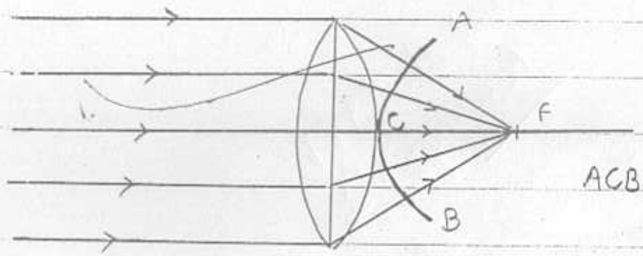
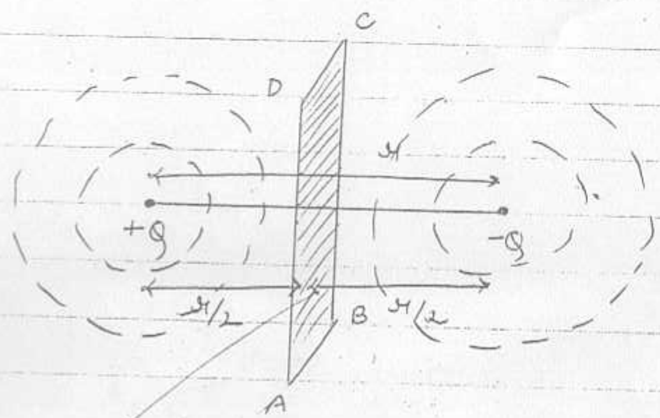
Physics

1. 

When a plane wave passes through a convex lens, the wavefront is <u>spherical</u> in shape centred at F (Principal focus) of lens.

2. ~~6 Volt is the stopping potential of photocell in which electrons with a maximum kinetic energy of 6eV are emitted.~~

③



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Plane ABCD, which lies midway between +q and -q at r/2 from each, is the equipotential surface for the system.

④ (i) $\lambda = 1\,mm = 10^{-3}\,m$

$\nu = \frac{c}{\lambda} = 3 \times 10^{11}\,Hz$

$\Rightarrow$ Microwaves belong to this part of spectrum.

(ii) $\lambda = 10^{-11}$ m

$$\nu = \frac{c}{\lambda} = 3 \times 10^{8+11}\ Hz = 3 \times 10^{19}\ Hz$$

γ-rays belong to this part of spectrum.

NOTE: 3×10^{19} Hz is a junction in X-rays and γ-rays.

5×10^{14}
5×10^{14}
5×10^{14}
10
3×10^{14}
10^{5}
5×10^{5}
3×10

(5) Photodiode is operated at reverse bias so that electron-hole pair produced by light can move to n and p-regions of diode respectively.
This increases emf of diode.
Also addition of electron and hole to n and p-regions respectively is easily observable and produces significant observation.

⑥ We know,

$$A \propto V \propto \frac{4}{3}\pi R^3$$

where A = Mass number of atomic nucleus
V = Volume of nucleus
R = Radius of nucleus.

So,

$$A_{Fe} \propto R^3_{Fe}$$

$$A_{Al} \propto R^3_{Al}$$

$$\therefore \left(\frac{A_{Fe}}{A_{Al}}\right)^{1/3} = \frac{R_{Fe}}{R_{Al}}$$

$$\Rightarrow \left(\frac{125}{27}\right)^{1/3} = \frac{R_{Fe}}{3.6 \text{ fermi}}$$

$$\Rightarrow \frac{5}{3} \times \cancel{3.6} \; 1.2 \text{ fermi} = R_{Fe}$$

$$\Rightarrow R_{Fe} = 6 \text{ fermi}$$

008

=> Nuclear radius of ^{125}Fe = 6 fermi

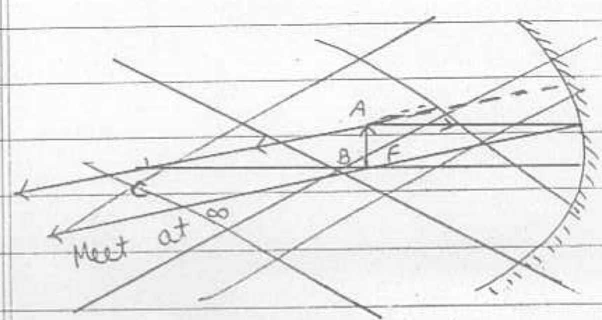
(7) If ε_f = Back emf induced
L = Self inductance of coil
$\frac{dI}{dt}$ = Rate of change of current,

then $\varepsilon_f = -L\frac{dI}{dt}$

where $L = \mu_0 n^2 A l$

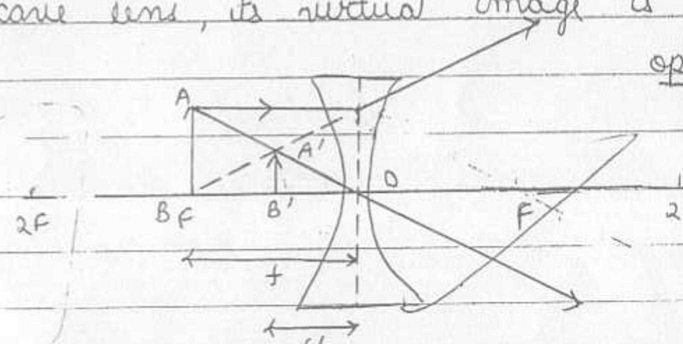
where n = Number of turns per unit length
A = Cross sectional area of coil
l = Length of coil.

⑧



sorry diagram below.

→ When object is held at principal focus of concave lens, its virtual image is formed between optical centre and principal focus of lens on object's side.



(9) $V_{net} = E_{net} - IR$

(i) When $I = 0$,

$V = E$.

Thus, sum of emf of all cells $= 6\,V = 3E$

Thus, emf of each cell $= 2V$

(ii) ~~Power dissipation will be maximum in series, when current is maximum.~~

~~$\therefore$ At 2A, power dissipation is maximum.~~

~~$P_{max} = I^2_{max} R = (4R)$ Watt.~~

Power dissipation is maximum at mid point of graph, ie when $I = 1A$

$P_{dis} = VI = 3 \times 1 = 3W$

Rough

$I = \frac{nE}{nr+R}$

VI

I^2R

$I = \frac{3E}{3r+R}$

$I = \frac{6}{3r+R}$

$6r + 2R = 6$

(10) Laws of radioactive decay states that
"The rate of decay of radioactive nuclei in a sample is directly proportional to the number of undecayed nuclei present in the sample at that instant of time."

$$-\frac{dN}{dt} \propto N$$

where $-dN/dt$ = Rate of decay of nuclei
N = Number of unstable, undecayed nuclei in sample.

If N_0 = Initial number of undecayed nuclei
N = Current number of undecayed nuclei
t = time elapsed
$\frac{dN}{dt}$ = Rate of decay of nuclei,

2008

then, by rate law,

$$-\frac{dN}{dt} \propto N$$

$$\Rightarrow -\frac{dN}{dt} = \lambda N$$

where λ = constant of proportionality called decay constant

$$\Rightarrow -\frac{dN}{N} = \lambda\, dt$$

Integrating both sides from 0 to t,

$$\int -\frac{dN}{N} = \int \lambda\, dt$$

$$\Rightarrow -\ln N = \lambda t + C$$

$$\Rightarrow \ln N = -\lambda t - C$$

when $t = 0$, $N = N_0$,

$$\therefore \ln N_0 = -C$$

$$\Rightarrow \ln \frac{N}{N_0} = -\lambda t$$

$$\Rightarrow \boxed{N = N_0 e^{-\lambda t}}$$

This is the required equation.

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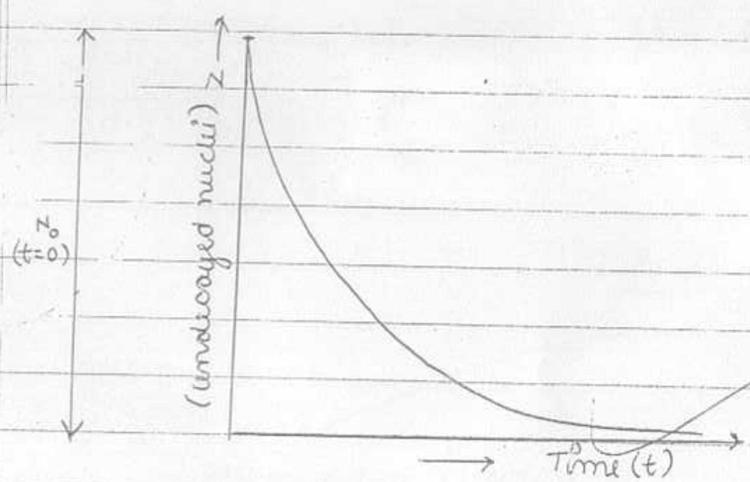
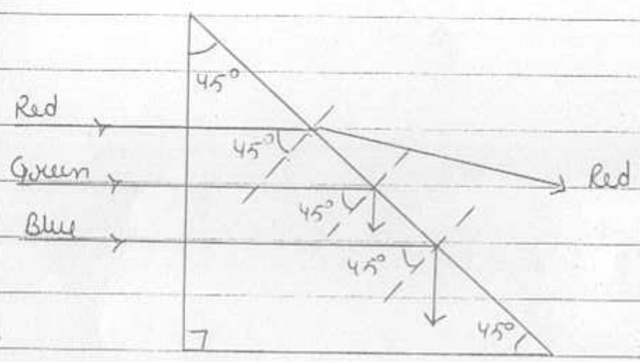


Plot of N vs t.

(11) Only red light will be transmitted through prism.



Reason :

For red light

$\mu = 1.39$

Angle of incidence, $i = 45$.

Now, $\sin 45 = \frac{1}{\sqrt{2}} = \frac{1}{1.414} < \frac{1}{1.39}$

$\Rightarrow$ Angle of incidence < Critical angle.

(Red light)

For blue - green,

$\sin 45 = \frac{1}{1.414} > \frac{1}{1.424}, \frac{1}{1.476}$

ie $i > C$

$\Rightarrow$ Blue and green will suffer Total internal reflection

Red will refract out

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(12) $\frac{A_x}{A_y} = \frac{2}{3}$ $\quad \rho_x = \rho_y$

$\frac{L_x}{L_y} = \frac{1}{2}$ $\Bigg\}$ given

$\cancel{\frac{R_x}{R_y} = \frac{\rho L_x A_y}{A_x \rho L_y} = \frac{1}{2} \cdot \frac{3}{2} = \frac{3}{4}}$

$\cancel{\Rightarrow R_x < R_y}$

In series,

$I = neAV_d$ (current is constant in series)

$\therefore V_d \propto \frac{1}{A}$

In both wires,

$$\frac{V_{d1}}{V_{d2}} = \frac{A_y}{A_x} = \frac{3}{2}$$

$\Rightarrow \boxed{\frac{V_{dx}}{V_{dy}} = \frac{3}{2}}$ in series

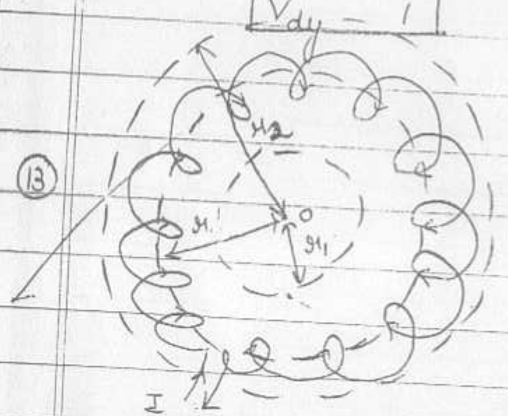
In parallel,

$$V_d = \frac{eE\tau}{m} = \frac{eV\tau}{ml} \propto \frac{1}{l} \quad \text{(Voltage is constant in parallel)} \qquad E = \frac{V}{l}$$

$$\therefore \frac{V_{dx}}{V_{dy}} = \frac{l_y}{l_x} = \frac{2}{1}$$

$$\Rightarrow \boxed{\frac{V_{dx}}{V_{dy}} = \frac{2}{1}} \quad \text{in parallel.}$$

(13)



consider a Toroidal solenoid.

Let r = Mean radius of ~~solenoidal~~ toroid

l = Length of solenoid = $2\pi r$

I = Current through solenoid

B = Magnetic field at its centre

$r_1 < r$, $r_2 > r$.

Consider three loops from O (centre of solenoidal toroid) of radius r_1, r_2, r such that r_1 loop is inside

$\oint \vec{B_1} \cdot \vec{dl} = \mu_0 I_{en}$ (Ampere's circuital Law)

where $I_{en} = 0$

$\vec{B_1}$ = Magnetic field at O, due to r_1.

As $I_{en} = 0$

$\Rightarrow \oint \vec{B_1} \cdot \vec{dl} = 0$

In loop of radius r_2,

$\oint \vec{B_2} \cdot \vec{dl} = \mu_0 I_{en}$

where $I_{en} = 0$

$\vec{B_2}$ = Magnetic field at O due to r_2.

As $I_{en} = 0$

$\Rightarrow \int \vec{B_2} \cdot \vec{dl} = 0$

In loop of radius r,

$\oint \vec{B} \cdot \vec{dl} = \mu_0 I_{en}$

where $\vec{B}$ = Magnetic field at O due to loop of radius r.

2008

Here $\quad I_{en} = I$

$\Rightarrow \quad B \cdot \int dl \cos 0 = \mu_0 I$

$\Rightarrow \quad B\, 2\pi r = \mu_0 I$

$\Rightarrow \quad B = \dfrac{\mu_0 I}{2\pi r}$

As toroid has N turns,

$$\boxed{B_{net} = \frac{\mu_0 N I}{2\pi r}}$$

$$\Rightarrow \boxed{\vec{B}_{net} = \mu_0 n I \hat{n}}$$

where n = number of turns per unit length of toroid.

where B_{net} = Total magnetic field at centre of solenoid.

$\hat{n}$ = Direction of field given by Right Hand thumb rule.

(14) $\beta_0 = \lambda$

(i) When D is increased,
the angular separation of fringes won't be affected.
But, the intensity may reduce on increasing D.

(ii) By relation,

$$\frac{s}{S} < \frac{\lambda}{d},$$

on increasing s,
angular separation will be increased.
The fringes will be distinctly visible as long as $\frac{s}{S} < \frac{\lambda}{d}$

where s = width of source slit.
S = Distance of source slit from two slits.

~~Also, on increasing s, diffraction eff~~

2008

(15) Given,

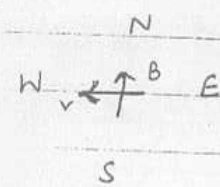
$V = 450\ m/s$ due west

$B_H = H = 4 \times 10^{-4}\ T$

Angle of dip $= 30°$.

$l = 30\ m$

$B_V = H \tan 30$
$= \frac{4}{\sqrt{3}} \times 10^{-4}\ T$



~~As~~ field given is horizontal and ~~are~~ aeroplane is also flying horizontally, so angle of dip ~~can't be considered~~ will be used to find vertical component of $\vec{B}$.

Thus, emf across wings, $\mathcal{E} = B_V l v$

$= \frac{4}{\sqrt{3}} \times 10^{-4} \times 30 \times 450$

$= \frac{5.4}{\sqrt{3}}\ V = \frac{5.4}{1.732}\ V = \underline{3.118\ V}$ (South wing to North wing)

Rough

$450 \times 3 = 13500$
$1.35 \times 4 = 5.40$

$H = B\cos 30$

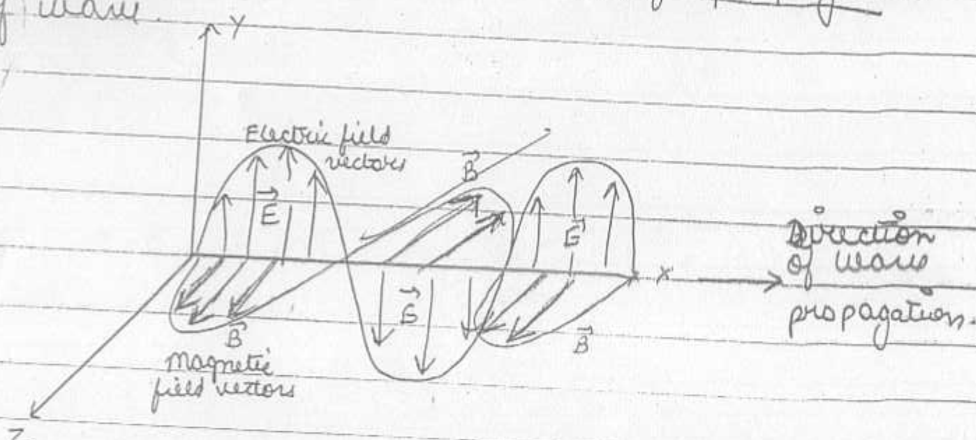
7324
2385
4939
$\frac{4}{\sqrt{3}} \times 10^{-4}$

$B_H = B\cos 30$

$B = \frac{H}{\cos 30}$

Note: Vertical component of $\vec{B}$ is

(16) Transverse nature of electromagnetic waves refers to sinusoidally varying electric and magnetic fields whose direction is perpendicular to direction of propagation of wave.



(17) Carrier waves of high frequency are used because they have <u>high energy</u> and can carry the message signal over <u>long distances</u>. ~~xxxxxx~~

$m = 80\%$

$E_c = 20\,V$

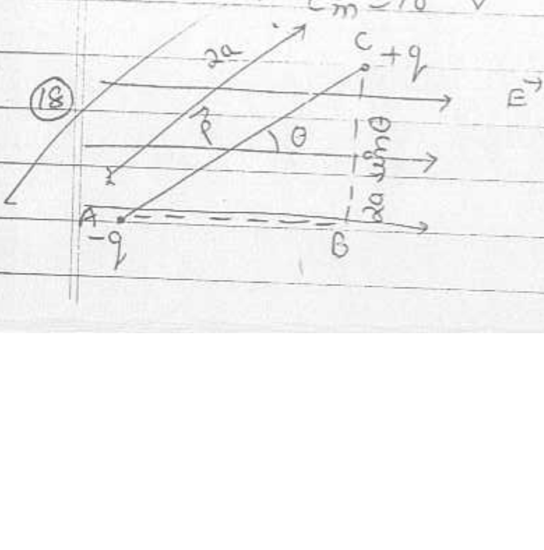
$E_m = ?$

We know,

$$m = \frac{E_m}{E_c} \Rightarrow E_m = mE_c = \frac{80}{100} \times 20 = \underline{16\,V}$$

$\Rightarrow E_m = 16\ V$

(18)



Consider an electric dipole which has charges $+q, -q$ separated by distance $2a$ placed in uniform electric

2008

Now, torque τ on dipole is

$$\tau = \text{Force} \times \text{Lever arm}$$

As can be seen from figure,

$$\sin\theta = \frac{BC}{AC} = \frac{BC}{2a}$$

$\Rightarrow$ lever arm, $BC = 2a\sin\theta$.

Also, force on each charge $= qE$

Thus, $\tau = qE \times 2a\sin\theta$

$$= (2aq)E\sin\theta$$

$$= pE\sin\theta$$

where p = Dipole moment of dipole

So,

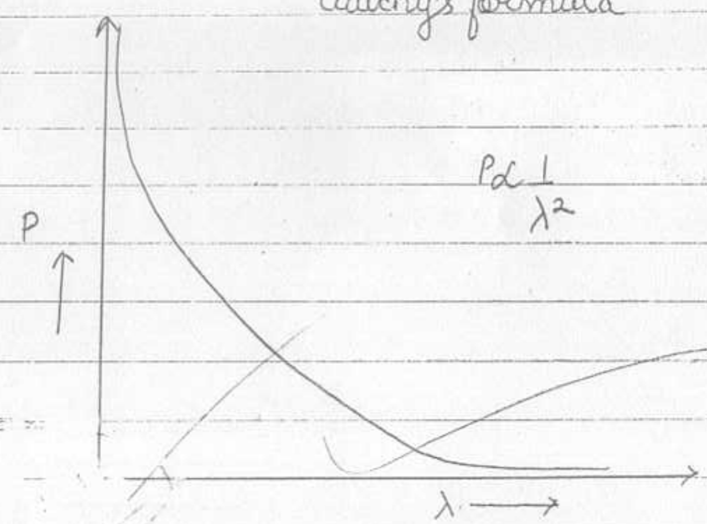
$$\boxed{\vec{\tau} = \vec{p} \times \vec{E}}$$

where direction of torque can be found out by Right Hand screw rule.

Rough

$P \propto \frac{1}{f} \propto \mu \propto \frac{1}{\lambda^2}$
$\downarrow$
$\lambda \downarrow$

(19) $P \propto \frac{1}{f} \propto \underbrace{\mu \propto \frac{1}{\lambda^2}}_{\text{Cauchy's formula}}$



$\boxed{P \text{ vs } \lambda}$

Given,
$\mu_{Lens} = 1.5$
$f = -20$ cm

Focal length of lens in air,

$$-\frac{1}{20} = (\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{—} ①$$

Focal length of lens in liquid,

$$\frac{1}{f} = ({}^{l}\mu_g - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right) \quad \text{—} ②$$

Dividing ① by ②,

$$-\frac{f}{20} = \frac{(\mu_g - 1)}{({}^{l}\mu_g - 1)} = \frac{1.5 - 1}{\left(\frac{1.5}{1.7} - 1\right)}$$

$$\Rightarrow \frac{f}{20} = \frac{0.5 \times 1.7}{(1.7 - 1.5)} = \frac{0.85}{0.2} = \frac{85}{20}$$

$$\Rightarrow \boxed{f = +85\text{ cm}}$$

No weightage for calculation as per M.S.

Rough

$$\frac{(1.5-1)1.7}{1.5-1.7}$$

$$= \frac{20 \times 1.7\,(0.5)}{(+0.2)}$$

$$= \frac{1.7}{2}$$

$$\frac{17}{0.2} \quad \frac{\cancel{170}\,85}{\cancel{2}}$$

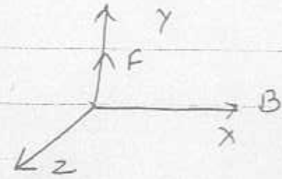
$$\frac{0.85}{0.2} \times \frac{\cancel{200}}{100}$$

$$\boxed{\frac{0.5}{0.2} \times 1.7}$$

$$\frac{20 \times 0.5 \times 1.7}{0.2}$$

$$\frac{0.5}{0.2} \times 20 \times 1.7$$

⑳



The force on the particle will act along +Y axis according to $q(\vec{v} \times \vec{B}) = \vec{F}$.

(i) For proton to be in equilibrium,

$F_E = F_B$

$\Rightarrow qE = qvB$

$\Rightarrow E = vB$

$\Rightarrow v = \frac{E}{B} = \frac{50\times10^3}{50\times10^{-3}} = 10^6$

$\Rightarrow$ Velocity of proton $= \underline{10^6 \text{ m/s}}$.

9031
2047
1984

(ii) Given, $I = 8\times10^{-4}$ A.

$v = 10^6$ m/s.

Force due to one proton $= \frac{1}{2}mv^2$

$= \frac{1}{2}\times1.67\times10^{-27}\times10^{12}$

$= 0.835\times10^{-15}$

$= 8.35\times10^{-16}$ N.

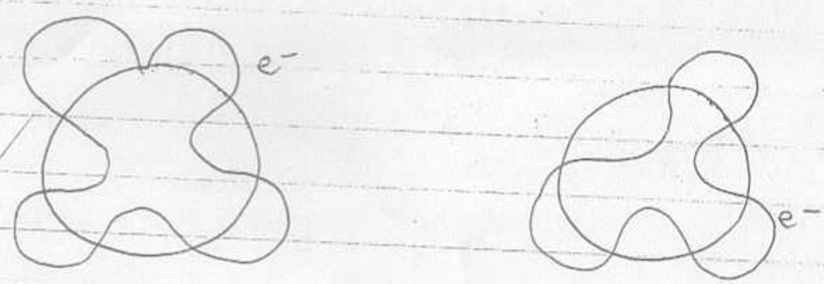
Total protons in 1 beam = I ...

Thus, total force due to beam $= 8.35 \times 10^{-16} \times 5 \times 10^{15}$

$= 8.35 \times 0.5$

$= \underline{4.175 \text{ N}}.$

(21)



Case 1 Case 2

Yes, consider <u>case 1</u> in which electron wave is <u>not in phase</u>. Thus, it <u>dies out</u> soon.

But, in <u>case 2</u>, as electron wave is <u>totally in phase</u>, thus [illegible] sustains.

So, the condition for a stable orbit is

$$\underline{n\lambda = 2\pi r}$$

where λ = Wavelength of electron wave
r = Radius of orbit.

By de - Broglie's hypothesis,

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

Thus $n\lambda = 2\pi r$

$$\Rightarrow n\frac{h}{mv} = 2\pi r$$

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

But L = angular momentum = mvr

so, $\boxed{L = \frac{nh}{2\pi}}$

Hence proved Bohr's second postulate that electron revolves in that orbit in which $L = n\left(\frac{h}{2\pi}\right)$, where n is an integer

(22) Permanent magnets, after magnetisation, always show magnetic effect, even in the absence of magnetic field, eg magnetised steel, magnetised alnico.

permanent magnet can be prepared by placing the substance to be magnetised in a solenoid and then passing strong current through solenoid.

For making permanent magnet, the material should have

1. High coercivity.
2. High retentivity.

Isotopes	Isobars
(23) 1. Isotopes are species with same number of protons but different number of neutrons.	1. Isobars have same number of nucleons, which have different number of protons and neutrons.
eg $^{12}_{6}C$, $^{14}_{6}C$ (Same Z different A) in $^{A}_{Z}X$	eg $^{40}_{18}Ar$, $^{40}_{20}Ca$ (Same A, different Z in $^{A}_{Z}X$ representation)

Given

$T_{1/2} = 5\,y \quad \Rightarrow \lambda = \dfrac{0.693}{5 \times 365 \times 86400}\ s^{-1}$

$R = \dfrac{R_0}{}$

Rough

~~1000 200 40~~ 84

We know,

$$R = R_0 e^{-\lambda t}$$

$$\Rightarrow \ln R = \ln R_0 - \lambda t$$

$$\Rightarrow \log R = \log R_0 - \frac{\lambda t}{2.303}$$

$$\Rightarrow \log \frac{R}{R_0} = -\frac{\lambda t}{2.303}$$

$$\Rightarrow \log \frac{3.125}{100}\frac{R_0}{R_0} = -\frac{\lambda t}{2.303}$$

$$\Rightarrow \log \frac{100}{3.125} = \frac{2.303}{\lambda t}$$

$$\Rightarrow t\,(2 - 0.4949) = \frac{2.303 \times 5 \times 365 \times 86400}{0.693}$$

$$\Rightarrow t = \frac{2.303 \times 5 \times 365 \times 86400}{1.5051 \times 6.93} = 3.563 \times 10^7\ s.$$

$$= 25\ y.$$

2221
.3623
.699
2.5623
4.9365

8.5801

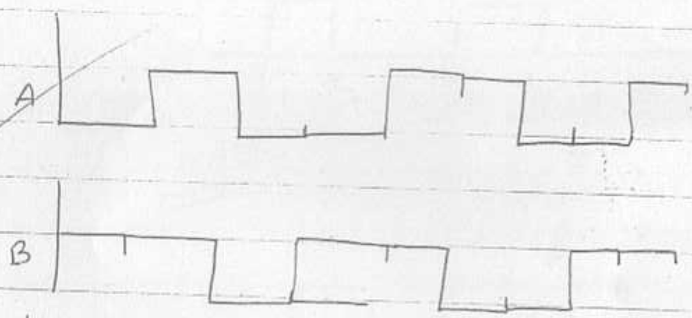
1775
8400
1.0282

8.5801
1.0282

7.5519

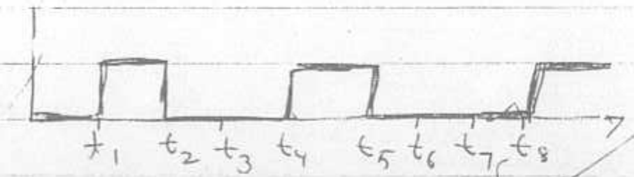
25 − 10
12.5 − 15
6.25 − 20
3.125 − 25

24

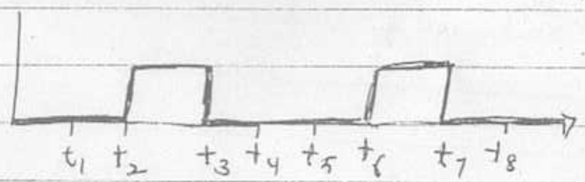


A	B	AND	OR	NOR	NAND
0	1	0	1	0	1
1	1	1	1	0	0
0	0.	0	0	1	1
0	1	0	1	0	1
1	1	1	1	0	0
1	0	0	1	0	
0	0	0	0	1	1
0	1	0	1	0	1

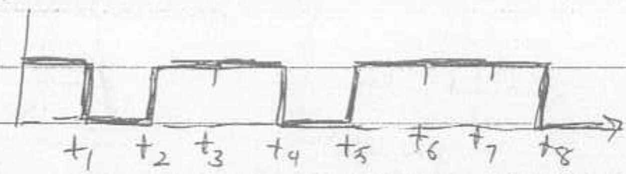
(i) AND



(ii) NOR



(iii) NAND

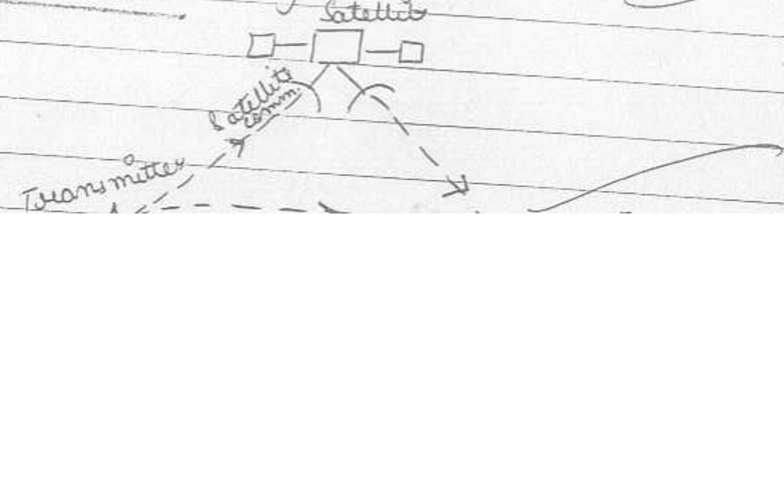


(25) 'LOS' communication is line of sight communication in which the transmitter and receiver are in a straight line and can transmit and receive signals in line of sight, without any obstacle in between.

Microwaves (Space waves) are used for LOS communication.

(I) TV communication
(II) Satellite links
(III) Microwave links

} use space mode propagation.



(26) Given,

$$\frac{P}{Q} = \frac{l_1}{(100-l_1)}$$

where $P = 5\,\Omega$

$Q = X\,\Omega$

$$\therefore \frac{5}{X} = \frac{l}{(100-l)} \quad —①$$

In next arrangement,

$$\frac{X}{5} = \frac{l+20}{(100-l-20)} = \frac{l+20}{80-l} \quad —②$$

comparing ①, ②,

$$\frac{l+20}{80-l} = \frac{100-l}{l}$$

$$\Rightarrow \cancel{l^2} + 20l = 8000 - 80l - 100l + \cancel{l^2}$$

$$\Rightarrow 200\,l = 8000$$

$$\Rightarrow l = 40$$

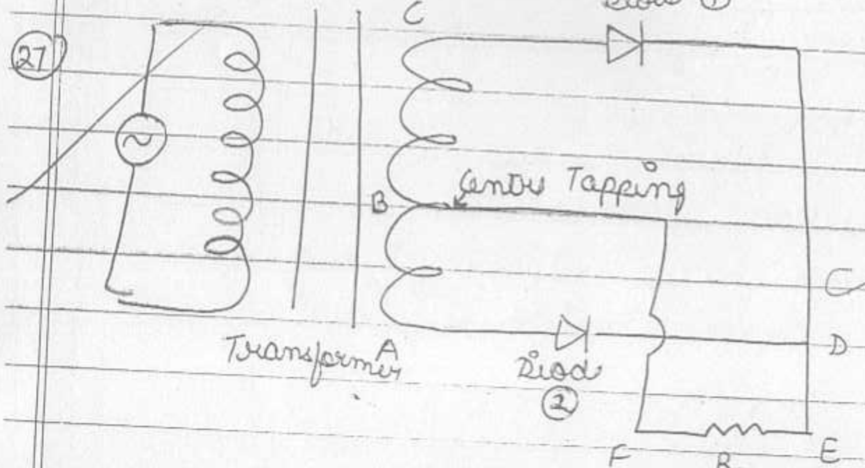
$\therefore \frac{5}{X} = \frac{20 \cdot 2}{20 \cdot 3} \Rightarrow X = 7.5\,\Omega$

Rough

$\frac{75}{50} \cdot \frac{3}{2} = \frac{60}{40}$

$\frac{2}{3} =$

(27)



Full wave rectifier

Above is a diagram of full wave rectifier.

Working principle :

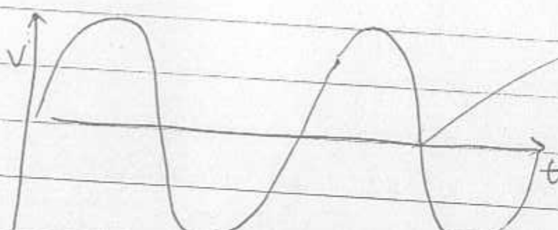
It is based on the principle that when

conduct.

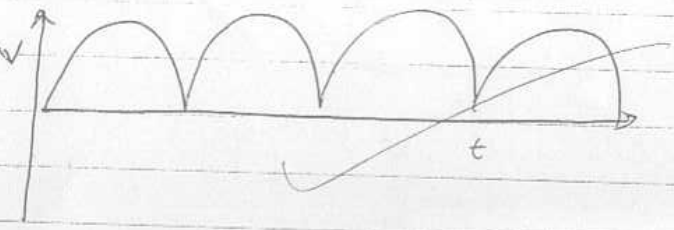
Here, a transformer is attached to an AC source. When A is +, C is -ve, then diode ② is forward biased and conducts across ADEFBA.

When A is -ve, C is +ve, diode ① is forward biased and conducts across CDEFBC.

Thus, when input is AC, we get pulsating DC as output across load resistance R_L.
But in rectifier, we keep voltage below breakdown voltage of diode.
Thus, rectifier converts input AC to DC form.

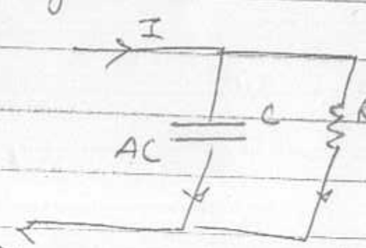


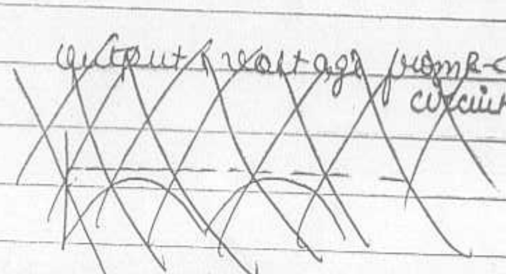
Input voltage.



Output voltage.

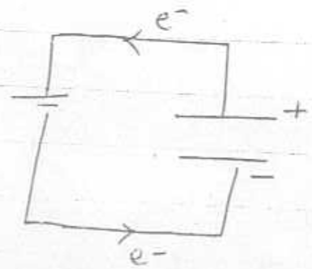
To remove AC element from this output, it is connected to RC circuit. Capacitor absorbs AC, DC flows through R.





Output voltage from R-C circuit

(28) (a) When a capacitor is being charged, then -ve charge is transferred from its +ve plate to its -ve plate.



Thus, this makes up the potential energy of parallel plate capacitor.

Work done on charge is stored as potential energy

so, $E = W$

But $dW = V\,dq$

where dW is small amount of work done in moving dq across a potential difference of V Volt

so, $dW = V\,dq$

But $q = CV$

$\Rightarrow dW = \dfrac{q\,dq}{C}$

Integrating to get total work,

$$E = W = \int \frac{q\,dq}{C} = \frac{Q^2}{2C}$$

where Q = Total charge on capacitor.

so, $\boxed{E = \frac{Q^2}{2C}}$ $\Rightarrow \boxed{E = \frac{1}{2} QV}$

But $Q = CV$.

$\therefore$ $\boxed{E = \frac{1}{2} CV^2}$

(b) For C_2, C_3,

equivalent capacitance is C_{23}.

$$\frac{1}{C_{23}} = \frac{1}{C_2} + \frac{1}{C_3} = \frac{1}{200} + \frac{1}{200} = \frac{1}{100}$$

$\Rightarrow C_{23} = 100\ pF$.

For C_{23} and C_1,

equivalent capacitance $C_{123} = C_1 + C_{23}$

$= (100 + 100)\ pF$

$= 200\ pF$.

Net capacitance C_{net},

$$\frac{1}{\ } = \frac{1}{\ } + \frac{1}{\ } = \frac{1}{\ } \Rightarrow \boxed{C_{net} = 100\ pF}$$

Across C_4,

voltage = $V = \frac{Q_{net}}{C}$

But $Q_{net} = C_{net} V_{net} = 100 \times 10^{-12} \times 300$

$= 3 \times 10^{-8}$ C

$V = \frac{3 \times 10^{-8}}{2 \times 10^{-12}} = 150$ V

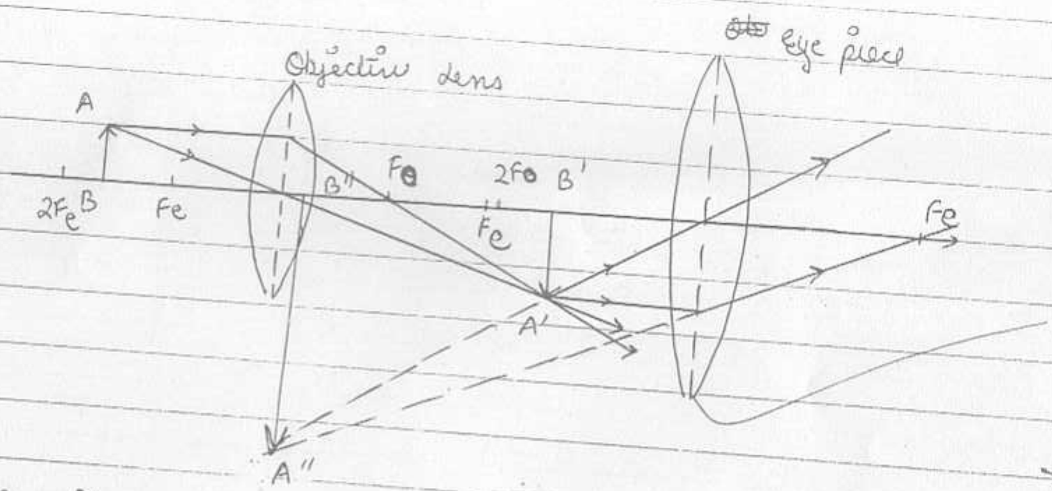
$\Rightarrow \boxed{\begin{array}{l} V_4 = 150 \text{ V} \\ Q_4 = 3 \times 10^{-8} C \end{array}}$

(29) Diag on next page.

Rough

$150 \times 2\ldots$
$\times 10^{\ldots}$

$= 3 \times 10^{\ldots}$



Magnifying power (Distinct vision) $= \left(-\frac{v_0}{u_0}\right)\left(1 + \frac{D}{f_e}\right)$

magnifying power (Image at ∞) $= \left(-\frac{v_0}{u_0}\right)\frac{D}{f_e}$

'–' sign shows inverted image.

Given,

$f_o = 2cm$

$f_e = 6.25cm$

$L = 15cm$

(i) Given $v_e = -25$.

$$\frac{1}{v_e} - \frac{1}{u_e} = \frac{1}{f_e}$$

$$\Rightarrow \frac{1}{u_e} = \frac{1}{v_e} - \frac{1}{f_e} = \frac{-1}{25} - \frac{1}{6.25} = \frac{-1}{25} - \frac{4}{25} = \frac{-5}{25} = \frac{-1}{5}$$

$\Rightarrow u_e = -5cm$.

$\therefore \underline{M_e} = 1 + \frac{D}{f_e} = 1 + \frac{25}{6.25} = \underline{\underline{5}}$

$V_o = 15 - 5 = 10cm$.

$$\frac{1}{V_o} - \frac{1}{u_o} = \frac{1}{f_o} \Rightarrow \frac{1}{u_o} = \frac{1}{V_o} - \frac{1}{f_o} = \frac{1}{10} - \frac{1}{2} = \frac{1-5}{10} = \frac{-4}{20}$$

$\Rightarrow \boxed{u_o = -2.5cm}$ from objective lens.

$\underline{\underline{M_o}} = \frac{V_o}{u_o} = -\frac{10}{2.5} = \underline{\underline{|-4| = 4}}$

(ii) Magnifying power $= M_o \times M_e = |(-4)| \times 5 = |-20| = 20$

(–) sign shows inverted image.

(30) For resonance in LCR circuit,

$X_L = X_C$, $I = I_{max}$

and $Z = R$

where Z = Impedance

R = Resistance

⇒ Current and voltage are in phase.

For resonant frequency,

$X_L = X_C$

$\Rightarrow L\omega = \frac{1}{C\omega}$

Rough

6.25

$2, \ + \frac{1}{u}$

$\frac{1}{v} = \frac{1}{f} + \frac{1}{2}$

$-\frac{1}{2.5} = \frac{1}{10}$

$= \frac{-4+5}{10}$

$=$

$u = -5$

$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$\frac{1}{6.25} - \frac{1}{5}$

$= \frac{4}{25}$

$\cancel{625}$ $\cancel{125}$ 25

$\cancel{20}$ 4

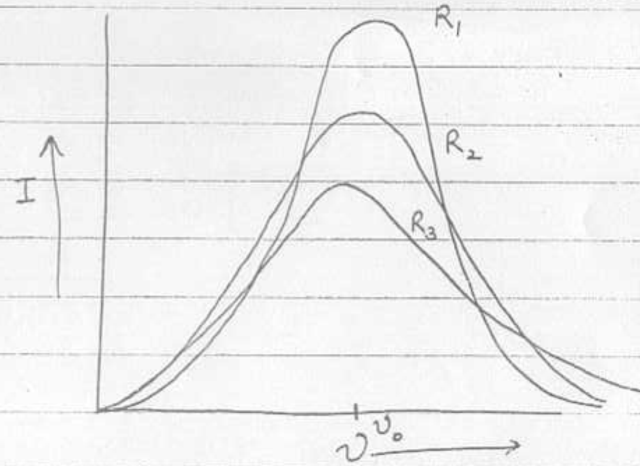
$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$= \frac{4}{25} - \frac{5}{\cancel{25}}$ 25

-1

$$\Rightarrow 2\pi\nu = \frac{1}{\sqrt{LC}}$$

$$\Rightarrow \boxed{\nu = \frac{1}{2\pi\sqrt{LC}}}$$



$R_1 < R_2 < R_3$

Plot in i_m, ν for different resistance

Quality factor of the circuit is the ratio of inductive reactance or capacitive reactance to impedance at resonance.
This it tells us, how narrow and sharp is the resonance curve ...

resonance in LCR circuit

$$Q = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{X_L}{Z} = \frac{X_C}{Z}$$

(i) $R = \frac{30}{2} = 15\,\Omega \quad \left(\frac{V}{I}\right)$

$X_C = \frac{40}{2} = 20\,\Omega \quad (V/I)$

$$Z = \sqrt{R^2 + X_C^2} = \sqrt{225+400} = \sqrt{625} = \boxed{25\,\Omega}$$

(ii) Wattless current = [illegible] = [illegible]

= current flowing through capacitor

$$= \frac{V_C}{X_C} = \frac{40}{20} = \boxed{2\,A}$$

rough.

$R = 25\,\Omega$
$I = 2A$
$V = 50V$
$I = \frac{V}{r}$
$= \frac{40}{}$

×