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

विषय **Subject :** Physics (042)

परीक्षा का दिन एवं तिथि
Day & Date of the Examination : 1/3/11, Tuesday

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 the Question paper : 55/1

अतिरिक्त उत्तर–पुस्तिका (ओं) की संख्या
No. of supplementary answer -book(s) used 3.

... शारीरिक अक्षमता से प्रभावित हो तो संबंधित वर्ग में ✓ का निशान लगाएं।
... physically challenged, tick the category

B D H S C

B = ... D = ... H = शारीरिक रूप से विकलांग S = स्पास्टिक, C = डिस्लेक्सिक
B = Blind, D = Deaf & Dumb, H=Physically Handicapped, S=Spastic, C=Dyslexic

... : हां / नहीं
... writer provided : **Yes / No** NO

... प्रत्येक भाग के बीच एक खाना रिक्त छोड़ दें। यदि परीक्षार्थी का ... नाम के प्रथम 24 अक्षर ही लिखें।
... written in one box and one box be left blank between each part of the ... case candidate's Name exceeds 24 letters, write first 24 letters.

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

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

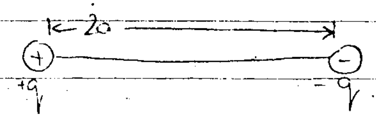
केन्द्रीय माध्यमिक शिक्षा बोर्ड — दिल्ली — असतो मा सद्गमय

प्रमाणित किया जाता है कि मैंने इस उत्तर-पुस्तिका का मूल्यांकन प्रश्न पत्र के समुचित सेट के अ... किया है।

Certified that I have evaluated this answer book according to the correct set of que... paper.

(1) Electric dipole moment for a dipole is defined as the product of either charge (magnitude) of the dipole and the distance between the two charges. It is a vector quantity and is denoted by 'p'.
Its direction is from negative to positive.
Its SI unit is C-m.

$$\boxed{\vec{p} = q \times (2\vec{a})}$$



(2) The angle of dip at the pole is 90°

(3) The potential on all points on the surface of a hollow metal sphere is constant and also the potential inside is the same

∴ V on surface = 10V
∴ V ~~on this~~ at the contre = 10V

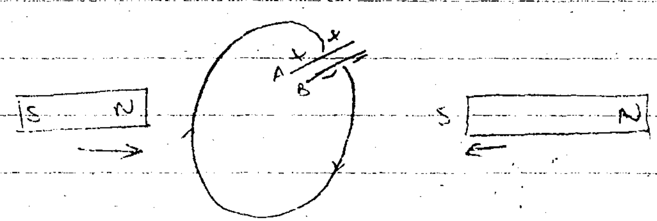
(4) Radio waves can be produced ~~using~~ by an accelerated charged particle. Radio waves have wavelength 0.3 – 600 m.

(5) Characteristics of nuclear forces

→ They are non central forces. They are the strongest forces found in nature

→ They show saturation properties and don't depend on the charge on nucleons

(6)



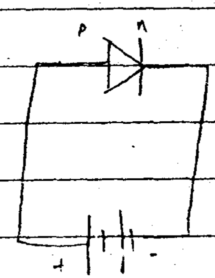
Using lenz's Law, we know that the charge will be induced in such a way so as to oppose the change in magnetic flux (ϕ_B)

∴ Plate A (upper plate) becomes positively charged.
Plate B (lower plate) becomes negatively charged.

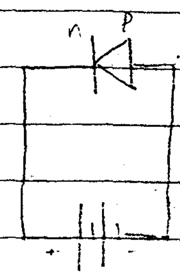
⑦

(i) In forward biased p-n junction, the length of the depletion layer <u>decreases</u> and hence it offers lower resistance.

(ii) In reverse biased p-n junction the length of the depletion layer <u>increases</u> and hence it offers greater resistance.



forward biased



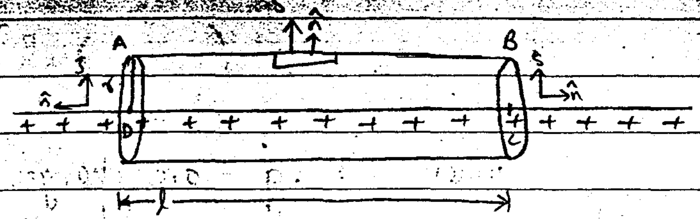
reverse biased

(8) Stopping potential is defined as the maximum negative potential of an electrode (anode) for which the Kinetic energy (maximum) of the emitted photoelectron becomes 0. It is denoted by V_0.

$$eV_0 = h\nu - \phi_0$$

where eV_0 = KE of particle
ν = incident frequency
ϕ = work function.

(9).



Given:-

λ = surface charge density.

Applying Gauss theorem.

$$\phi_E = \frac{q}{\varepsilon_0}$$ where q = total charge enclosed by cylinder.

$$\boxed{\phi_E = \frac{\lambda l}{\varepsilon_0}}$$ as $(q = \lambda l)$.

(Outward if wire is positively charged).
(Inward if wire is negatively charged).

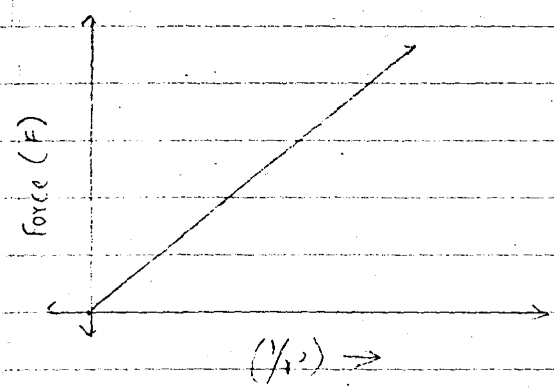
(10) Acc. to Coulomb's Law

$$F = \frac{kq_1q_2}{r^2}$$

where q_1, q_2 = are charges
r = distance b/w them
k = constant.

$$\therefore F \propto \frac{1}{r^2}.$$

(a) (1μC, 2μC)



⇒ Force is repulsive

⇒ When $\frac{1}{r^2} = 0$, i.e $r \to \infty$.

Force is 0.

⇒ Slope of graph = kq_1q_2 = +ve.

(11) Expression for Lorentz force.

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

where F = lorentz force
q = charge on particle
$\vec{v}$ = velocity vector of particle.
$\vec{B}$ = magnetic field intensity.

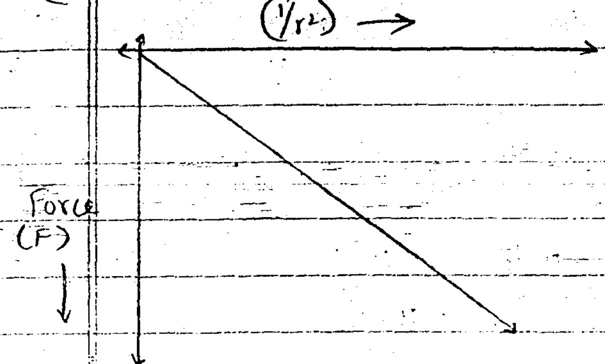
Work done = $F.d$
$= Fd \cos\theta$ where d = displacement.

But since force applied is always at 90° to velocity vector i.e displacement

$$W = Fd \cos 90°$$

$$\boxed{W = 0}$$

(b) $(2\mu C, -3\mu C)$.



$\Rightarrow$ Force is attractive.

$\Rightarrow$ When $\frac{1}{r^2} = 0$, i.e $r \rightarrow \infty$,
$F = 0$

$\Rightarrow$ Slope of graph $= kq_1q_2 = -ve$ //.

(12) Eddy currents are currents that are induced in a closed circuit or coil due to a charging magnetic flux linked with the circuit / coil.

$$i = \frac{-d\phi/dt}{r} = -\frac{\varepsilon_{induced}}{r}.$$

The (−) sign indicates that current induced opposes the change in magnetic flux (Lenz's law).

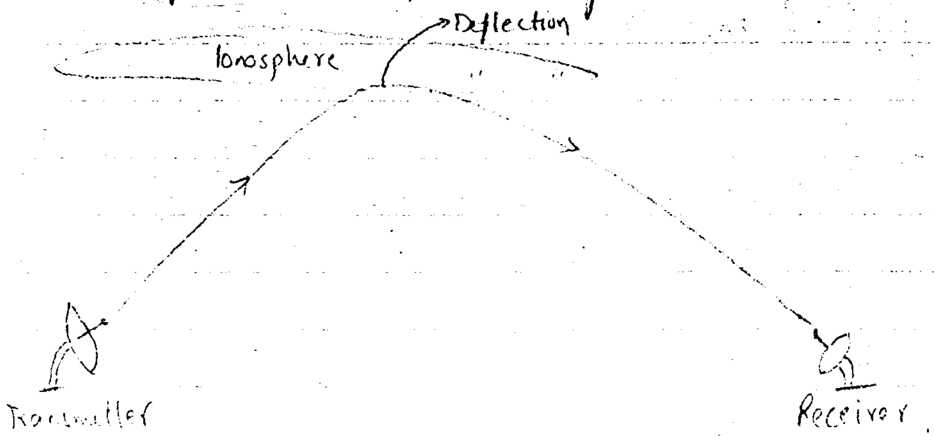
Application

→ It is used in induction motors and heaters.

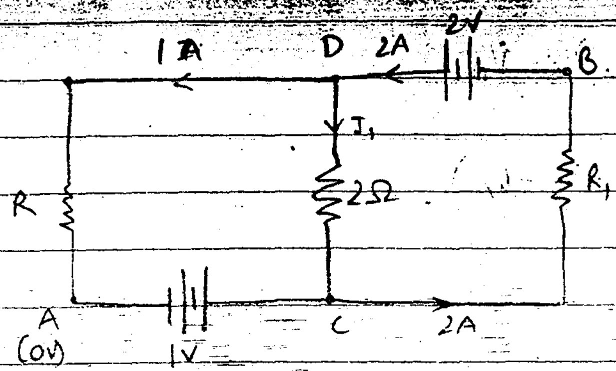
→ It is used in speedometers and odometers for vehicles.

eclor

(13) Sky wave communication is a mode of communication in which the wave is projected towards the sky where it is deflected by the ions in the ionosphere to reach a receiver far away.
It's range is 3 – 30 MHz.
This is so because waves of higher frequency are not deflected by the ionosphere and pass into space.



(14)



Applying Kirchoffs Ist law at junction D.

$1 + I_1 = 2$

$\Rightarrow \boxed{I_1 = 1A}$

Potential at A = 0 V.

∴ Potential at C = 1 V. = $V_C - V_A$

Potential b/w D and C = $V_D - V_C = 2(1) = 2V$

Potential b/w D and B = $V_B - V_D = -2V$

∴ Potential b/w A and B = $V_B - V_A$

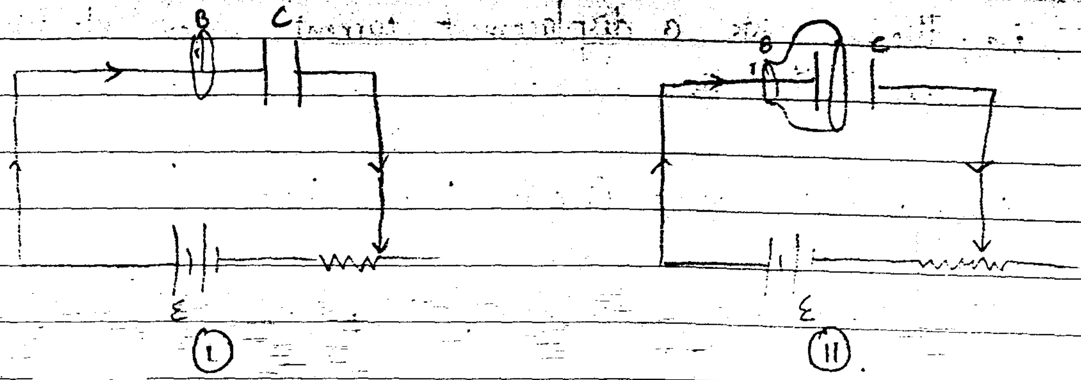
$= (V_B - V_D) + (V_D - V_C) + (V_C - V_A)$.

$= -2 + 2 + 1$.

$= 1\,V$.

∴ Potential at B = 1 V

(15)



Ampere's ·ital law states that.

$$\oint B \cdot dl = \mu_0 I$$

But there is a drawback here.

In fig (I), at point B there is a magnetic field as current I is threading the loop.

But in fig (II) for a tiffin box shaped surface, magnetic field at B becomes 0.

∴ Maxwell introduced another term in the law.

$$I_D = \epsilon_0 \frac{d\phi_E}{dt}$$

i.e there exists a displacement current when electric flux is changing with time

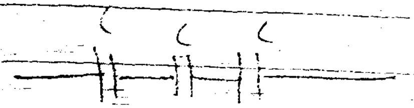
∴ Modified ampere's Circuit law become

$$\oint B \, dl = \phi_B = \mu_0 \left(I + I_D \right)$$

(16) Let each capacitor have a capacitance of C.

When they are in series

$$\frac{1}{C_s} = \frac{1}{C} + \frac{1}{C} + \frac{1}{C}$$



$$\frac{1}{C_s} = \frac{3}{C}$$

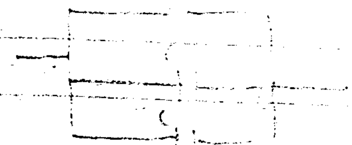
$$\Rightarrow C_s = \frac{C}{3}.$$

$$1\mu F = \frac{C}{3} \qquad (\text{given } C_s = 1\mu F)$$

$$\Rightarrow \boxed{C = 3\mu F}$$

When connected in parallel.

$$C_p = C + C + C = 3C$$



$$\boxed{C_p = 9\mu F}$$

When connected to same source V.

$$E_s = \frac{1}{2} C_s V^2$$

E_s = Energy in series combination

$$E_s = \frac{1}{2}(1) V^2$$

E_p = Energy in parallel combination.

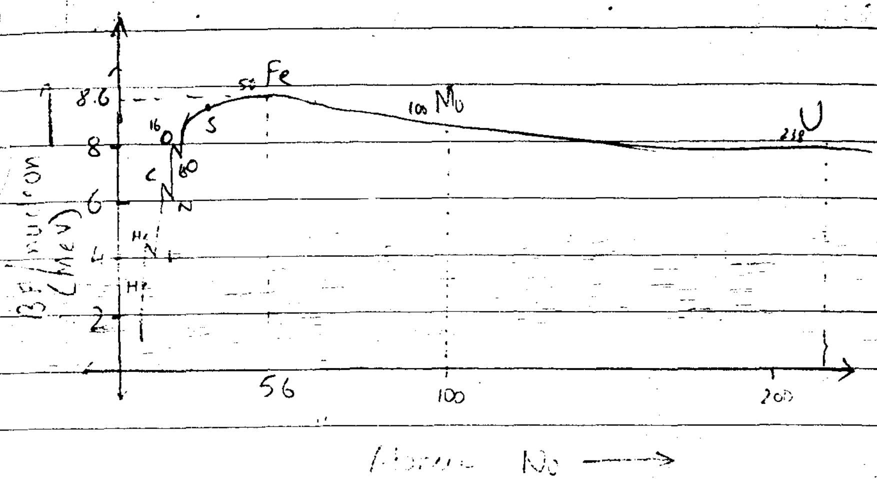
$$E_p = \frac{1}{2} C_p V^2$$

$$= \frac{1}{2}(9) V^2$$

$$\therefore \frac{E_s}{E_p} = \frac{1}{9}$$

$$E_s : E_p = 1 : 9$$

(17)



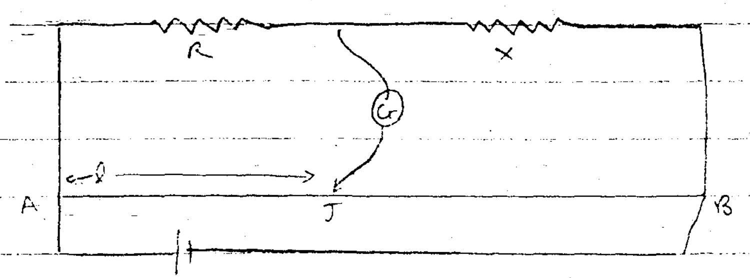
Nuclear Fission

→ When a heavy nucleus disintegrates into smaller, lighter nuclei, we can see from the graph that Binding energy/nucleon increases. Thus energy is released when a heavy nucleus disintegrates to give almost equal fragments, energy is released.

Nuclear fusion

→ When two lighter nuclei fuse together to give a heavy nucleus we again see an increase in binding energy/nucleon Thus energy is released in a nuclear fusion reaction.

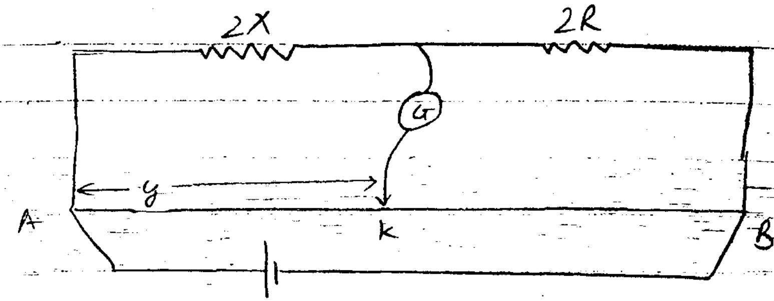
(18).



Acc. to wheatstone bridge Principle.

$$\frac{R}{X} = \frac{l}{100-l} \quad \text{—(1)}$$

(i) ~~Rthoooo~~ If R becomes $2R$ and X becomes $2X$:



Again acc. to wheatstone bridge principle

$$\frac{2X}{2R} = \frac{y}{100-y}$$

$$\Rightarrow \frac{X}{R} = \frac{y}{100-y} \quad \text{— (II)}$$

Comparing (I) and (II).

$$\boxed{y = 100 - l} \longrightarrow \text{New position of balance point.}$$

$$100 - y = l.$$

(ii) If galvanometer and battery are interchanged, there will be no effect on balance point.

(19) Given : → $\mu_g = 1.5$ → ~~Diverging~~ Converging lens (Convex).

(i) μ_m [illegible]5.

(a) $$\frac{1}{f_{air}} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$ (lens makers formula)

$$\Rightarrow \frac{1}{f_{air}} = (1.5 - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{— (I)}$$

$$\frac{1}{f_{medium}} = \left(\frac{1.5}{1.65} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{— (II)}$$

$$\Rightarrow \frac{1}{f_{medium}} = -ve$$

∴ It will behave as a <u>diverging</u> lens.

(b) Dividing (I) by (II)

$$\frac{f_{medium}}{f_{air}} = \frac{(1.5 - 1)}{\left(\frac{1.5}{1.65} - 1\right)}$$

$$\Rightarrow \frac{f_{medium}}{f_{air}} = \frac{-\overset{10}{\cancel{0.5}} \times \overset{0.55}{\cancel{1.65}}}{\underset{3}{\cancel{0.15}}}$$

$$= -5.5$$

$$\boxed{f_{medium} = -5.5 \; f_{air}}$$

(ii) $\mu_m = 1.33$

(a) $$\frac{1}{f_{medium}} = \left(\frac{1.5}{1.33} - 1\right)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{— (III)}$$

$$\frac{1}{f_{medium}} = +ve$$

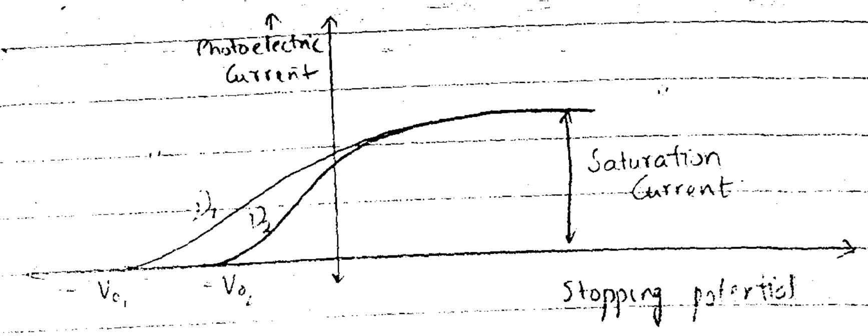
It will behave as a <u>converging</u> lens.

(b) Dividing (I) by (III).

$$\frac{f_{medium}}{f_{air}} = \frac{0.5 \times 1.33}{1.5 - 1.33} \approx \frac{0.5 \times 4}{3\left(1.5 - \frac{4}{3}\right)} = \frac{\cancel{0.5} \times 4 \times \cancel{3}}{\cancel{3} \times \cancel{0.5}} = 4$$

$\therefore \boxed{f_{medium} = 4 \times f_{air}}$

(20)



As we can see from the graph:

$\boxed{\text{Stopping potential for } \nu_1 > \text{Stopping potential for } \nu_2}$

Acc to Einstein's equation

$$eV_0 = h\nu - \phi_0$$

where V_0 = stopping potential

ϕ_0 = work function

ν = incident frequency

For ν_1

$$eV_{0_1} = h\nu_1 - \phi_0 \quad \text{- (I)}$$

For ν_2

$$eV_{0_2} = h\nu_2 - \phi_0 \quad \text{- (II)}$$

(I) - (II)

$$e(V_{0_1} - V_{0_2}) = h(\nu_1 - \nu_2)$$

$$V_{0_1} - V_{0_2} = \frac{h}{e}(\nu_1 - \nu_2)$$

as $\nu_1 > \nu_2$ (given).

$$V_{0_1} - V_{0_2} = +ve$$

$$\therefore \boxed{V_{0_1} > V_{0_2}}$$

(21) (1) → Height of antannae

It is required for the height of antanna to be atleast $(\lambda/4)$ where λ → wavelength of transmission to avoid distortion and for clear transmission
Thus, for lower frequencies, λ is high, thus height is very large
But for higher frequencies, λ is small, thus height is small

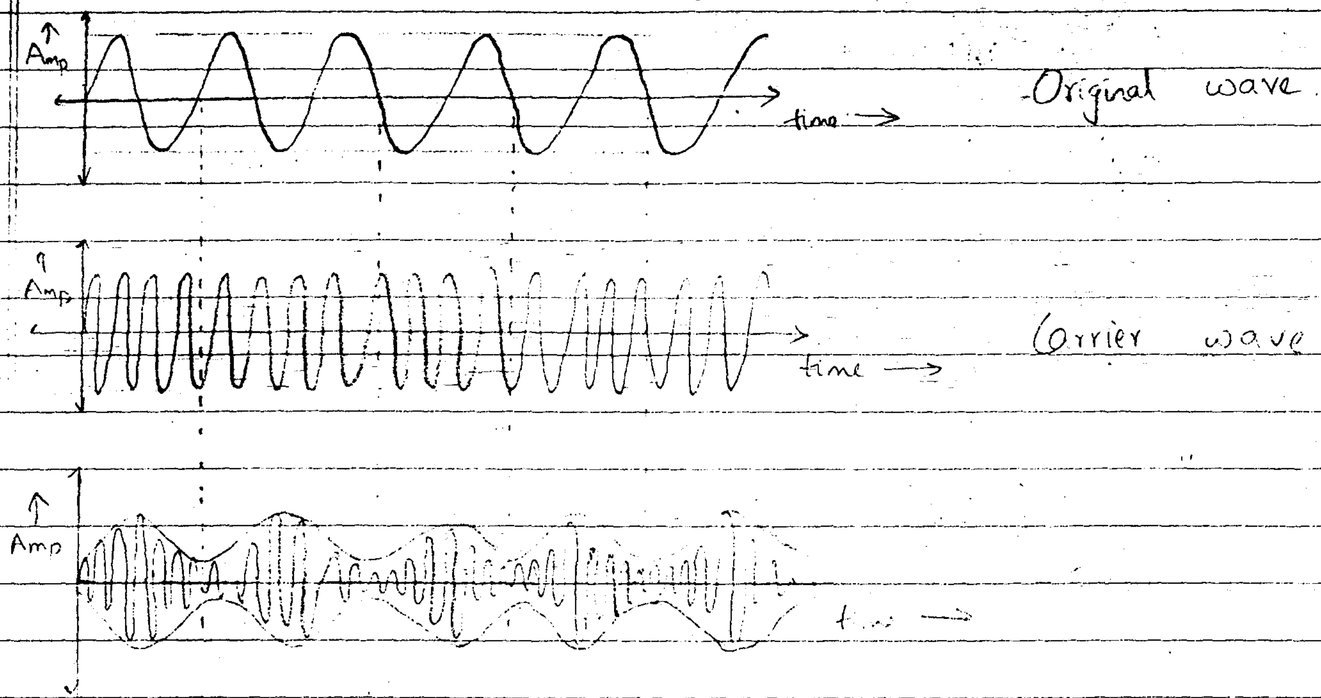
This follows from the relation

$$\boxed{\nu\lambda = c}$$

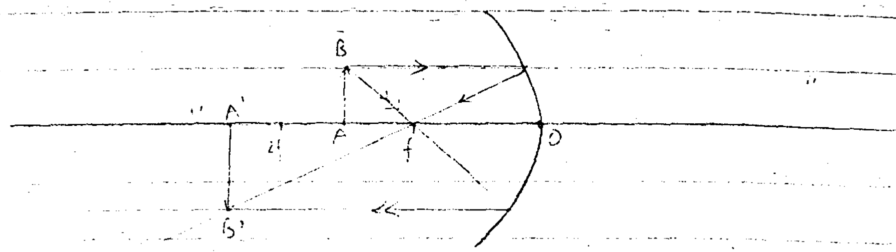
(2) Power Radiated

The power radiated is proportional to $(1/\lambda)^2$. Thus for lower frequency, this power is low as λ is high.
But for higher frequency, λ is small, thus power radiated is more.

Hence we need to modulate the original signal on higher frequency Carrier wave.


Amp
time →
Original wave
Amp
time →
Carrier wave
Amp
time →

22(a) Mirror formula $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$



Let object distance $(u) = -(f+x)$ where $x < f$.
(taking sign convention)

$\therefore \frac{-1}{f} = \frac{1}{v} - \frac{1}{f+x}$

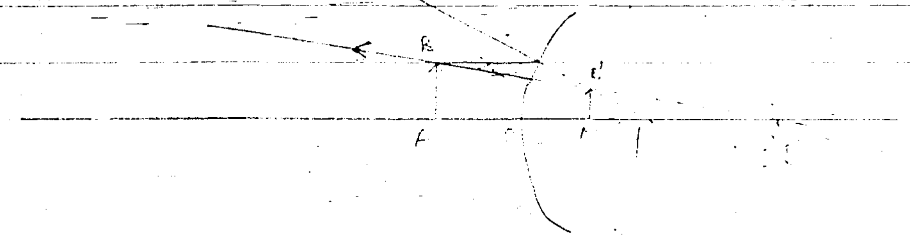
$\Rightarrow \frac{1}{v} = \frac{1}{f+x} - \frac{1}{f} = \frac{f - f - x}{f(f+x)}$

$\frac{x-f-f}{f(f-x)}$

$$v = -\frac{f(f+x)}{x}.$$

Thus image is real and beyond 2f.

(b)



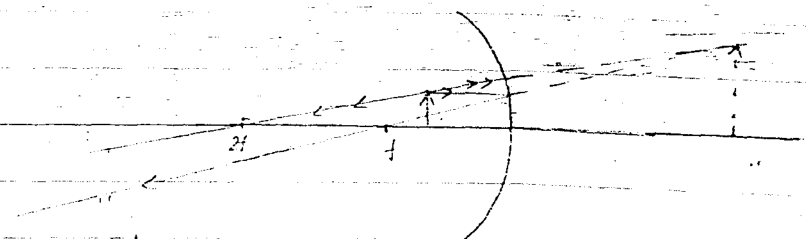
Let object distance = −u. (as u is negative) (sign convention)
focal length = f.

$$\therefore \frac{1}{f} = \frac{1}{v} + \frac{1}{(-u)}.$$

$$\Rightarrow \frac{1}{f} + \frac{1}{u} = \frac{1}{v} \quad \Rightarrow \boxed{v = \frac{uf}{u+f}}.$$

Thus image distance is positive
→ Virtual image.

c)



Let $(-u)$ be object distance $u < f$ (sign convention)

$$\therefore \frac{1}{f} = \frac{1}{v} + \frac{1}{(-u)}$$

$$\frac{-1}{-f} - \frac{1}{(-u)} = \frac{1}{v}$$

Let $u = (f-x)$ $x < f$

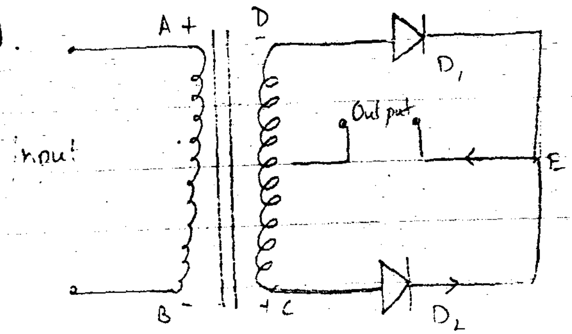
$$\Rightarrow \frac{-1}{f} - \frac{1}{f-x} = \frac{1}{v}$$

$$v = \frac{f(f-x)}{(x-2f)} = +ve$$

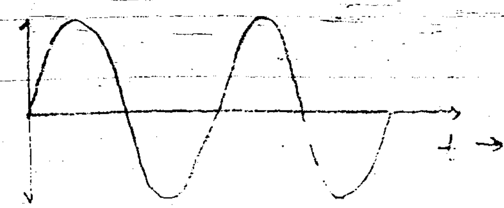
$$m = \frac{-v}{u} = \frac{f\cancel{(f-x)}}{(2f-x)\cancel{(f-x)}} > 1$$

∴ Image is virtual and enlarged.

(23).



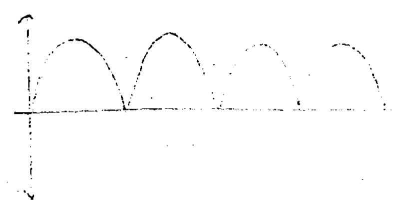
Input (AC)



Working

- A full wave rectifier consists of 2 p-n diodes connected across the same output line

Output (DC)



(1) When A is +ve and B is -ve, due to induction D becomes -ve and C becomes +ve. Thus D_2 becomes forward biased and allows current to pass. But D_1 doesn't, being reverse biased.

(2) When A becomes -ve and B +ve in 2nd half cycle, C acquires -ve and D becomes +ve. Thus D_1 becomes forward bias and conducts electricity but D_2 doesn't. 24(a)

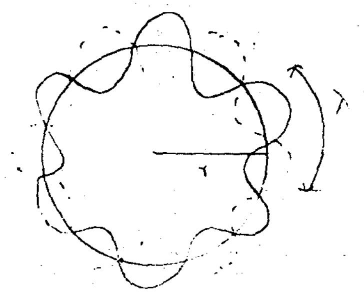
<u>Principle</u>:

An ideal ideal acts like a conductor when forward biased but doesn't conduct electric current when it is reverse biased.

24(a) **Bohr's Second Postulate**

Electrons can only revolve in certain fixed orbits called stationary orbits. In these stationary orbits the angular momentum of the e^- is an integral multiple of ~~h/2π~~ $\left(\frac{h}{2\pi}\right)$.

$$mvr = \frac{nh}{2\pi}.$$



For integral no. of waves

$$2\pi r = n\lambda.$$

Acc. to de Broglie's hypothesis

$$\lambda = \frac{h}{mv}.$$

$$\therefore\ 2\pi r = \frac{nh}{mv}$$

$$\Rightarrow \boxed{mvr = \frac{nh}{2\pi}}$$

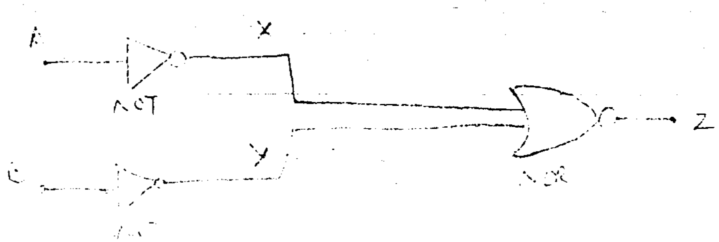
Hence Proved.

24 (b) Total energy $= -13.6\,eV$.

Kinetic energy $= -TE = \underline{13.6\,eV}$.

Potential energy $= -2KE = -2 \times 13.6 = \underline{-27.2\,eV}$.

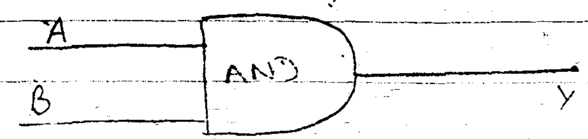
(25)



A	B	X	Y	Z
0	0	1	1	0
0	1	1	0	0
1	0	0	1	0
1	1	0	0	1

Looking at the truth table it is a

AND Gate.



(26) $f_o = 4\ cm$

$f_e = 10\ cm$

$u_o = -6\ cm$

$$\frac{1}{f_o} = \frac{1}{v_o} - \frac{1}{u_o}$$ (lens formula)

$$\Rightarrow \frac{1}{4} - \frac{1}{6} = \frac{1}{v_o}$$

$$\Rightarrow \frac{3-2}{12} = \frac{1}{v_o} = \frac{1}{12}$$

$$v_o = 12\ cm.$$

$\therefore$ Length of microscope = 12cm

Magnifying power $= -\frac{L}{u_o}\left(1+\frac{d}{f_e}\right)$

$= -\frac{32}{6}\left(1+\frac{25}{10}\right)$

$=$ .7

Magnifying power $= -7$

(-ve sign denotes inverted image)

If we approximate $u_o = f_o$.

Magnifying power $= -\frac{L}{f_o}\left(1+\frac{d}{f_e}\right)$

$= -3\,(3.5)$

$= -10.5$

Magnifying power $= -10.5$

(27) <u>Element I</u>

$R = R_1$

$V = V$

$P = P_1$

<u>Element II</u>

$R = R_2$

$V = V$.

$P = P_2$.

<u>Now,</u>

$P = \frac{V^2}{R}$.

$P_1 = \frac{V^2}{R_1}$ — (I) and $P_2 = \frac{V^2}{R_2}$. — (II).

(i) When connected in series

$R_{net} = R_1 + R_2$.

From (I) and (II)

$R_{net} = V^2\left(\frac{1}{P_1} + \frac{1}{P_2}\right)$.

$\text{Power} = \frac{V^2}{R_{net}} = \frac{\cancel{V^2}}{\cancel{V^2}\left(\frac{1}{P_1} + \frac{1}{P_2}\right)} = \boxed{\frac{P_1 P_2}{P_1 + P_2} = \text{Power}}$

When connected in parallel

$$\frac{1}{R_{net}} = \frac{1}{R_1} + \frac{1}{R_2}.$$

Using ① and ②.

$$\frac{1}{R_{net}} = \frac{P_1}{V^2} + \frac{P^2}{V^2} = \frac{1}{V^2}\left(P_1 + P_2\right)$$

$$\therefore \text{Power} = \frac{V^2}{R_{net}} = V^2 \times \frac{1}{V^2}\left(P_1 + P_2\right)$$

$$\boxed{\text{Power} = P_1 + P_2}$$

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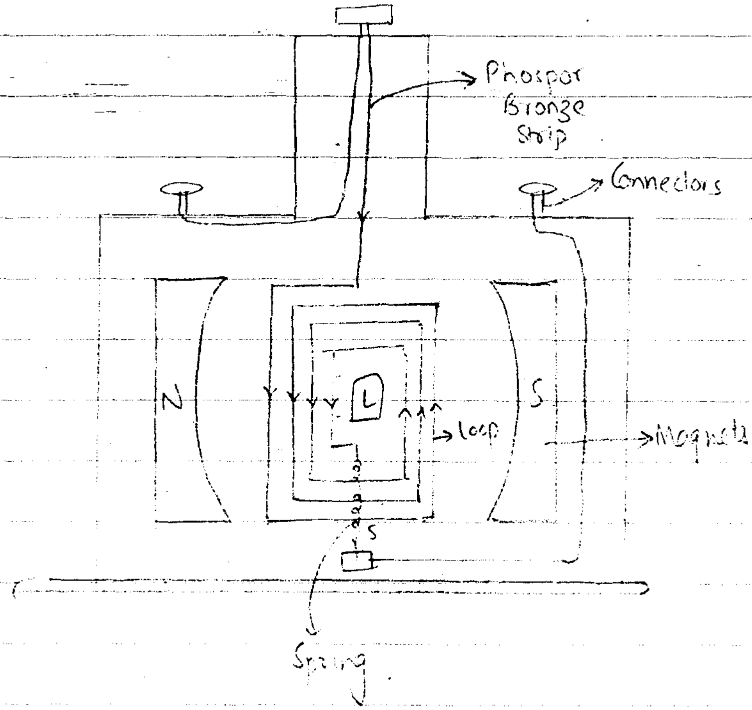
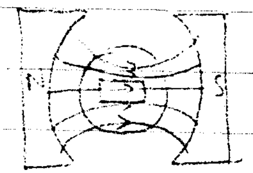
Supplementary Answer-Book(s) No. 2

28(a)





Radial field

Principle :-

The principle of a moving coil galvanometer is that a current carrying loop in a magnet field experiences a torque.

$$\boxed{\tau = nIBA}$$ (for radial field $\theta = 90°$).

where n = no. of turns in loop,

I = current in loop

B = magnetic field.

A = Area of loop.

(b) for a galvanometer at equilibrium

$$k\theta = nBIA.$$

(where k = spring constant, θ = angle moved)

$$\therefore \frac{\theta}{I} = \frac{nBA}{k}.$$

$$\boxed{I_s = \frac{nBA}{k}}$$ Current Sensitivity.

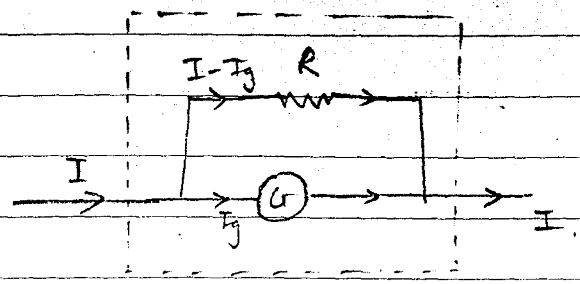
To improve I_s, the easiest way is to increase the no. of turns in the loop. But due to this the resistance (R) of the loop also increases

$$\boxed{V_s = \frac{nBA}{kR}}$$ = Voltage Sensitivity.

$$\therefore V_s \propto \frac{1}{R} \qquad R \uparrow, V_s \downarrow.$$

∴ Increasing current sensitivity of a galvanometer may not necessarily increase its voltage sensitivity.

(c)



Ammeter.

To measure current I, using galvanometer of max current I_g we need to connected a low resistance resistor in parallel called a shunt.

$$\therefore \quad I_g G = (I - I_g) R$$

$$R = \left(\frac{I_g}{I - I_g}\right) G$$

∴ R can be calculated.

(9)

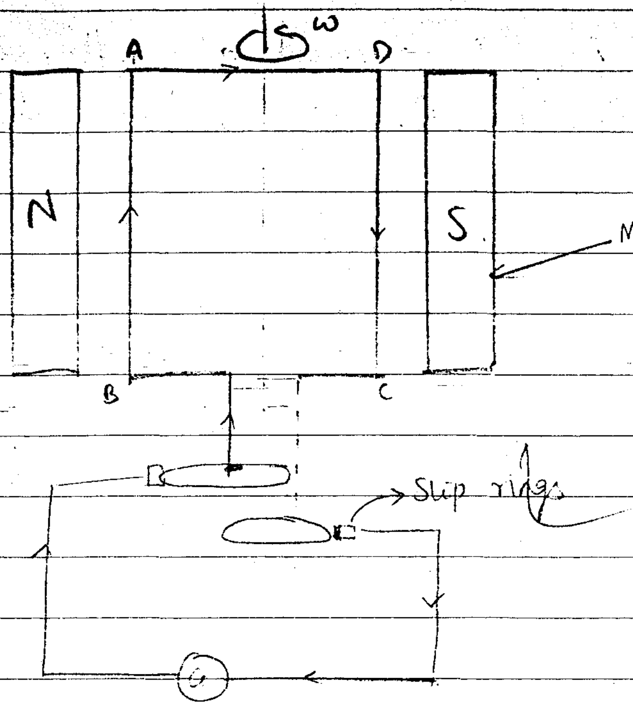


fig (i)

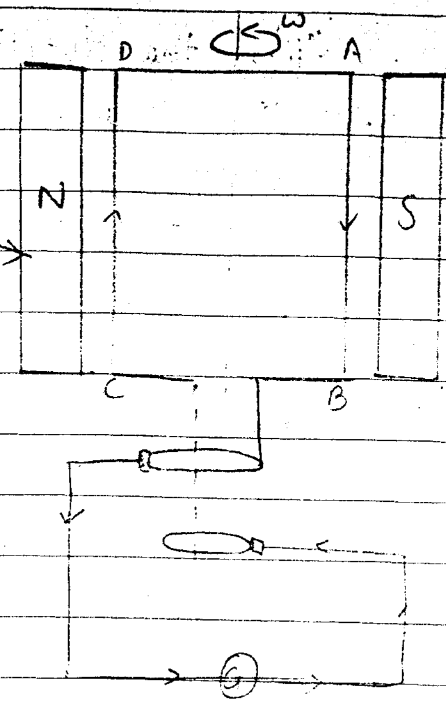
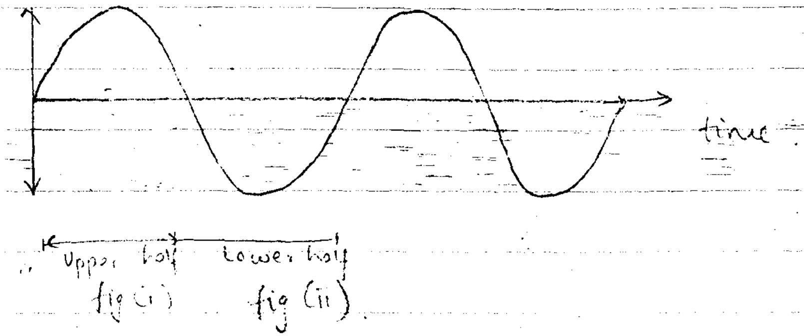
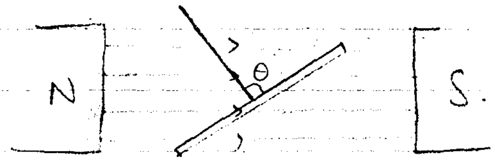


fig (ii)

An ac generator consists of a coil being rotated in a magnetic field. The changing magnetic flux leads to generation of emf.
From fig (i), from Fleming's right hand rule, the direction in AB is from up to down. Thus current in the circuit flows in clockwise direction.

From fig (ii), the direction is AB, is reversed i.e after a half cycle current in the circuit now flows in clockwise direction. Thus ac. voltage is generated.





$\phi = NBA \cos\theta$.

But $\frac{\theta}{t} = \omega \Rightarrow \theta = \omega t$

$\therefore \phi = NBA \cos \omega t$.

where N = number of turns

A = area

B = magnetic field

ω = angular velocity.

$$\varepsilon = \frac{-d\phi}{dt} = + NBA\omega \sin \omega t$$

$$\therefore \boxed{\varepsilon = NBA\omega \sin \omega t}$$

$$\boxed{\varepsilon_{max} = NBA\omega}$$

The generator doesn't generate electricity it only converts one form to another.

It converts the <u>mechanical energy</u> to rotate the coil into <u>electrical energy</u>.

(30) Coherent sources are those sources which emit light in phase or at a constant phase difference.
These are very important to obtain interference. It the sources are non coherent, then the phase between them keeps on changing, which makes the interference unsustained and the bright and dark fringes cannot be differentiated. The screen appears to be of uniform intensity.

Let

$$y_1 = A_1 \sin(\omega t)$$
$$y_2 = A_2 \sin(\omega t + \phi)$$

By superposition principle

$$y = y_1 + y_2$$

$$\Rightarrow y = A_1 \sin\omega t + A_2(\sin\omega t \cos\phi + \cos\omega t \sin\phi).$$

$$\Rightarrow y = A_1 \sin\omega t + A_2 \sin\omega t \cos\phi + A_2 \cos\omega t \sin\phi$$

$$\Rightarrow y = \sin\omega t (A_1 + A_2 \cos\phi) + A_2 \sin\phi \cos\omega t.$$

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$$\Rightarrow y = \sin\omega t (A_1 + A_2 \cos\phi) + A_2 \sin\phi \cos\omega t.$$

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Supplementary Answer-Book(s) No. 3

(30) Continued

Let $A_1 + A_2 \cos\phi = R\cos\theta$ — (1)

$A_2 \sin\phi = R\sin\theta$ — (2)

$\therefore y = R\sin\omega t\cos\theta + R\cos\omega t\sin\theta$

$$\boxed{y = R\sin(\omega t + \theta)}$$

Squaring (1) and (2) and adding

$$R^2(\sin^2\theta + \cos^2\theta) = A_2^2\sin^2\phi + A_1^2 + A_2^2\cos^2\phi + 2A_1A_2\cos\phi$$

$$\Rightarrow R^2 = A_1^2 + A_2^2 + 2A_1A_2\cos\phi$$

$$\boxed{R = \sqrt{A_1^2 + A_2^2 + 2A_1A_2\cos\phi}}$$

$$I_{net} = kR^2$$
$$= kA_1^2 + kA_2^2 + 2kA_1A_2 \cos\phi.$$

$$\Rightarrow I_{net} = I_1 + I_2 + 2\sqrt{I_1 I_2} \cos\phi.$$

For maxima.

$\phi = 0, 2\pi, 4\pi \ldots$

$\phi = 2n\pi \qquad n = 0, 1, 2 \ldots$

$I_{net} = I_1 + I_2 + 2\sqrt{I_1 I_2}$

Maxima fringe

$\frac{xd}{D} = n\lambda. \qquad n = 0, 1, 2 \ldots$

($2n\pi$ corresponds to $n\lambda$ as $2\pi = \lambda$.)

$$\Rightarrow \boxed{x = \frac{n\lambda D}{d}}$$

Fringe width $= x_{n+1} - x_n$

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

For minima:

$\phi = \pi, 3\pi, 5\pi = (2n+1)\frac{\lambda}{2}$ $\quad n = 0, 1, 2, \ldots$

$\phi = (2n+1)\pi$

$I_{net} = I_1 + I_2 - 2\sqrt{I_1 I_2}$

Minima fringe

$$\frac{xd}{D} = (2n+1)\frac{\lambda}{2}$$

$$\Rightarrow x = \frac{(2n+1)}{2}\frac{\lambda D}{d}$$

$n\lambda$

Fringe width $= x_{n+1} - x_n$

$$\beta = \frac{(2n+3)}{2}\frac{\lambda D}{d} - \left(\frac{2n+1}{2}\right)\frac{\lambda D}{d} = \frac{\lambda D}{d}$$

$$\boxed{\beta = \frac{\lambda D}{d}}$$

Thus, fringe of maximum intensity and minimum intensity are equal.

$$\boxed{\beta = \frac{\lambda D}{d}}$$

Acc. to Cauchy's formula.

$$\lambda \propto \frac{1}{\mu}.$$

When immersed in water the fringe width (β') would decrease

$$\boxed{\beta' = \frac{\beta}{\mu} = \frac{\lambda D}{\mu d}}$$