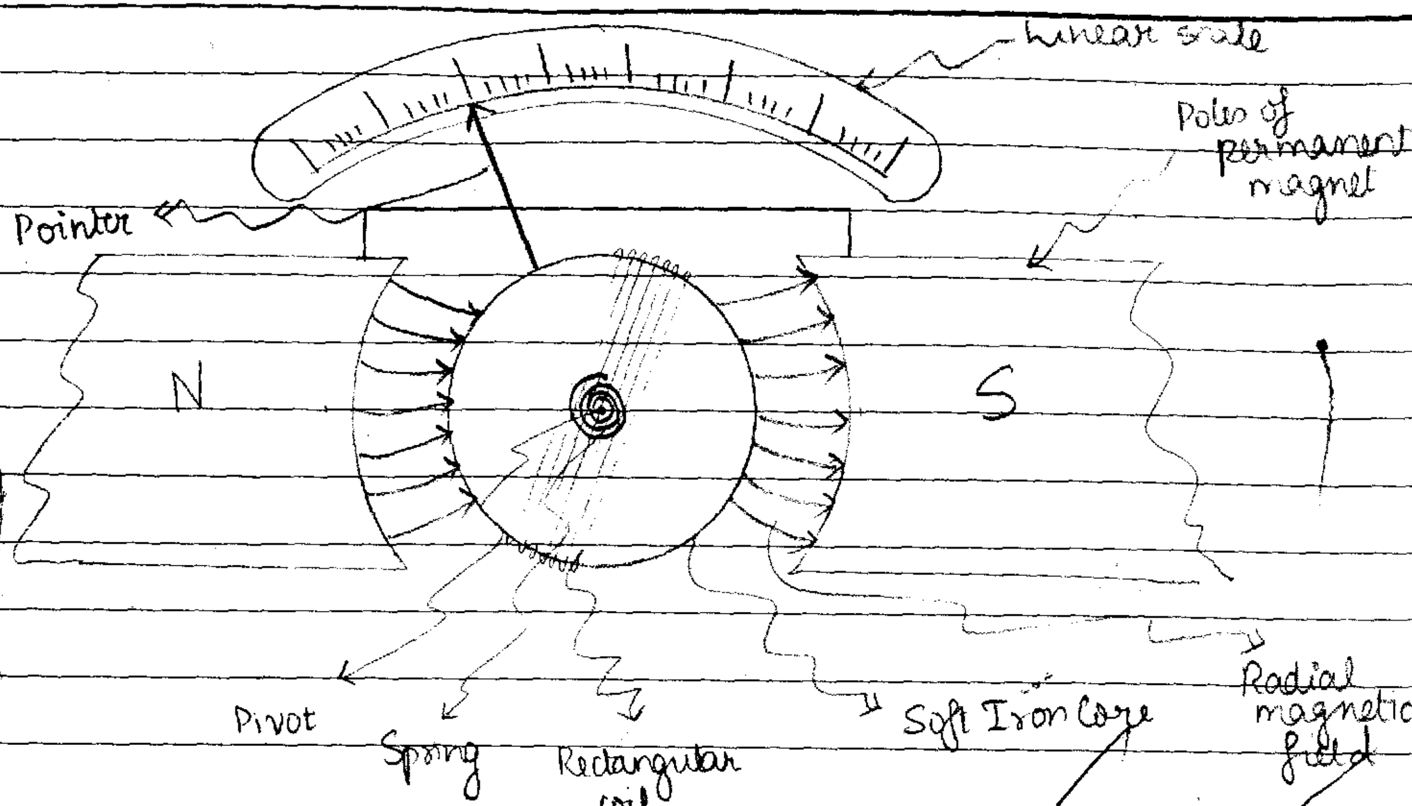
and $BC = c_1 t$, $AD = c_2 t$

$$\therefore \frac{\sin i}{\sin r} = \frac{BC/AC}{AD/AC} = \frac{BC}{AD} = \frac{c_1 t}{c_2 t}$$

$$\Rightarrow \frac{\sin i}{\sin r} = \frac{c_1}{c_2} = n_{21}$$

Hence derived Snell's Law of Refraction.

23.




MOVING COIL GALVANOMETER

Working:

(i) In a moving coil galvanometer, rectangular coil of many turns kept in a radial magnetic field experiences a torque which is a measure of the current passing through the coils.

(ii) Deflecting Torque, $\tau = BANI\cos\theta$ —— ①
where,

B is magnetic field
A is area of coil
N is number of turns
I is current through coils
$\theta$ is angle between A & B.

Restoring Torque, $\tau = k\phi$ —— ②
where,

k is ~~sp~~ torsional constant
$\phi$ is deflection produced

Clearly, ① = ②

$\Rightarrow$ Deflecting Torque = Restoring Torque

$$BANI\cos\theta = k\phi$$

$$\frac{\phi}{I} = \frac{BAN}{k}$$

$$\Rightarrow \phi = \left(\frac{BAN}{k}\right) I$$

Clearly, deflection produced in the coil $\phi \propto I$ current passing through coil.

Thus, moving coil galvanometer can be used to measure current.

→ Radial magnetic field:

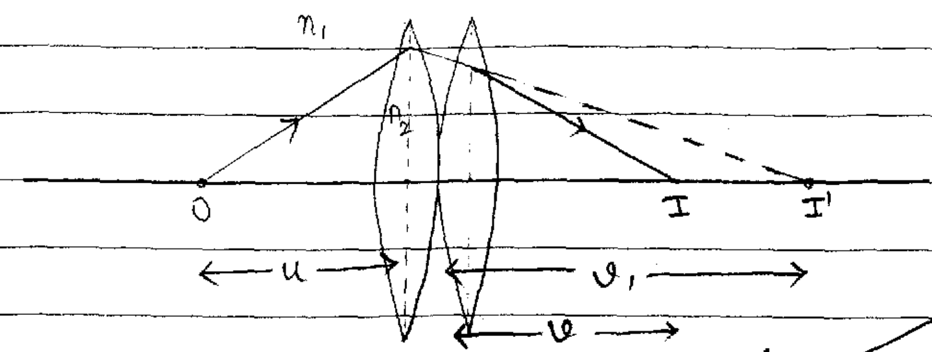
(i) Maximizes Torque as plane of coil is always ⊥r to magnetic field.

(ii) Magnetic field is maximized around the coil using radial magnetic field.

24. → Power of a lens is defined as its ability to converge of diverge a beam of light.

It is given by the reciprocal of focal length in metres. $P = \frac{1}{f(m)}$

→ SI Unit is Dioptre (D)




Let two lens 1 and 2 of focal lengths $f_1$ and $f_2$ be placed in contact coaxially. Let refractive index of glass be $n_2$ and air $n_1$

Using $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$

For lens 1, $\frac{n_2}{v_1} - \frac{n_1}{u} = \frac{n_2 - n_1}{R_1}$ —— (1)

For lens 2, $\frac{n_2}{v} - \frac{n_1}{v_1} = \frac{n_2 - n_1}{R_2}$ —— (2)

(1) + (2) => $\frac{n_2}{v_1} - \frac{n_1}{u} + \frac{n_2}{v} - \frac{n_1}{v_1} = n_2 - n_1 \left( \frac{1}{R_1} + \frac{1}{R_2} \right)$

For lens, 1,

$$\frac{1}{f_1} = \frac{1}{v_1} - \frac{1}{u} \quad \text{——— (1)}$$

for lens 2,

$$\frac{1}{f_2} = \frac{1}{v} - \frac{1}{v_1} \quad \text{——— (2)}$$

eqs (1) + (2) $\Rightarrow$ $\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{v} - \frac{1}{u} + \cancel{\frac{1}{v_1}} - \cancel{\frac{1}{v_1}}$

$$\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{v} - \frac{1}{u}$$

But $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

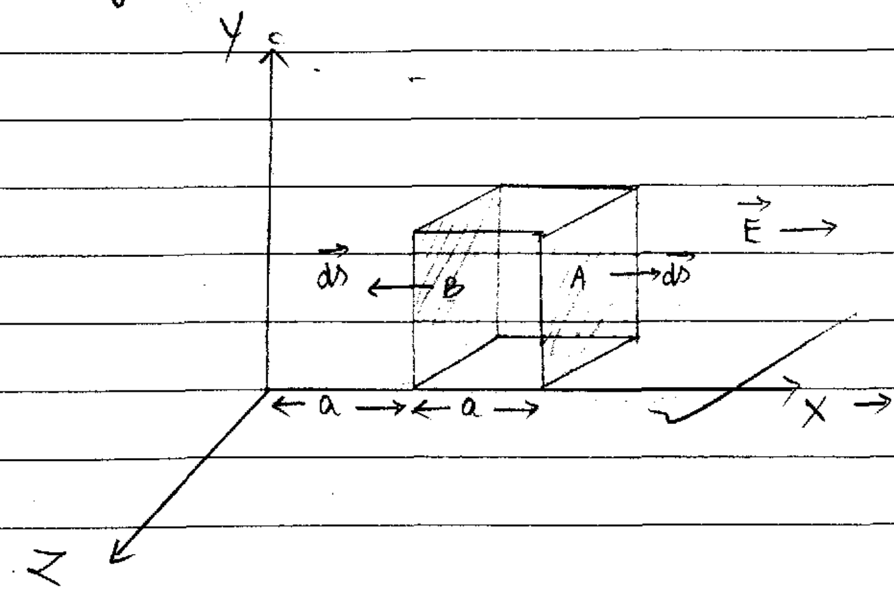
$$\Rightarrow \boxed{\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}}$$

Thus proved.

25. → Gauss's Law in Electrostatics states that the surface integral of electric field over the entire Gaussian surface is $1/\varepsilon_0$ times the total charge enclosed by the surface.

$$\Rightarrow \phi = \oint \vec{E} \cdot \vec{ds} = \frac{\Sigma q}{\varepsilon_0}$$

(i) Flux passes only through right and left faces of cube as shaded in diagram below, as $\vec{E} \perp r\ \vec{ds}$ for all other faces & $\phi = 0$.



For face A, $d\phi = \int \vec{E} \cdot \vec{ds} \cos 0$

$d\phi = \vec{E} \int \vec{ds}$

$\Rightarrow \phi_A = E \times a^2$

$\Rightarrow \phi_A = C a^2 \ Nm^2 C^{-1}$

For face B, $d\phi = \int \vec{E} \cdot \vec{ds} \cos 180$

$d\phi = -\vec{E} \int \vec{ds}$

$\Rightarrow \phi_B = -E a^2$

$\Rightarrow \phi_B = -C a^2 \ Nm^2 C^{-1}$

Net flux through the cube, $\phi = \phi_A + \phi_B$

$\Rightarrow \boxed{\phi = 0}$

(ii) Using Gauss's Law

$$\text{as } \phi = \frac{\Sigma q}{\varepsilon_0}$$

$$0 = \frac{\Sigma q}{\varepsilon_0}$$

$$\boxed{\Sigma q = 0}$$

- Net charge inside the cube is zero.

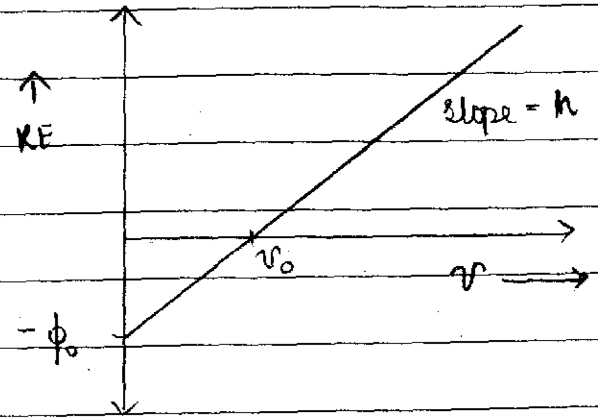
26 Features of Photoelectric effect

(i) Photoelectric effect does not take place unless incident radiation has a minimum energy equal to the threshold energy of the metal.

(ii) There is no time lag between incidence of radiation and emission of photoelectrons.

This proves photon theory of electromagnetic radiation.

Graph :




(i) As $KE = h\nu - \phi_0$

compared to $y = mx + (-c)$

Clearly , $m = h$

$\therefore$ Slope of graph gives Planck's constant value.

(ii) also , $c = -\phi_0$

$\therefore$ y - intercept of graph gives value of work function of material.

27. Difference between final energy and initial energy.

$$\Delta U = \frac{1}{2} \frac{C_1 C_2}{C_1+C_2} (V_2 - V_1)^2$$

where

$C_1 = 400\,pF = 400 \times 10^{-12}\,F$

$V_1 = 100\,V$

$C_2 = 100\,pF = 100 \times 10^{-12}\,F$

$V_2 = 0\,V$

∴ Substituting the values,

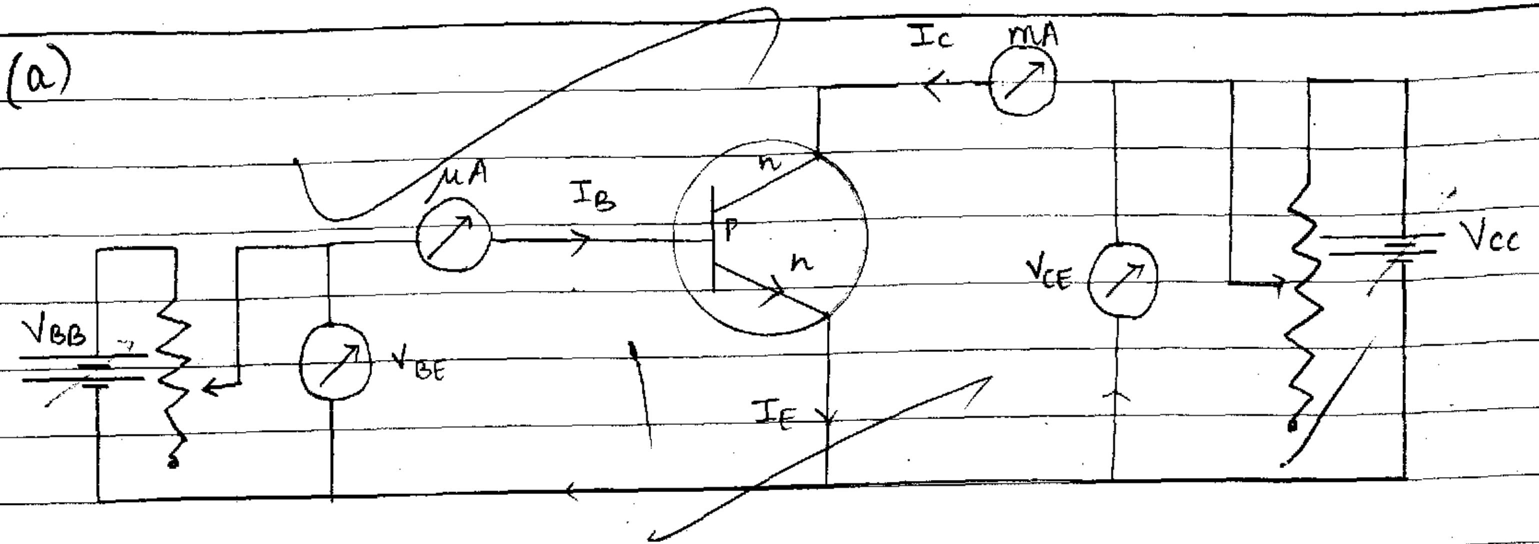
$$\Delta U = \frac{1}{\cancel{2}} \frac{{}^{2}\cancel{4} \times \cancel{10^4} \times \cancel{10^{-12}}}{5 \times \cancel{10^2}} \times \cancel{10^4}$$

$$= \frac{2}{5} \times 10^{4-12+2}$$

$$= 0.4 \times 10^{-6}$$

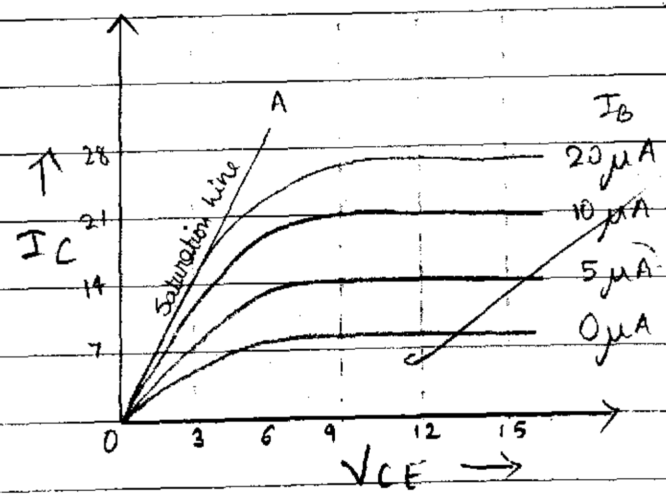
$$= \boxed{4 \times 10^{-7}\,J}$$ is the energy difference

28. (a)




2012

Output characteristics :



0901

**Fictitious Roll No.**
(To be entered by Board)

अपना अनुक्रमाँक इस उत्तर–पुस्तिका पर न लिखें
Please do not write your Roll Number on this Answer-Book

अतिरिक्त उत्तर-पुस्तिकाओं की संख्या..........
Supplementary Answer Book(S) No. ......

29. (a) As $\beta = \frac{\lambda D}{d}$ and $\theta = \frac{\lambda}{d}$

(i) When separation between two slits $d$ decreases, as $\beta \propto 1/d$ and $\theta \propto 1/d$

$\beta$ increases and $\theta$ also increases

where $\beta$ is linear fringe width and $\theta$ is angular width.

(ii) when width of source slit $s$ is increased, fringes are visible till condition

$\frac{s}{S} < \frac{\lambda}{d}$ is satisfied

where $s$ is width of source slit

$S$ is distance of source from slit

$\lambda$ is wavelength of light used

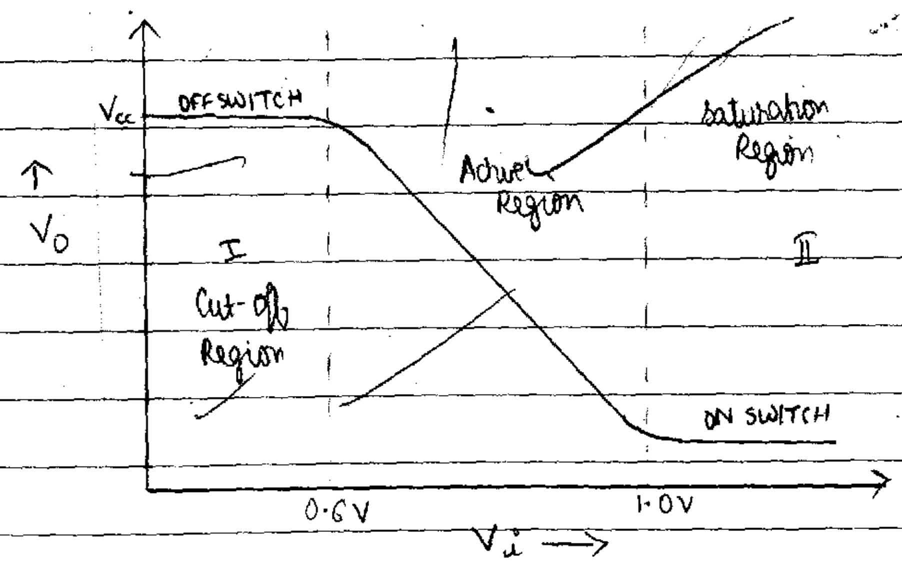
$d$ is separation between slits

after that, fringes are too close together to be properly detected.

Calculating $\beta_{ac}$:

(i) Consider a constant value of $V_{CE}$, say 9V.
(ii) For $V_{CE} = 9V$, from graph, calculate $\Delta I_C$ and $I_B$.
(iii) Thus $\beta_{ac} = \frac{\Delta I_C}{\Delta I_B}$ may be obtained from graph.

(b)

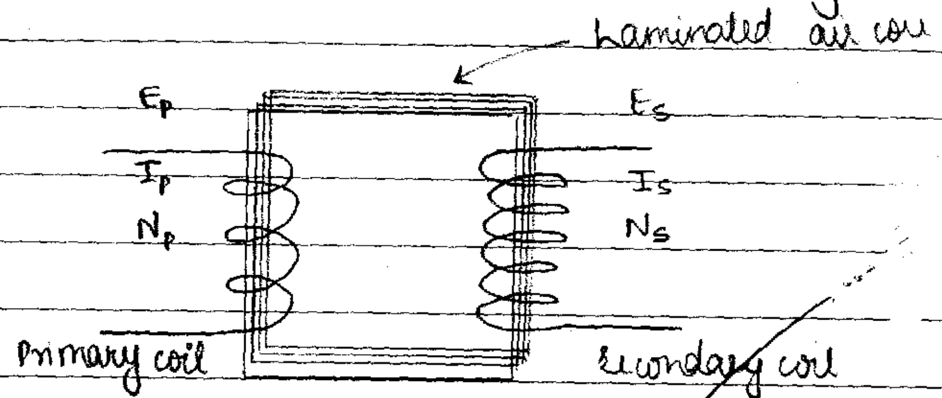



→ In shaded regions I & II, transistor can operate as a switch.

Transfer characteristics

30. (a) Principle:

A step-up transformer works on the principle of Mutual Induction ie when flux linked with the primary coil changes, an induced current is set up in secondary coil.




STEP-UP TRANSFORMER

Working:

(1) Emf in primary coil,

$$E_p = -N_p \frac{d\phi}{dt} \quad \text{——} \quad (1)$$

(iii) → The differ colours interfere incoherently.

→ Thus we obtain a central white fringe.

→ On either side is red colour fringe

→ Farther away is observed blue colour fringe

→ after a few fringes, no distinct fringes are observed.

(b) Given $\delta = \lambda/3$

As phase difference, $\phi = \frac{2\pi}{\lambda} \times \delta$

$$\phi = \frac{2\pi}{\cancel{\lambda}} \times \frac{\cancel{\lambda}}{3} = \frac{2\pi}{3}$$

$$\phi = \frac{2\pi}{3}$$

$\therefore$ Intensity at point required, $I = I_0 \cos^2(\phi/2)$

$= I_0 \cos^2(\pi/3)$

$= I_0 \times 1/4$

$\Rightarrow \boxed{I = \frac{I_0}{4}}$ Thus, proved

(ii) Emf in secondary coil, $E_s = -N_s \frac{d\phi}{dt}$ —— (2)

(iii) $\frac{(1)}{(2)} \Rightarrow \frac{E_p}{E_s} = \frac{N_p}{N_s}$ —— (3)

(iv) For an ideal transformer of 100% efficiency,

Input power = Output power

$\Rightarrow E_p I_p = E_s I_s$

$\Rightarrow \frac{E_p}{E_s} = \frac{I_s}{I_p}$ —— (4)

(v) (3) & (4) $\Rightarrow \frac{E_s}{E_p} = \frac{N_s}{N_p} = \frac{I_p}{I_s}$

(v) Thus for a step-up transformer as $N_s > N_p$

$\Rightarrow \boxed{E_s > E_p}$

∴ The voltage is stepped up by just having more number of turns in secondary coil.

Also, $I_s < I_p$.

(b) (i) Eddy - current losses :

→ This occurs due to eddy currents set up in the primary and secondary coils.

→ It can be minimised by using laminated air-cores or by cutting slits into the coils.

(ii) Magnetic Flux Leakage :

→ This occurs when ~~two co~~ the flux linked with one coil is lost and is not fully linked to second coil.

→ It can be minimised by winding the coils over one another ie primary over the secondary.