Ans 1 → The phase difference between the applied Voltage & the Current in the Circuit is 0° i.e. they are in phase with each other because Voltage across ~~Indu~~ inductor leads current by phase $\pi/2$ & Voltage across Capacitance lags behind current by $\pi/2$. Therefore voltage across L & C cancel each other & only Voltage across resistance exist.

Ans 2 → By Einstein Photoelectric equation

$$\frac{1}{2}mv^2 = h\nu - W_0$$

$\frac{1}{2}mv^2 \rightarrow$ Kinetic energy of emitted electron

$\nu \rightarrow$ frequency of incident ~~radiat~~ light

$W \rightarrow$ Work function of metal

Now For 1st material

$$\frac{1}{2}mv^2 = h\nu_1 - W_1$$

For second material

$$\frac{1}{2}mv^2 = h\nu_2 - W_2$$

Now K.E of electrons are equal

$$h\nu_1 - W_1 = h\nu_2 - W_2$$

Now as $W_1 > W_2$

$$h\nu_1 - h\nu_2 = W_1 - W_2 = +ve$$

$$\nu_1 > \nu_2$$

∴ Ultraviolet radiation of frequency ν_1 is higher than ν_2.

3/ Activity of a radionuclide is the rate of disintegration of the nuclide. It is equal to disintegration per second.

$$\text{Activity}, A = -\frac{dN}{dt} = \lambda N$$

Now SI unit of activity is Becquerel. It is one disintegration per second.

4. Direction of motion of electron → +ve x axis i.e $+\hat{i}$ direction
Direction of magnetic field → +ve y axis i.e, $+\hat{j}$ direction

∴ force on electron $= -e(\vec{v} \times \vec{B})$
$\vec{v}$ → velocity , $\vec{B}$ → magnetic field

$-e(\vec{v} \times \vec{B}) = -e(\hat{i} \times \hat{j}) \Rightarrow -evB\hat{k}$

∴ Direction of force is in $-\hat{k}$ direction i.e −ve Z-axis.

5. length of dipole antennae $= \frac{\text{Wavelength}}{2} = \frac{\lambda}{2}$

$\lambda = \frac{c}{\nu} = \frac{3 \times 10^8}{6 \times 10^8} = \frac{1}{2}\ m$

∴ length $= \frac{1}{2 \times 2} = \frac{1}{4}\ m$

$\Rightarrow \quad 2x^2 - 8x + 4 = 0$

$\Rightarrow \quad x^2 - 4x + 2 = 0$

$\Rightarrow \quad x = \frac{+4 \pm \sqrt{16-8}}{2} = \frac{4 \pm \sqrt{8}}{2} = (2 \pm \sqrt{2})\ m$

Ans 7 Voltage = 30 V

First ring → blue → 6

Second ring → black → 0

third ring → yellow → (4)

∴ Resistance = $60 \times 10^4\ \Omega$

∴ Current = $\frac{\text{Voltage}}{\text{Resistance}} = \frac{30}{60 \times 10^4} = \frac{1}{2 \times 10^4} = \frac{1}{20} \times 10^{-3}\ A$

$= \frac{1}{20}\ mA = \cdot 05\ mA$ ½

8/ ~~R_G~~

Resistance of Galvanometer, $G = 30\,\Omega$

Full scale deflection for current, $I_g = 2\,mA$

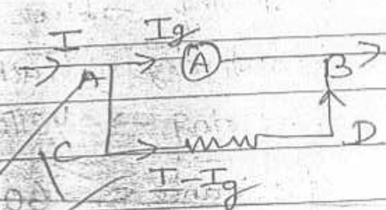
Let the value of Resistance needed be R. It should be
Connected in parallel with ammeter

$$I = 0.3\,A$$

$$V_{AB} = V_{CD}$$

$\Rightarrow$ ~~$I_g \times Resi$~~

$\Rightarrow$ $I_g \times G = (I - I_g)\,R$



$$\Rightarrow R = \frac{I_g \times G}{I - I_g} = \frac{2\times10^{-3} \times 30}{0.3 - 2\times10^{-3}}$$

As $0.3 - 2\times10^{-3} \approx 0.3$

$$R = \frac{2\times10^{-3}\times 30}{0.3} = \frac{2\times10^{-3}\times 30\times10}{3} = 0.2$$

9. $E_p = 200V$, $E_S = 20V$, $I_p = ?$, $I_s = \frac{E_s}{20\Omega} = \frac{20}{20} = 1A$ ½

$E_p \to$ Voltage across primary , $E_s \to$ Voltage across secondary , $I_p \to$ primary current , I_s - Secondary current

Now efficiency = $\frac{\text{output power}}{\text{input power}} = \frac{E_S I_S}{E_p I_p}$ 1½

$\Rightarrow \frac{80}{100} = \frac{20 \times 1}{200 \times I_p} \Rightarrow I_p = \frac{20 \times 100}{80 \times 200} = \frac{1}{8}$ Ampere

$= 0.125$ Ampere 1

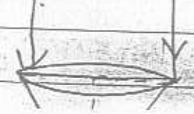
10. Resolving power of the Compound microscope is the ability of the microscope to form distinct images of two very close objects. Smaller the distance between two distinct images, greater is the resolving power of microscope.

R.P of microscope = ~~$\frac{\lambda}{2\mu \sin\theta}$~~ $\frac{2\mu \sin\theta}{\lambda}$

$\lambda \to$ wavelength of light used.

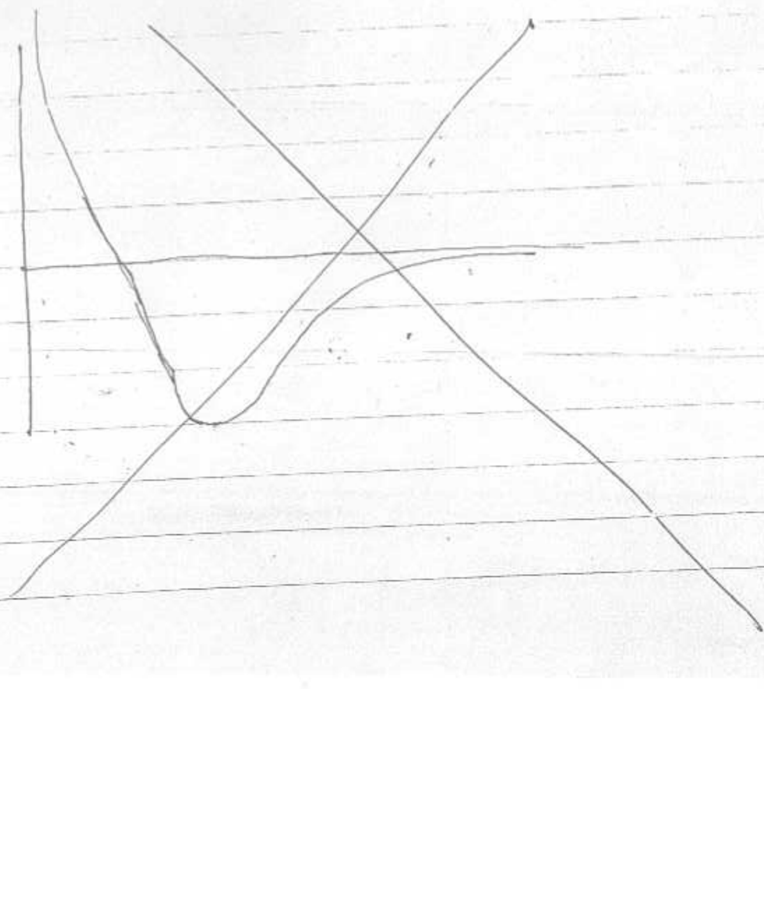
$\mu \to$ medium between objective lens & ~~image~~ object

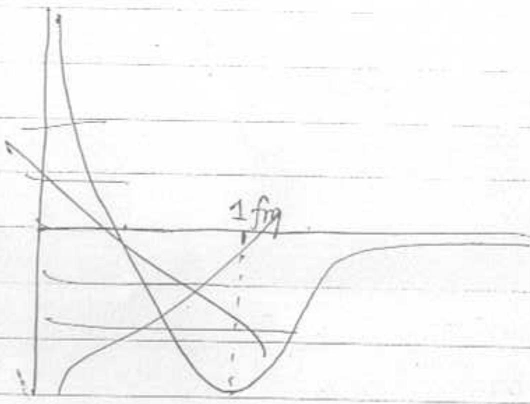
$\theta \to$ half cone angle.

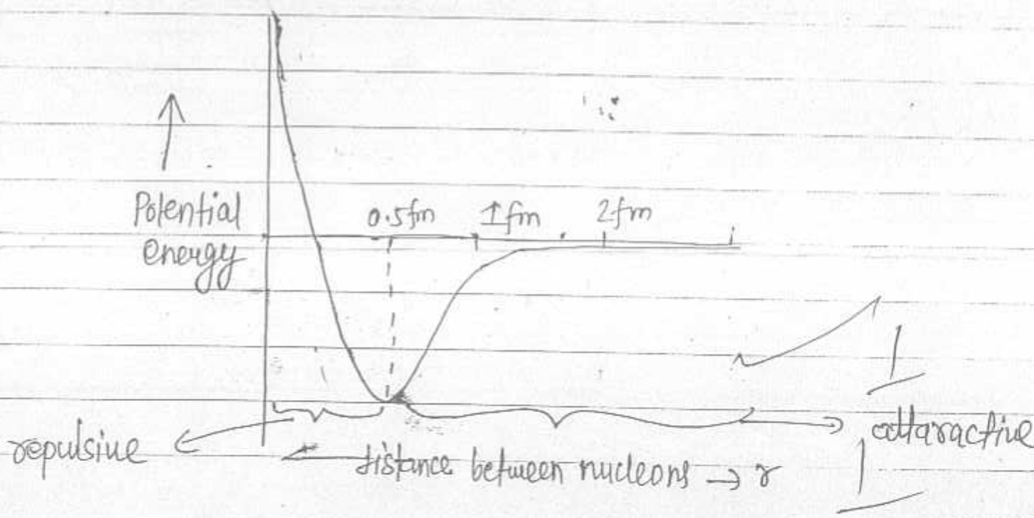


(i) when refractive index between the object & objective len
increases, then Resolving power of microscope ~~decreases~~
(ii) increases. 1/2

(iii) When wavelength of radiation used is increased th
Resolving power decreases. 1/2



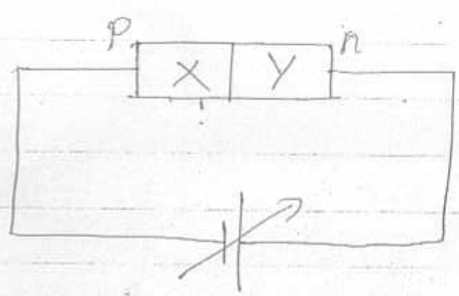

1 fm


Potential energy
0.5fm
1fm
2fm
repulsive
distance between nucleons → r
attaractive

(9)

The nuclear force is short range forces. At distance less than 0.5 fm it becomes repulsive. above 0.5 fm (0.01 fm) it becomes attaractive.

12



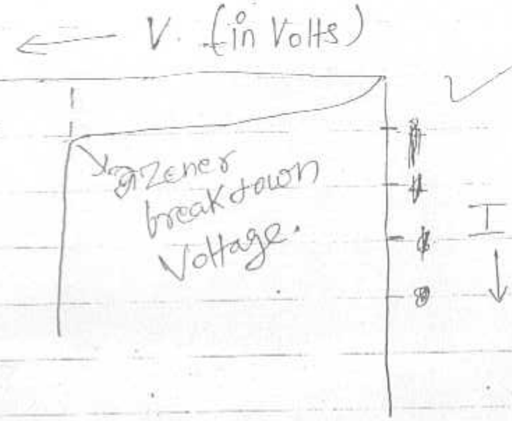
X is made by doping Ge Crystal with Indium. therefore it becomes ~~p-Junction~~ p-side of p-n junction

Y is made by doping Ge Crystal with arsenic. Therefore it becomes n-side of p-n Junction

(i) The Junction will be reversed biased as negative of battery is Connected to p-side.

active

(ii)



On increasing Voltage Current increases very slightly. At a Certa[in] Voltage current increases abruptly.

s

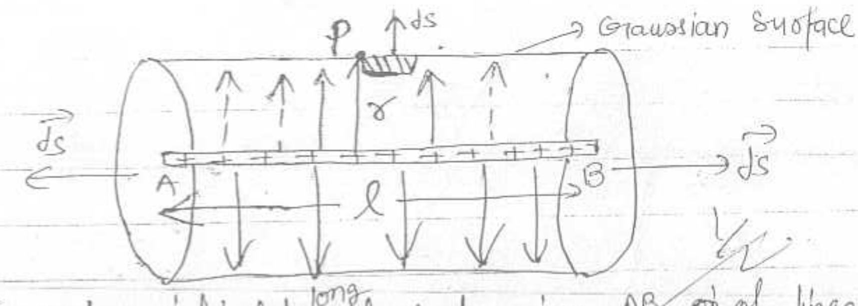
ecomy

13

Gauss Theorem in electrostatics states that electric flux of an electric fiel[d] over a closed surface in vaccum is $\frac{1}{\epsilon_0}$ times the total charge conta[ined] inside the closed surface.

is

$$\oint \vec{E} \cdot \vec{ds} = \frac{q}{\epsilon_0}$$



Consider a long infinitely long charged wire AB of linear charge density 'λ'. we have to find electric field at an point P near the wire at distance 'r'

Now let us draw a gaussian surface as cylinder with the wire AB as axis having a point P on its surface.

On the ends of cylinder area vector is ⊥ to the electric field so the ends of cylinder makes no contribution to flux. On the surface of cylinder $\vec{E}$ is in same direction as $\vec{ds}$

∴ By Gauss law

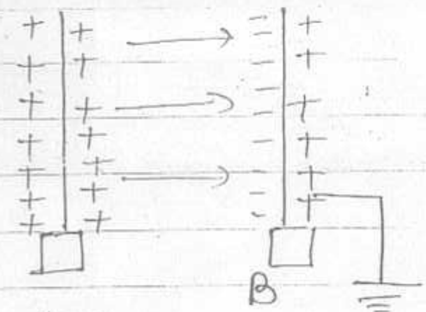
$$\oint \vec{E} \cdot \vec{ds} = \frac{q}{\epsilon_0}$$

Now $q = \lambda l$ where l is length of wire under consideration

$$\Rightarrow \quad E \cdot 2\pi r l = \frac{\lambda l}{\epsilon_0}$$

$$\Rightarrow \quad \boxed{E = \frac{\lambda}{2\pi \epsilon_0 r}}$$

14



Principle of parallel plate Capacitor

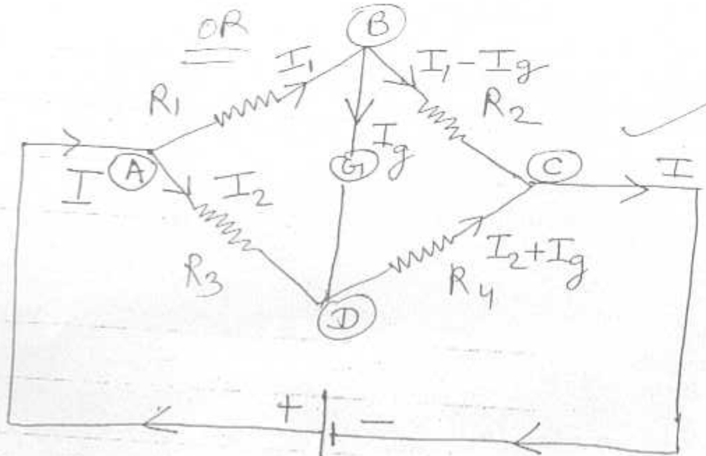
Consider a metal plate or rod A having positive charge on it. let us assume it is given Charge equal to its Capacity Now we can't store any charge on it. Now if we bring an uncharged rod B near it due to electrostatic induction a negative charge is induced on its surface near to A & a equal positive Charge is induced on its surface away from A. As negative charge on plate B is nearer to A then positive charge, therefore potential of ~~rod A~~ plate A decreases & now we can give more charge to it. Now ~~we~~ we connect B to earth the positive charge ~~of~~ on plate B ~~flow~~ is neutralised by negative charge of earth but negative charge on plate remains as such as it is bound to plate ~~rod~~ A by induction. Now the potential of rod A reduce greatly due to this negative charge as now there is no positive charge on B which increases potential of A. Now we can give more charge to A then earlier. In this way capacity of the plate A increased greatly when we bring an uncharged plate or rod near it.

(i) The electric field between plates $\rightarrow \frac{\sigma}{\epsilon_0}$ ½

(ii) Potential difference $\rightarrow$ ~~$\frac{\sigma d}{\epsilon_0}$~~ $\frac{\sigma d}{\epsilon_0}$ ½

(iii) Capacitance $\rightarrow \frac{\epsilon_0 A}{d}$ ½

OR



Under balance condition no current flows through Galvanometer.

∴ $I_g = 0$ & let galvanometer resistance be G.

Now current in each branch is shown.

$$I = I_1 + I_2$$

Applying Kirchoff's law in loop ABD we have

$$I_1 R_1 + I_g G - I_2 R_3 = 0$$

$$\Rightarrow I_1 R_1 + 0 - I_2 R_3 = 0 \Rightarrow I_1 R_1 = I_2 R_3 \quad —(1)$$

$$\Rightarrow \frac{I_1}{I_2} = \frac{R_3}{R_1}$$

In loop BCD

$$(I_1 - I_g) R_2 - (I_2 + I_g) R_4 - I_g G = 0$$

as $I_g = 0$

$\Rightarrow I_1 R_2 - I_2 R_4 = 0 \Rightarrow I_1 R_2 = I_2 R_4$ — (2)

$$\Rightarrow \frac{I_1}{I_2} = \frac{R_4}{R_2} \quad \text{— (2)}$$

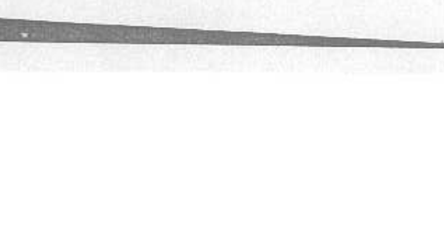
from (1) & (2)

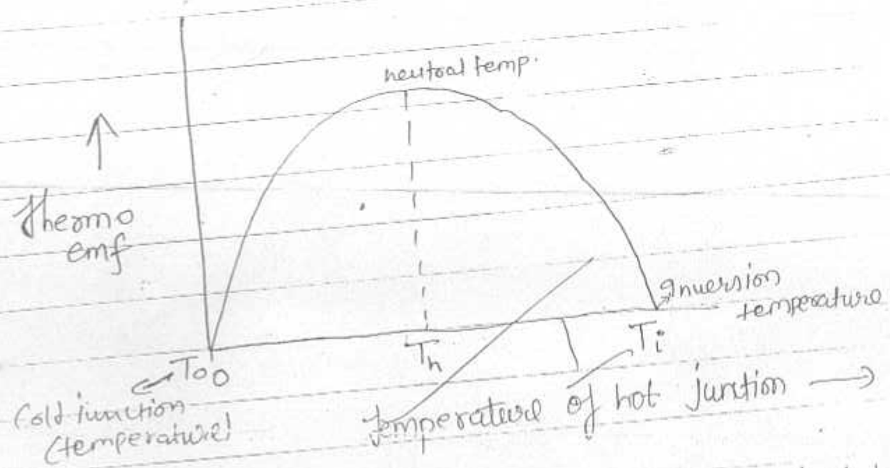
$$\frac{R_3}{R_1} = \frac{R_4}{R_2}$$

$$\Rightarrow \boxed{\frac{R_1}{R_2} = \frac{R_3}{R_4}}$$

16

Seebeck effect is the Generation of the electricity when two metal are Connected to each other & its one Junction is Kept at a high temperature & other Junction is Kept at ~~temp~~ low temperature. When a temperature difference is maintained between the junctions then an emf is produced.





(i) when temperature of Cold Junction is increased neutoal temperature remains unchanged. ½

(ii) ~~I~~ when temp. of Cold Junction is increased then inversion temperature decreases because neutoal temperature is as much above the cold junction temp. as that inversion temp. is above neutoal temp. ½

$$\therefore \quad T_n - T_o = T_i - T_n$$

$$T_i = 2T_n - T_o.$$

as T_o increases T_i decreases.

Rough
$T_h - T_c = T_i - T_h$
$T_i = 2T_h - T_c$

17 (i) Infrared rays ½
(ii) Ultraviolet rays. ½
(iii) X rays. ½

½

Infrared rays are used in heaters for producing heating effect. ½
Ultraviolet rays are used for melting metals ✗
X rays are used to detect fracture parts of bone. ½

18 refractive index $\mu_g = 1.6$

Radius of curvature = 30 cm = R_1 & R_2 but $R_1 = +30$ cm, $R_2 = -30$ cm

Object height, $h_1 = 5$ cm

$u = -12.5$ cm

Now focus of the lens, $f = (\mu g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) = (1.6 - 1)\left(\frac{1}{30} - \left(-\frac{1}{30}\right)\right)$ ½

$= \frac{6}{10} \times \frac{2}{30} \Rightarrow f = \frac{300}{12} = 25$ cm

From lens formula

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \quad \frac{1}{2}$$

$f = +25$ cm, $u = -12.5$ cm, $v = ?$

$$\frac{1}{v} - \left(-\frac{1}{12.5}\right) = \frac{1}{25} \Rightarrow \frac{1}{v} = \frac{1}{25} - \frac{1}{12.5} = \frac{1-2}{25}$$

$\frac{1}{2}$

$v = -25$ cm

Now magnification $\frac{h_2}{h_1} = \frac{v}{u} = \frac{-25}{-12.5} = 2 \quad \frac{1}{2}$

$h_2 \rightarrow$ height of image $\quad \frac{1}{2}$

$h_2 = 2 \times h_1 = 2 \times 5 = 10$ cm Ans

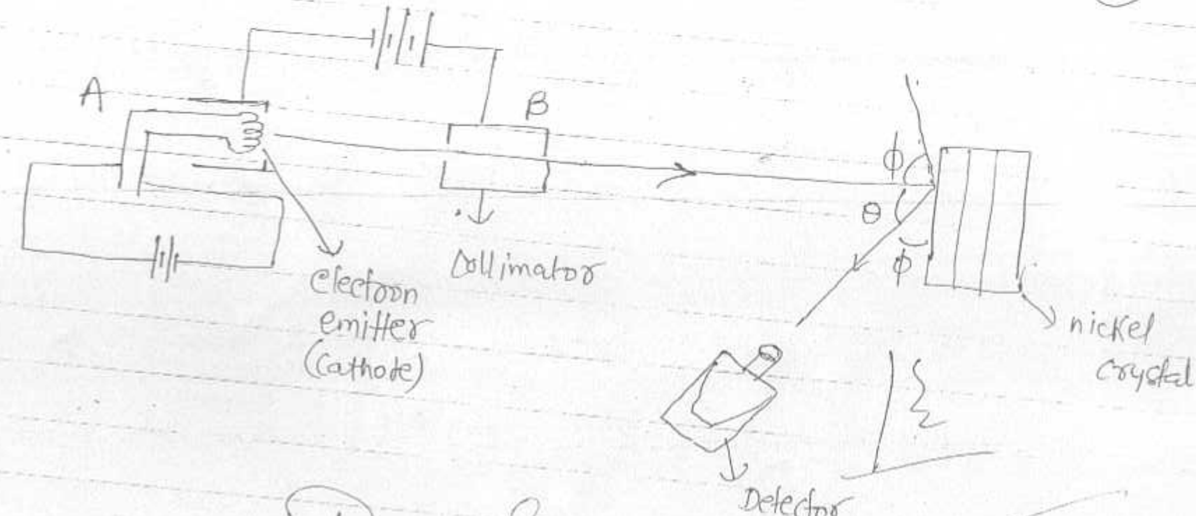
∴ height of image = 10 cm

Rough

$\frac{1}{25} - \frac{1}{12.5}$

$\Rightarrow \frac{1-2}{25}$

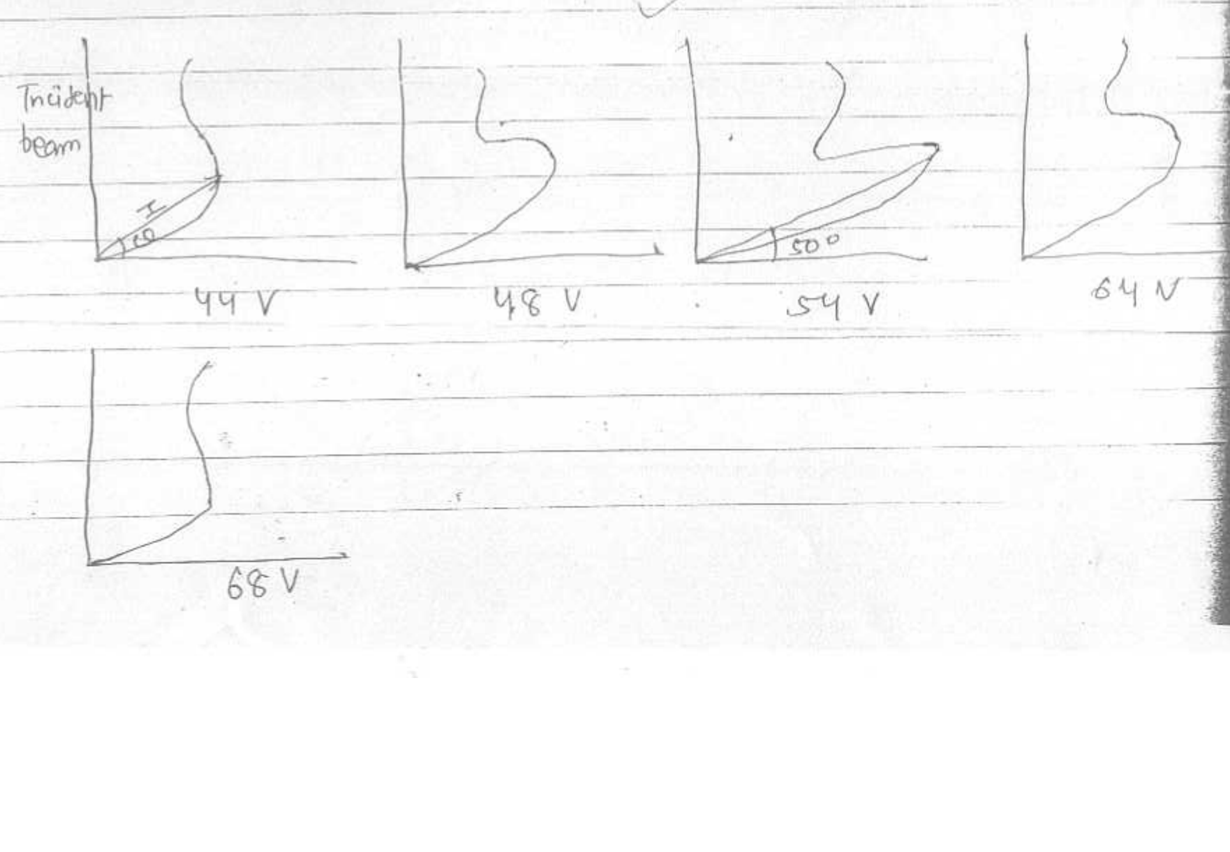
$-\frac{1}{25}$



Davisson & Germer experiment

A is a tungensten filament coated with Barium oxide which on heating from low tension battery emits electoon. Collimator make the electoon beam fine. The electrons from Collimator falls in Nickel Crystal & get Scattered in all directons. There is detector which is connected to sensitive Galvanometer which measures current & hence intensity at all Scattering angles θ.

According to classical mechanics the intensity of scattered beam at all directions remains same. But when the applied voltage is 54V & scattering angle is 50° there is a sharp bump in the graph of intensity versus scattering angle which means intensity of electrons scattered at that point is maximum. The intensity at that point is maximum due to constructive interference between the electrons scattered from different layers of nickel crystal.



Now ϕ = angle between layers of nickel crystal & scattered beam

$$\theta + 2\phi = 180^\circ \Rightarrow 50^\circ + 2\phi = 180^\circ \Rightarrow \phi = 65^\circ$$

By Braggs law for first order

$$2d \sin\theta = n\lambda \quad \text{where } n = 1$$

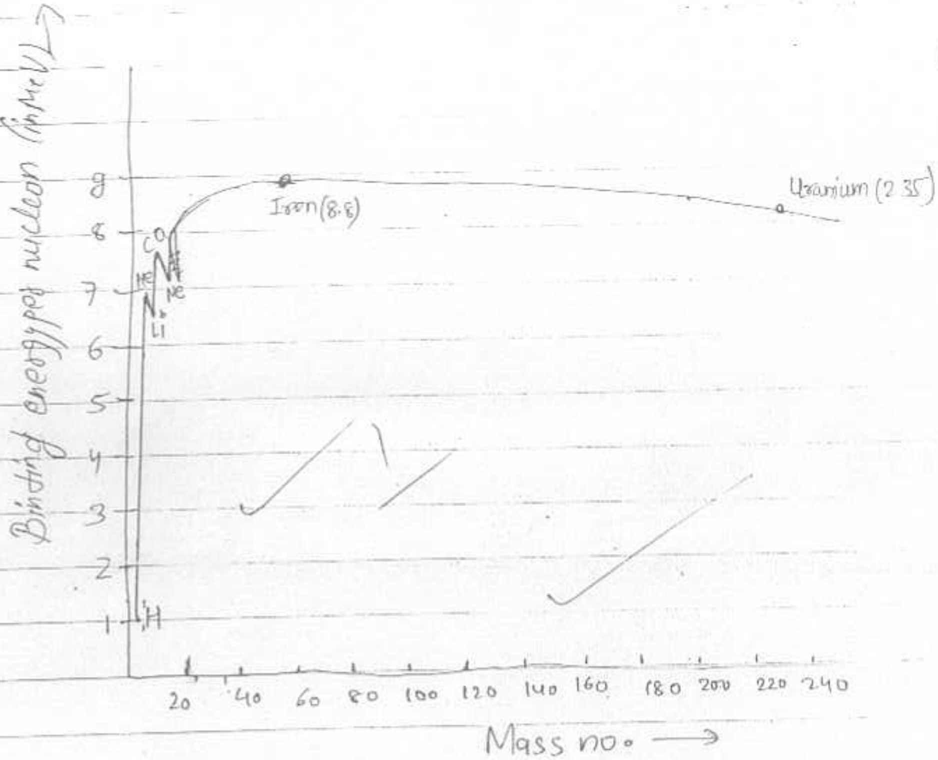
$d = 0.91$ Å (atomic crystal spacing)

$$\Rightarrow 2 \times 0.91 \times \sin 65^\circ = \lambda \Rightarrow \lambda = 1.65 \text{ Å}$$

& from debroglie relation

$$\lambda = \frac{12.27}{\sqrt{V}} = \frac{12.27}{\sqrt{54}} = 1.66 \text{ Å}$$

As there is close agreement between the values of debroglie wavelength of electrons by Davisson & Germer experiment & debroglie experiment the wave nature of electrons is established.



~~Now: Binding energy/nucleon = mass of ... p~~
~~where = Am_p + (~~

mass of $^{40}_{20}Ca$, m_N = 39.962589

Mass of proton, m_p = 1.007825 u

mass of neutron, m_n = 1.008665 u

Atomic no. of $^{40}_{20}Ca$, Z = 20

Atomic mass, A = 40

Now Binding energy = $[[m_p \times Z + m_n (A-Z)] - m_N] \times c^2$

Mass defect

= $[1.007825 \times 20 + 1.008665 \times 20 - 39.962589]$

= .367211 amu

Binding energy = .367211 × 931

= 341.8734411 MeV

Binding energy per nucleon

= $\frac{341.873441}{40}$ MeV/nucleon

= 8.545 MeV/nucleon.

1/2

Rough

4) 341.873441 (8.54
32
21
20
18
16
20

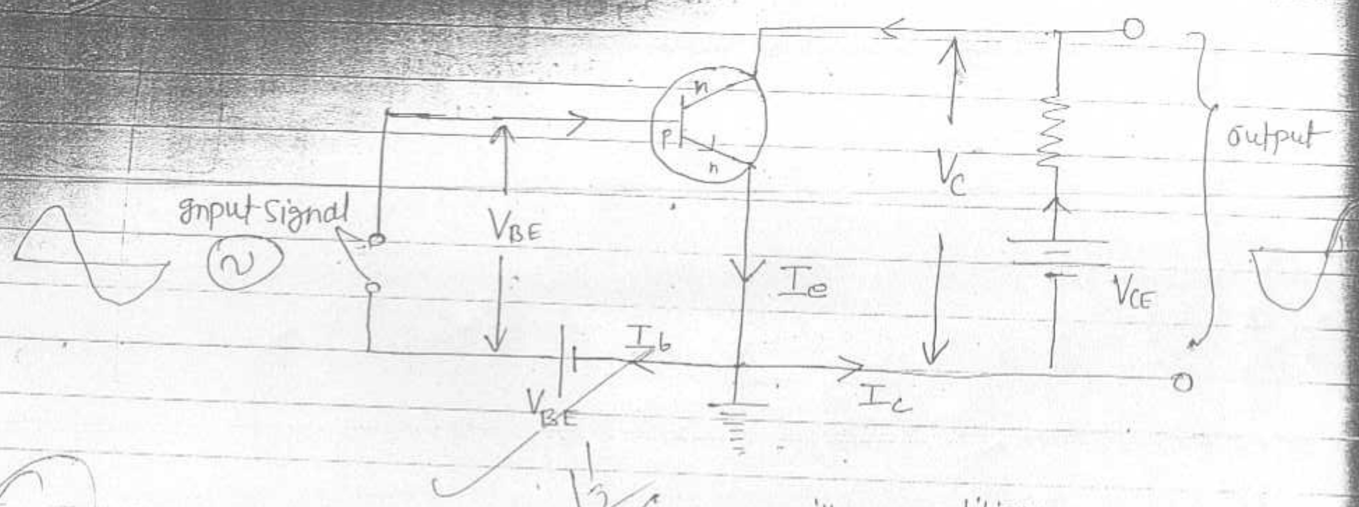
Rough

10.07825
2
20.15650
20.17330
40.32980
39.962589
10.08665
2
20.17330

0391

40.329800
39.962589
.367211

367211
931
367211
1101633
3304899
341.873441



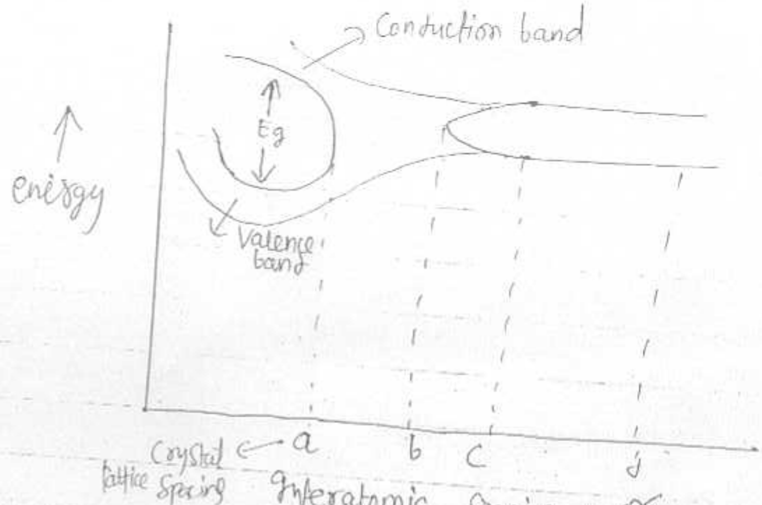
Common emitter amplifier

The phase difference between the input signal and output voltage is 180°.

The Common Emitter amplifier is ~~used~~ preferred to Common base amplifier

(i) It gives Current gain better & more than Common base amplifier.

(ii) Power loss is less.



In solids like in Silicon atom there are 14 electrons ($1s^2 2s^2 2p^6 3s^2 3p^2$)
When solids ~~are~~ atoms are not in crystal lattice they don't interact with each other.
But in Crystal lattice each atoms start interacting with other atoms & influence the energy of its neighbouring atom. In atoms there are subshells which are filled by electrons. Only valence electrons are affected as they are outermost electrons

(i) When two atoms are far, i.e at distance $r > d$ they don't interact with each other.

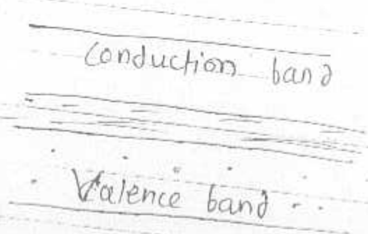
(ii) Between c & d they starts influencing each other. In Silicon in outermost shell there are two electrons in S subshell & 2 electrons in P subshell. there are 4 electrons but ~~Spae~~ there is space for 8 electrons. when N atoms are taken then electrons are 4N & unfilled ~~sub orbit~~ space is also 4N. Between c & d energy of these electrons starts changing & their energy level starts mixing with each other. Due to this a large no. of ~~bands~~ closely spaced energy levels are formed which form energy bands.

(iii) At b the energy level complete difference between these energy levels completely dissappears & they form a band of energy levels. In this stage we can't distinguish between 4N electrons energy level in which electrons are present & energy levels which are unfilled.

(iv) ~~Beyond~~ After b & in between a & b the energy level containing 4 electrons are seperated from the ~~four~~ energy levels which are unfilled. The energy level which is completely filled is called Valence band & energy level which is unfilled is called Conduction band. The energy Gap between Valence & conduction band is called Forbidden energy gap.

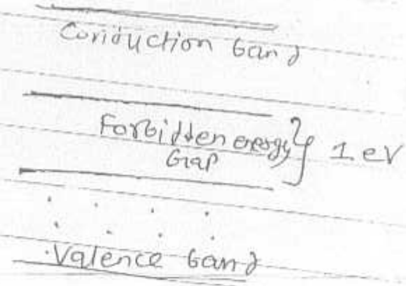
(i) For Conductor

In Conductors Valence band & Conduction band overlaps with each other. There is no energy gap between them



(i) For intrinsic semiconductor

In intrinsic semiconductor energy gap is of order 1–2 eV



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 – पुस्तिका संख्या 1
Supplementary Answer-Book No. 854251

Ans 23 → Modulation is the technique in which low frequency Signal is Superimposed on the high frequency Carrier wave so that information Signal can be transmitted.

Need for modulation

(i) For low frequency Signal transmission of order 20Hz 20 KHz we need antennae of height half the wavelength of Signal so that antennae can sense properly the variations in Signal. For low frequency Signal of 20 Hz we need antennae of length about 20 Km which is impossible. So we superimpose information signal on Carrier wave. Due to this antennae length required decreases.

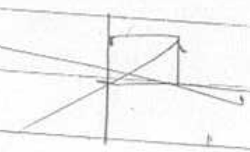
(2) Power radiated by antennae of length l is $\propto \frac{1}{l^2}$

As high power are needed for good transmission therefore antennae length should be small.

(3) When many signals are transmitted at the same time we can't distinguish between them but by ~~using~~ transmitting signal at high frequency, we can allocate a band to each user & this reduces the interference of waves/noise.

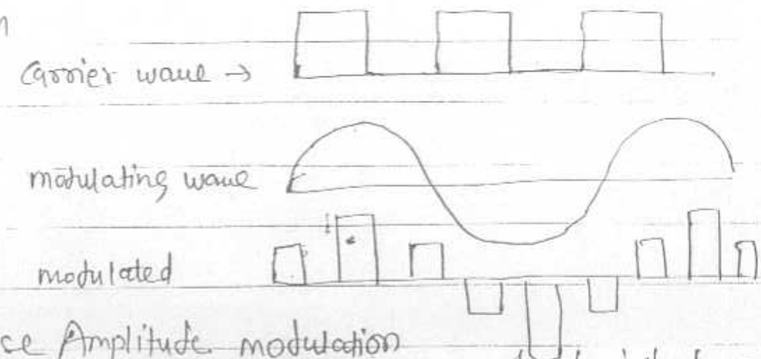
For PAM

Carrier wave →



45.2 (31)

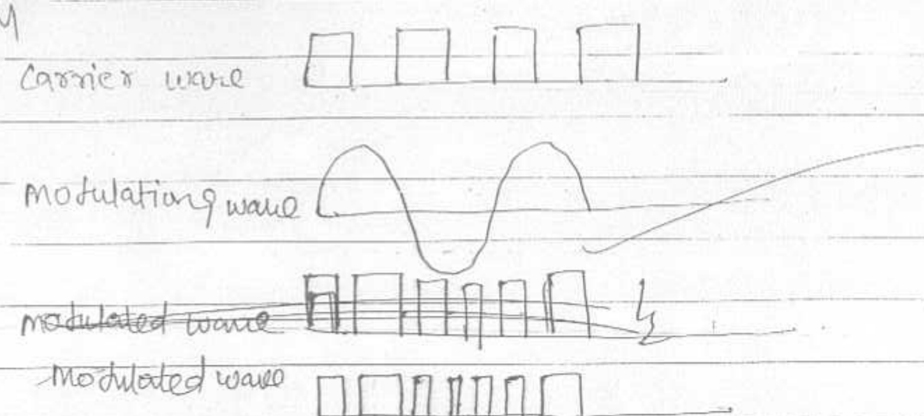
For PAM



1/2

In Pulse Amplitude modulation
Amplitude of carrier wave changes according to instantaneous value of modulating signal

For PDM



In Pulse duration modulation duration (or width) of the pulse changes ~~chan~~ according to instantaneous value of modulating signal.

Only

उत्तर-पुस्ति
अथवा बाह
अपना अनु
उत्तर पुस्ति
उत्तर-पुस्ति
न छोड़कर
उत्तर-पुस्ति
पुस्तिका के
अन्य अति
अपने उत्त
पूरे प्रश्न (
यदि आप
पुस्तिका दे
पर दिये हु
केवल नी
3. एफ अथव
में उस क
1. उत्तर-पुस्ति
2. यदि परीक्ष
तो वह म
प्रकार उ
अंकित
(क)
(ख)
(ग)
(घ)
(ङ)
(च)
(छ)
(ज)
(झ)

24

LASER → Light Amplification by Stimulated emission of radiation.

We use diode lasers as light sources for optical Communication links because:

(i) Diode laser emits highly monochromatic & coherent light. 1/2

(ii) The frequency of the light emitted is very high. They can be easily modulated by the information Carrying signal.

(iii) The diode laser supply adequate power required for transmission. 1/2

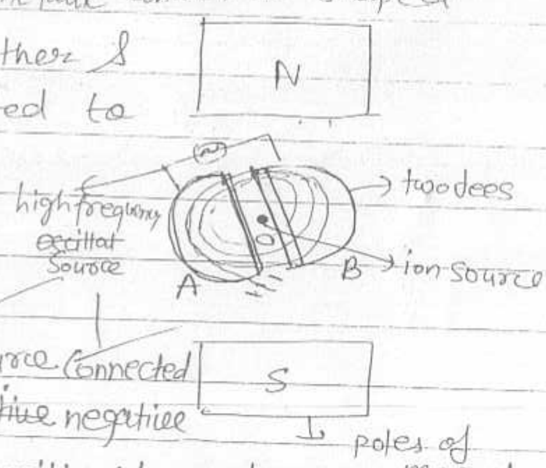
(iv) The diode laser dimensions are Compatible to that of the optical fibres needed for transmission. So they Can easily introduce light in the Core of the optical fibres without any loss.

25

CYCLOTRON → It is a device which is used for accelerating positively Charged particles to high speed.

Principle → It is based on the principle that a particle can be accelerated with the use of electric field & magnetic field simultaneously and a particle experience a force in magnetic field which forces it to follow a circular path & frequency of the ions is independent of their velocity

Construction → It consists of two hollow metallic conduct D-shaped conductor placed parallel to each other & facing each other. they are connected to an ac source & they are placed between the north & south pole of a strong magnet



Working → the ion is produced at O. The a.c source connected to two Dees makes the B Dee negative & A-Dee positive. Due to this the positive charged particle get accelerated to the B-Dee. Inside the D it is in an electric field free space. It experiences a magnetic force which causes it

1 + 0
Only

to follow a Circular path with Constant velocity. As the ion arrived at the Gap between D at the same time half cycle of the a.c Source gets Completed & now A-Dee becomes negative. Due to this ion get accelerated to Dee-A & again it follows a Circular path of greater radius & greater velocity. As we ~~know~~ deduce that frequency of the ~~osc~~ a.c Source ~~becom~~ is equal to frequency of Charged particles the ion follows Circular path of ~~radi~~ greater radius again & again & finally A is accelerated to high velocity.

Now $m \rightarrow$ mass of ion.
$V \rightarrow$ velocity of ion.
$r \rightarrow$ radius of path
$f \rightarrow$ frequency of cyclotron.

Now $\frac{mv^2}{r} = BqV \Rightarrow V = \frac{Bqr}{m}$

or time taken to complete half circle

$$= \frac{\pi r}{v} \Rightarrow \frac{\pi r m}{Bqr} = \frac{\pi m}{Bq}$$

Time taken to complete full circle, $T = \frac{2\pi m}{Bq}$

∴ Cyclotron frequency is equal to the frequency of ion source $= \frac{1}{T} = \frac{Bq}{2\pi m}$ 1

From relation we see frequency of cyclotron is independent of speed of charged particle. 1/2

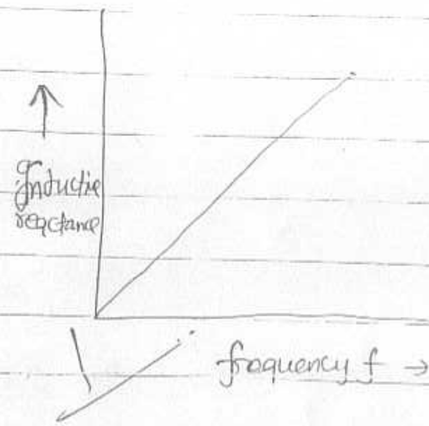
26 A26

Inductive reactance X_L is the resistance posed to current by the inductor. It arises because inductor induces a self induced emf in itself which opposes the rising current

1 + 0

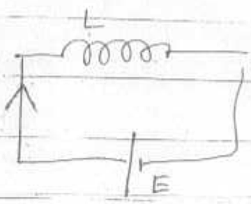
1/4 Only

Its value is ωL or $2\pi f L$



Ac Voltage applied $E = E_0 \sin \omega t$

Now self induced emf ~~tedi~~ in inductor at a time 't' when current through it changes at rate $\frac{dI}{dt}$



$$-L\frac{dI}{dt}$$

This must be equal to applied voltage at a time 't' for maintaining current

$$L\frac{dI}{dt} = E_0 \sin \omega t$$

Fictitious Roll No.
(To be entered by Board)

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

अतिरिक्त उत्तर – पुस्तिका संख्या 2
Supplementary Answer-Book No. 6542554

$$\int_0^I dI = \int_0^T \frac{E_0}{L} \sin \omega t \, dt$$

$$I = \frac{E_0}{L\omega} \left| -\cos \omega t \right|_0^T$$

$$I = \frac{E_0}{\omega L} \left[-\cos \frac{2\pi}{T} t \right]_0^T$$

$$I = \frac{E_0}{\omega L} \left[-\cos 2\pi - (-\cos 0) \right.$$

$$\int dI = \int \frac{E_0}{L} \sin \omega t \, dt$$

$$I = E_0$$

$$I = \frac{E_0}{\omega L} - \cos\omega t$$

$$I = \frac{E_0}{\omega L} \sin(\omega t - \pi/2)$$

$$I = I_0 \sin(\omega t - \pi/2)$$

where $E_0/\omega L = I_0$

So current ~~is max~~ lags behind applied voltage by a phase $\pi/2$.

½

27 Coherent sources are those sources which have same frequency and a constant phase difference between them.

They are required to obtained sustained interference because if the light sources are not coherent then they do not have stable phase difference & hence they are unable to show interference

It can be showed mathematically :-

oard)

let two waves are

$$E_1 = E_0 (\sin(\omega_1 t + \phi_1))$$
$$E_2 = E_0 \sin(\omega_2 t + \phi_2)$$

Now Intensity $\propto$ (amplitude)^2

$$I_1 = KE_1^2 = K E_0^2 \sin^2(\omega_1 t + \phi_1) = \frac{KE_0^2}{2}$$

because $\sin^2(\omega_1 t + \phi_1)$ has average value $1/2$ & as frequenly ω_1 & ω_2 are very high of order 10^{14} Hz we take average

$$I_2 = KE_2^2 = KE_0^2 \sin^2(\omega_2 t + \phi_2) = \frac{KE_0^2}{2}$$

~~the three~~ When they superimpose them their net intensity

$$= K(E_1 + E_2)^2$$
$$= K(E_1^2 + E_2^2 + 2E_1E_2)$$
$$= K\left(\frac{E_0^2}{2} + \frac{E_0^2}{2} + 2E_0^2 \sin(\omega_1 t + \phi_1) \sin(\omega_2 t + \phi_2)\right]$$
$$= I_1 + I_2 + I_{12}$$

$I_{12} \longrightarrow$ Interference term

f (i) & (ii

res

0

nly

$$I_{12} = 2KE_0^2 \sin(\omega_1 t + \phi_1)\sin(\omega_2 t + \phi_2) = KE_0^2\left(\cos\left((\omega_1-\omega_2)t + (\phi_1-\phi_2)\right) - \cos\left((\omega_1+\omega_2)t + (\phi_1+\phi_2)\right)\right)$$

The average of this term is also zero if $\omega_1 - \omega_2 \neq 0$

But when $\omega_1 = \omega_2$ then it reduces to

$$I_{12} = KE_0^2 \cos(\phi_1 - \phi_2) = 2\sqrt{I_1 I_2}\cos(\phi_1 - \phi_2)$$

If the $\phi_1 - \phi_2$ is constant then this value of I_{12} exist. But if $\phi_1 - \phi_2$ is unstable then average value of this is also zero & we observe no interference as interference term is zero.

INTERFERENCE PATTERN	DIFFRACTION PATTERN
(1) The width of all the fringes whether dark or bright is same.	(2) The width of fringes is not same but it is maximum for central maxima & then decreasing.
(2) Intensity of all the dark fringes are equal & intensity of all the bright fringes are same	(3) Intensity of all the dark & bright fringes are not same but decreasing.

4 ~~41~~ (by Board)

(3) The ~~phase~~ path difference at constructive interference is ~~same~~ λ & at destructive interference is λ/2

(3) The path difference is reverse of interference pattern.

(4) In interference pattern there is also some diffraction effect due to slits.

(4) In diffraction ~~not inter~~ there is no effect of interference.

6\.

$$A \xleftarrow{x} O \xleftarrow{1-x} B$$

A: $4\mu C$, O, B: $-2\mu C$

let potential at o be zero.

Now potential at o due to A $= \frac{4}{4\pi\epsilon_0 x}$

Potential at O due to A $= \frac{-2}{4\pi\epsilon_0 (1-x)}$

Total of (i) & (ii) in figures

Net potential ⇒ $\frac{4}{4\pi\epsilon_0 x} - \frac{2}{4\pi\epsilon_0 (1-x)} = 0$

⇒ $\frac{1}{4\pi\epsilon_0}\left[\frac{4}{x} - \frac{2}{(1-x)}\right] = 0$

⇒ $\frac{4(1-x) - 2x}{x(1-x)} = 0$

⇒ $4 - 4x - 2x = 0$

⇒ $4 - 6x = 0$

⇒ $x = \frac{2}{3}$ m Ans

So potential is zero at distance $\frac{2}{3}$ m from $4\mu C$ charge.