

Section - A

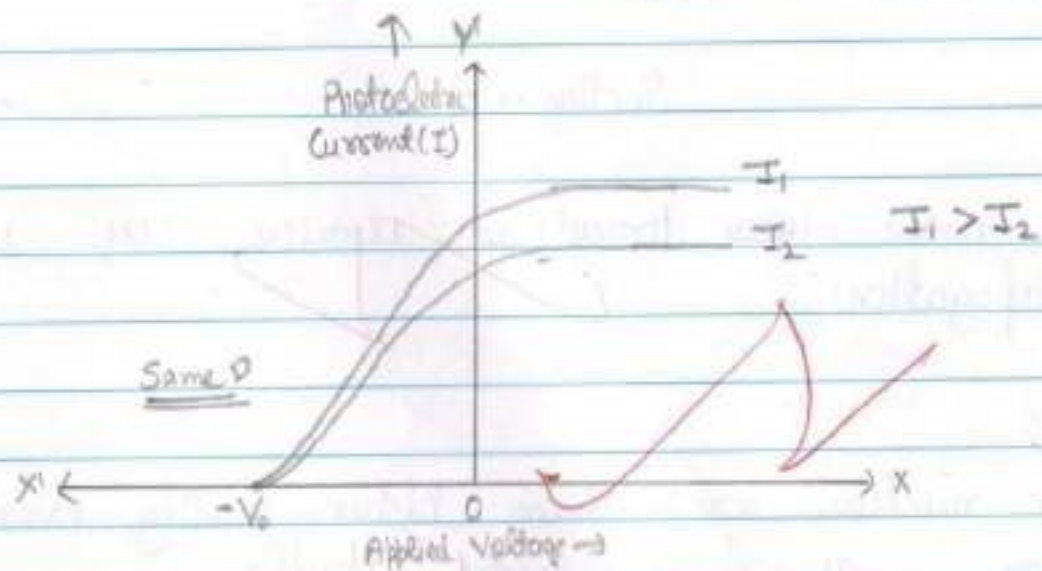
A-1. Short wave ~~uses~~ broadcast services use sky wave propagation.

A-2. Daughter nucleus would have higher binding energy per nucleon, as it is more stable.

A-3. UV Rays are used for water purification.

eye surgery requires high frequency waves like UV, X ray or γ rays.

A-4. Photoelectric current increases as the intensity of incident radiation increases.



A-5 We know that frequency ν is given by

$$\nu = \frac{qB}{2\pi m}$$

for a proton and electron entering the field,

$q = e$, B is same for both

$$\Rightarrow \nu \propto \frac{1}{m}$$

i.e. frequency is inversely proportional to mass.

Now, as $m_p > m_e \Rightarrow \gamma_p < \gamma_e$
 Hence, electron will move in circular path with higher frequency.

A-6 Given $A_c = 15V$ and modulation index $\mu = 60\% = \frac{60}{100}$

Now, we know that

$$\mu = \frac{A_m}{A_c}$$

$$\Rightarrow \frac{60}{100} = \frac{A_m}{15}$$

$$\Rightarrow A_m = 15 \times 0.6$$

$$\Rightarrow \underline{A_m = 9V}$$

Hence, the peak voltage of modulating signal should be 9V in order to have a modulation index of 60%.

A-7

Given $\lambda = 412.5 \text{ nm}$
 $= 412.5 \times 10^{-9} \text{ m}$

Now, $E = \frac{hc}{\lambda} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8 \text{ J}}{412.5 \times 10^{-9}}$

$= \frac{6.6 \times 10^{-34} \times 3 \times 10^8 \text{ eV}}{412.5 \times 10^{-9} \times 1.6 \times 10^{-19}}$

$= \frac{33 \times 3 \times 10^{34+8+19+7}}{8 \times 4.125}$

$= \frac{33}{8 \times 1.375} = \frac{4.125}{1.375}$

$= \frac{4125}{1375} = \frac{825}{275} = \frac{165}{55} = \frac{33}{11}$

$E = \underline{\underline{3 \text{ eV}}}$

Now, for metals where $E > \phi$ will give photoelectric effect where ϕ is the work function

CBSE 2018

7

⇒ Na (1.92 eV) and K (2.15 eV) will give photoelectric emission when light of wavelength is incident on them.

A-8

Given, balancing point in open circuit = 350 cm

balancing point in closed circuit = 300 cm

where R (external resistance) = 9Ω

Let K be the potential gradient.

In ~~closed~~ ^{open} circuit, potentiometer measures E_{mf}
⇒ $E = Kl_1 = 350K$ — (1)

In closed circuit, potentiometer measures Voltage
⇒ $V = Kl_2 = 300K$ — (2)

$$\text{Now, } \frac{E}{R+r} = \frac{V}{R}$$

$$(E-V)R = Vr$$

$$\text{or } r = \left(\frac{E-V}{V} \right) R$$

$$\Rightarrow r = \left(\frac{350\text{K} - 300\text{K}}{300\text{K}} \right) \times 9$$

$$= \frac{350 - 300}{300} \times 9$$

$$= \frac{50}{300} \times 9$$

$$= \frac{9}{6} = \frac{3}{2} = \underline{\underline{1.5\Omega}}$$

Hence internal resistance of the cell is 1.5Ω

A-9 (a) Infra red waves are often called as heat waves as they are produced by moderately warm and hot bodies or by vibrating molecules about their mean position.

(b) "Electromagnetic waves transport momentum" as they travel from one place to another they carry along with them momentum and energy where momentum p is given by

$$p = \frac{U}{c} = \frac{h}{\lambda}$$

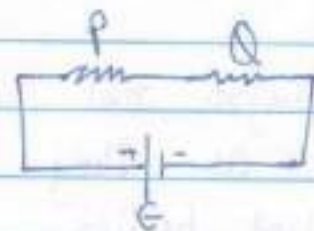
10
A-10

Given $R_P : R_Q = 1 : 2$

Let the ratio be k

$$\Rightarrow R_P = k \times 1 = k$$

$$R_Q = k \times 2 = 2k$$



Now, as in a series circuit current remains same in both the bulbs.

Power P : Power Q

$$I^2 R_P : I^2 R_Q$$

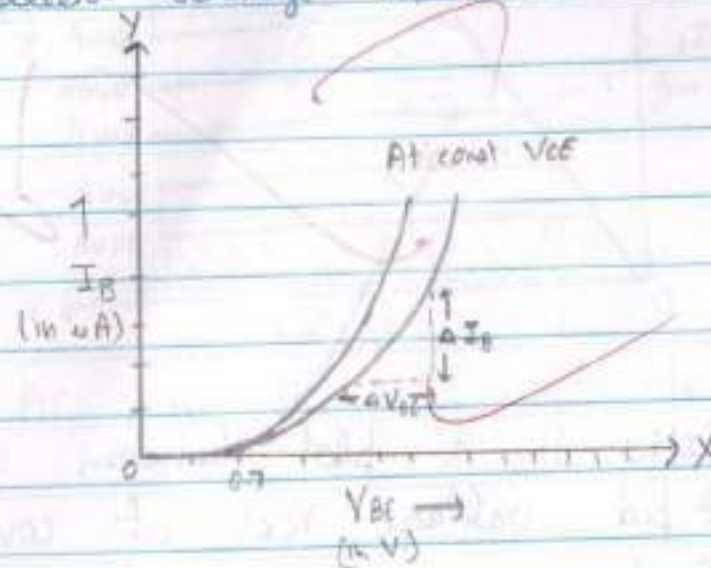
$$= R_P : R_Q$$

$$= k : 2k$$

$$= \underline{\underline{1 : 2}}$$

A-11

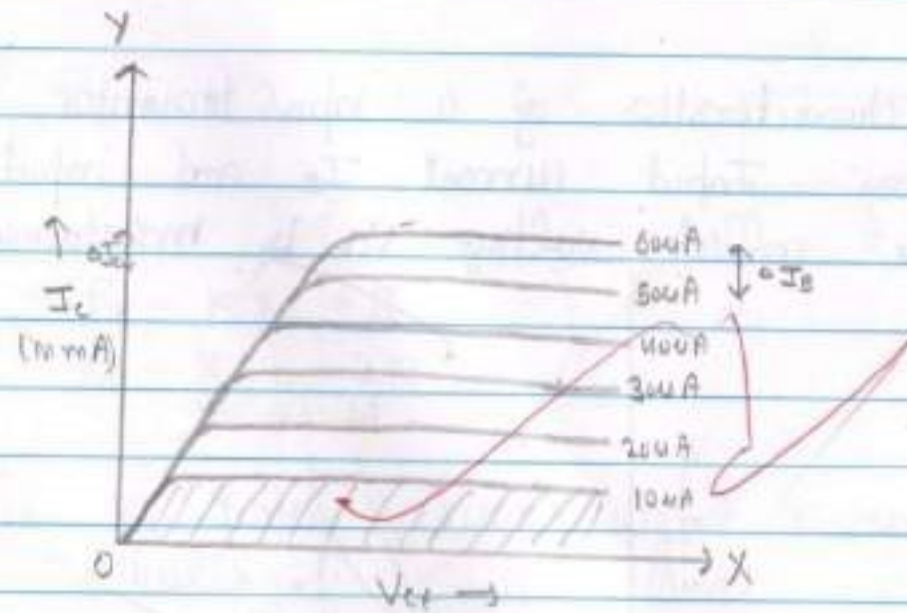
Input characteristics of a npn transistor is a plot between Input current I_B and input voltage V_{BE} while collector voltage V_{CE} is maintained constant.



Input resistance $R_i = \left(\frac{\Delta V_{BE}}{\Delta I_B} \right)_{V_{CE}}$

(a) Input resistance can be calculated by measuring the change in V_{BE} with respect to I_B as shown in graph. with R_i is given by

$R_i = \left(\frac{\Delta V_{BE}}{\Delta I_B} \right)_{V_{CE}}$



Output characteristics is a plot between output current I_c and output voltage V_{ce} at constant input Base current I_b

(b) Current amplification factor β is given by

$$\beta = \frac{\Delta I_c}{\Delta I_b}$$

Two corresponding lines from output characteristics can be chosen and change in base current ΔI_b can be

found and corresponding to it change in collector current can be found.

and β can be calculated as

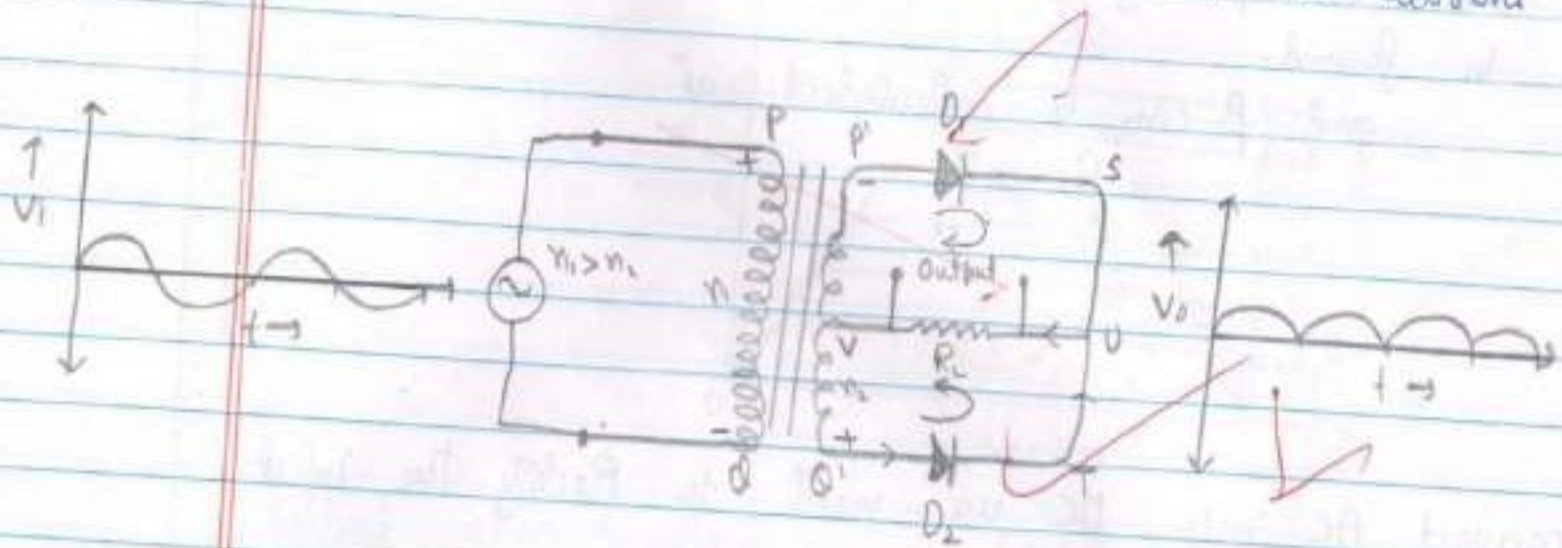
$$\beta = \frac{\Delta I_c}{\Delta I_b}$$

A-12 Q. To convert AC into DC we need to Rectify the input voltages.

As two pn junctions are to be used, a full wave rectifier is a suitable device.

Principle - A full wave rectifier is based upon the principle that a pn diode conducts in forward bias and does not conduct in reverse bias, thus it can be used to

convert AC voltage or current to DC current suitably.



A step down transformer is used and it is center tapped such that only one diode conducts during one half of AC cycle and direction of flow of current through load is same in both the half cycles.

When the positive half cycle of input voltage passes say end P is +ve and Q is negative then end P' will be -ve and Q' will be +ve and diode D_2 will conduct as it gets forward biased.

During negative half cycle of input ac P will be negative and Q positive then, P' will be negative and Q' positive and the diode conducts this time will be D_2 as it gets forward biased.

In both the positive and negative half cycles of input AC we get the direction of flow of current as same and thus a pulsating D.C output is obtained.

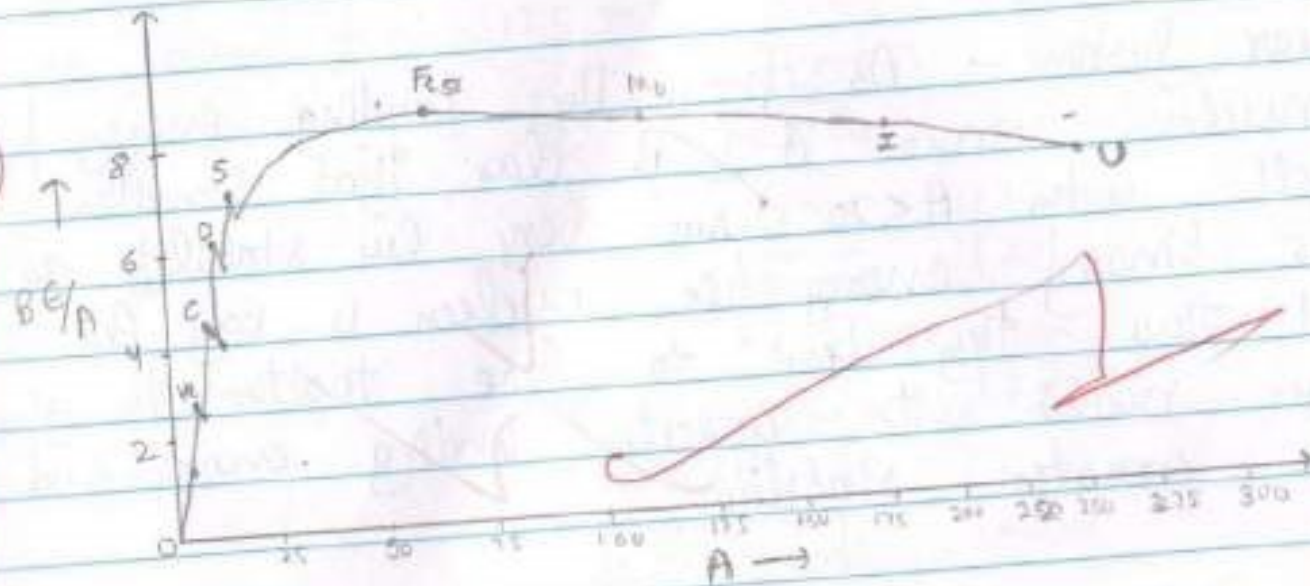
(b) NAND Gate $Y = \overline{A \cdot B}$



Truth table $\rightarrow$

A	B	$Y = \overline{A \cdot B}$
0	0	1
0	1	1
1	0	1
1	1	0

A-13
3



Nuclear fission $\rightarrow$ Heavier nuclei undergo nuclear fission to form two ~~two~~ stable daughter nuclei. As from the Binding energy per nucleon curve it is clear that for $A > 120$ the binding energy per nucleon starts decreasing i.e. ~~they~~ their stability starts decreasing and ~~they~~ tend to split themselves into smaller nuclei with greater binding energy per nucleon of range $20 < A < 120$.

Nuclear fusion $\rightarrow$ As from the Binding energy per nucleon curve it is clear that smaller nuclei with $A < 20$ have very less stability as their binding energy per nucleon is very less and thus they tend to fuse together to give bigger nuclei with greater binding energy and thus greater stability.

(1) Given $T_{1/2} = 10$ years

Now, activity $R = \lambda N$

At $t = 0$

$$\frac{R}{R_0} = \left(\frac{1}{2}\right)^n$$

where $n = \text{no. of half life.}$

Now, given $R = 3.125\%$

$$\Rightarrow \frac{R}{R_0} = \left(\frac{3.125 R_0}{100 \times R_0} \right) = \left(\frac{1}{2} \right)^n$$

$$= \frac{3125}{100000} = \left(\frac{1}{2} \right)^n$$

$$= \frac{625}{20000} = \left(\frac{1}{2} \right)^n$$

$$= \frac{125}{4000} = \left(\frac{1}{2} \right)^n$$

$$= \frac{5}{80} = \left(\frac{1}{2} \right)^n$$

$$= \frac{1}{16} = \left(\frac{1}{2} \right)^n$$

$$\Rightarrow \left(\frac{1}{2} \right)^n = \left(\frac{1}{2} \right)^4$$

$$\Rightarrow \boxed{n=4}$$

$$\frac{25}{800} = \left(\frac{1}{2} \right)^n$$

$$\frac{5}{160} = \left(\frac{1}{2} \right)^n$$

$$\frac{1}{32} = \left(\frac{1}{2} \right)^n$$

$$\Rightarrow \left(\frac{1}{2} \right)^5 = \left(\frac{1}{2} \right)^n$$

$$\Rightarrow n=5$$

Hence, 5 half lives are required to reduce activity to 3.125%

$$\Rightarrow \text{Time taken} = T_{1/2} \times n$$

$$= 10 \times 5 = \underline{\underline{50 \text{ years}}}$$

A-14

(a) Modulating a message signal is very important due to the following reasons

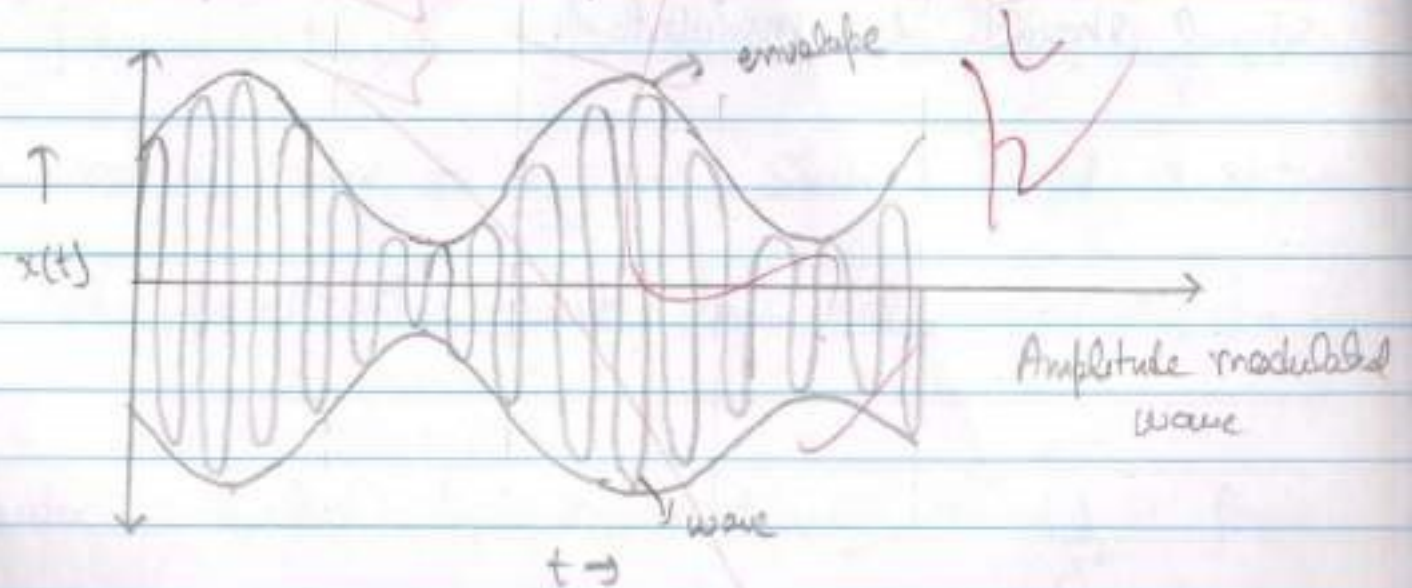
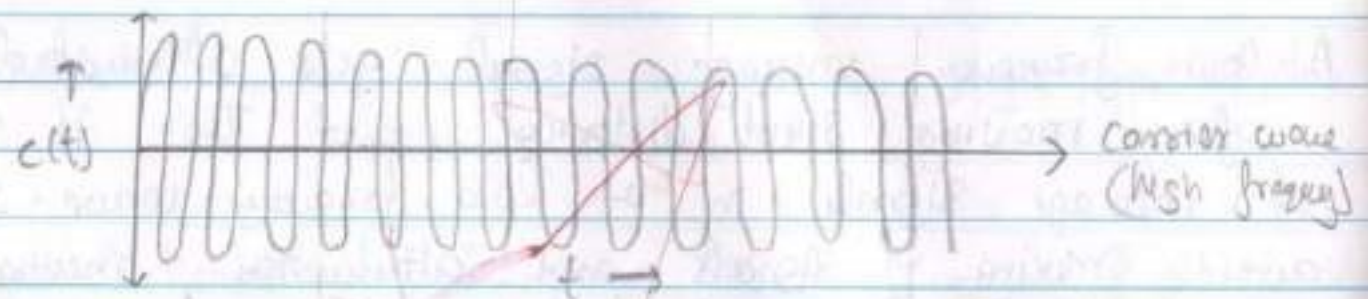
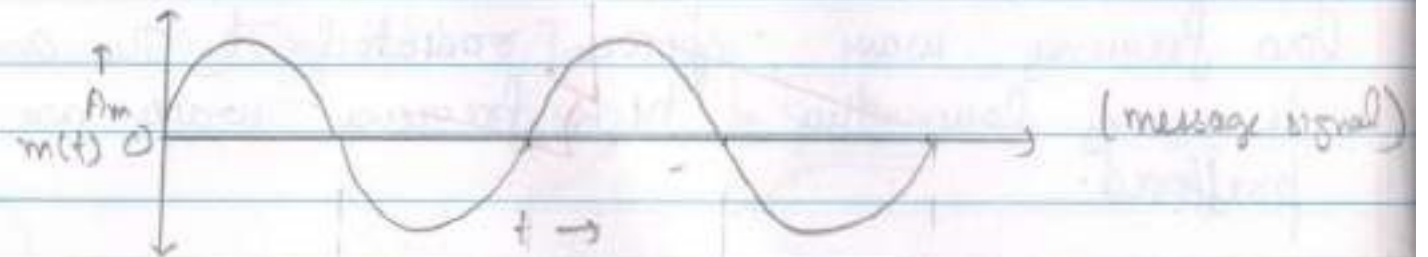
(i) Practical height of antenna — For a wave of about 20 kHz frequency height of antenna required is $\frac{\lambda}{4}$ which is nearly equal to 3.75 km. Such a height of antenna is not practically possible and not economically feasible.

(ii) Power radiated by an antenna is $\propto \frac{1}{\lambda^2}$, for a

low frequency wave, power radiated by the antenna is very low, ~~thus~~ high frequency waves are preferred.

(iii) A low frequency message signal gets attenuated after moving short distance and there is mixing of message signals in a low frequency wave. So to avoid mixing of signals and attenuation, message signal should be modulated.

(b)



Q-15 (a) We know that $\frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} \Rightarrow \frac{a_1}{a_2} = \sqrt{\frac{I_1}{I_2}} = K$

Also, $\frac{I_{\max}}{I_{\min}} = \left(\frac{a_1 + a_2}{a_1 - a_2} \right)^2$
 $= \left(\frac{a_1/a_2 + 1}{a_1/a_2 - 1} \right)^2$

$\Rightarrow \frac{I_{\max}}{I_{\min}} = \left(\frac{K+1}{K-1} \right)^2$

Now, let $I_1 = I$ as slit S_1 is covered with glass $I_2 = \frac{I}{2}$

$\Rightarrow \frac{I_1}{I_2} = \frac{I}{I/2} = 2 = K^2$

$\Rightarrow K = \sqrt{2}$

$\Rightarrow \frac{I_{\max}}{I_{\min}}$ becomes

$$= \left(\frac{\sqrt{2}+1}{\sqrt{2}-1} \right)^2$$

$$= \frac{2+1+2\sqrt{2}}{2+1-2\sqrt{2}}$$

$\frac{I_{\max}}{I_{\min}} =$	$\frac{3+2\sqrt{2}}{3-2\sqrt{2}}$
-------------------------------	-----------------------------------

- (b) If monochromatic light is replaced with white light then the fringes formed due to various constituent colours will overlap. In the center we will get a bright white ~~for~~ maxima, on moving further on both sides coloured fringes will be obtained.

A-11 (a) Bohr stated that electrons are permitted to revolve in only those orbits whose angular momentum is an integral multiple of $\frac{h}{2\pi}$ such that $mvr = \frac{nh}{2\pi}$ where n is a integer.

De Broglie's Hypothesis explained the stability of these orbits using dual nature of matter. He considered electrons to be matter wave such that their wavelength λ is given by $\lambda = \frac{h}{mv}$ ①

Now, as stationary waves are formed due to orbital motion of electrons, the circumference of

The orbit should be an multiple of wavelength of electron that is.

$$\cancel{mvr = n\hbar} \quad 2\pi r = n\lambda$$

Now, λ from (1) $= \frac{h}{mv}$

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

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



This is the same condition which Bohr stated and thus De Broglie explained it.

(b) We know that $E_3 - E_1 = \frac{-13.6}{n_2^2} - \left(\frac{-13.6}{n_1^2} \right) \text{ eV}$

$$= -\frac{13.6}{14^2} + \frac{13.6}{1^2}$$

$$= 13.6 - \frac{13.6}{16}$$

$$= 13.6 - 0.85$$

$$= \underline{12.75 \text{ eV}}$$

Now, $E = h\nu$

$$\Rightarrow 12.75 \times 1.6 \times 10^{-19} \text{ J} = h\nu$$

$$\Rightarrow \nu = \frac{12.75 \times 1.6 \times 10^{-19}}{6.6 \times 10^{-34}}$$

$$= \frac{12.75 \times 8}{33} \times 10^{15}$$

$$= \frac{4.25 \times 8 \times 10^{15}}{11}$$

$$= \frac{42.5 \times 8 \times 10^{14}}{11}$$

$$\begin{array}{r} 13.6 \\ - 0.85 \\ \hline 12.75 \end{array}$$

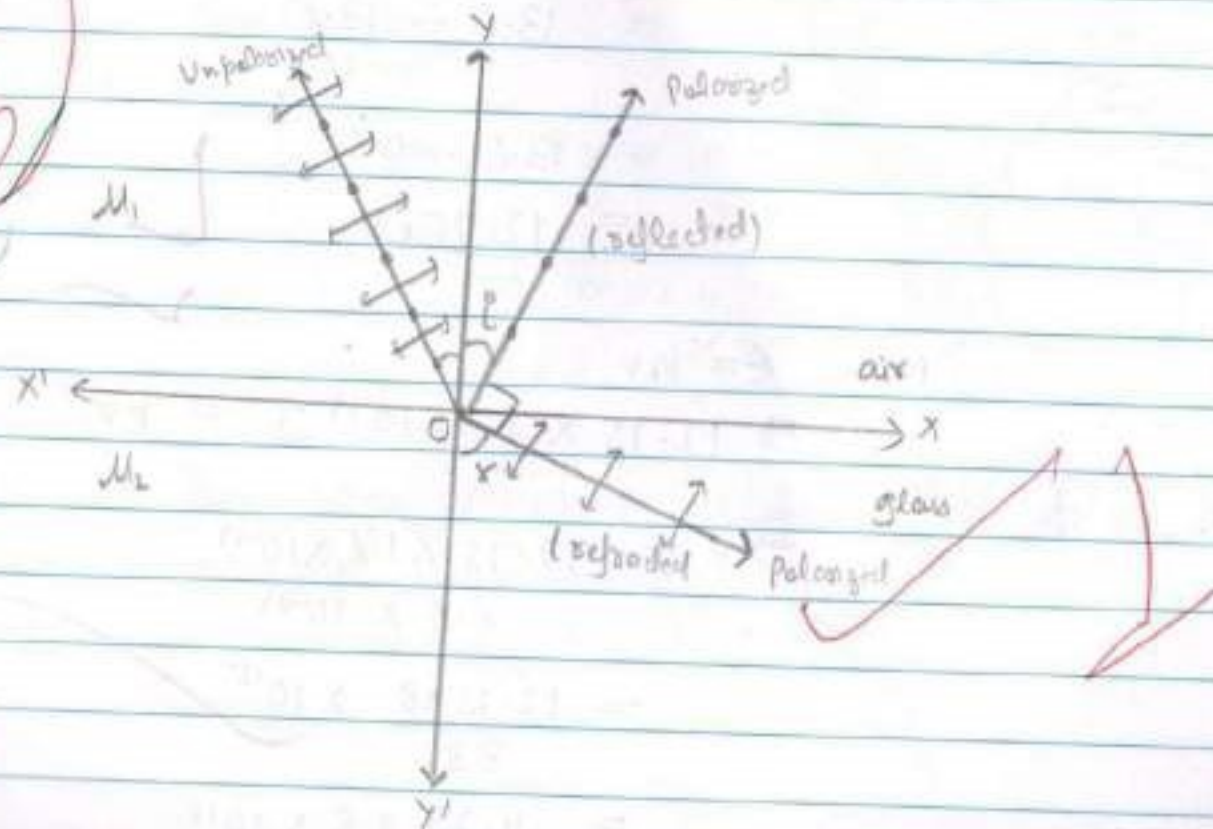
$$\begin{array}{r} 12.75 \\ \times 1.6 \\ \hline 1.5 \end{array}$$

8302323

$$\begin{aligned}
 & 3.8 \times 8 \times 10^{14} \\
 & = 30.4 \times 10^{14} \\
 & = \underline{\underline{3.04 \times 10^{15} \text{ Hz}}}
 \end{aligned}$$

A-7 (a)

3



CASE 2018

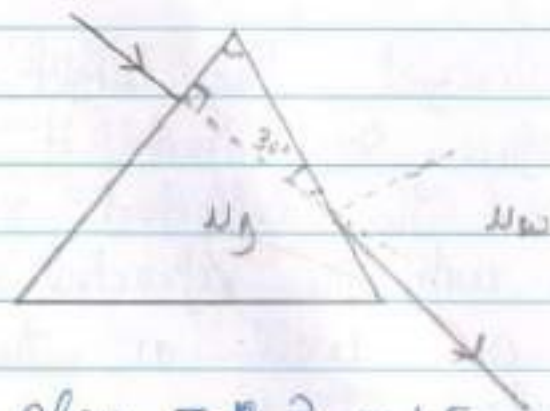
29

When an unpolarized light is incident on a plane surface such that it reflects as well as refracts and the reflected ray makes an angle of 90° with the refracted ray, then both the reflected as well as the refracted ray are plane polarized.

Condition for this is given by Brewster's law which says that the tangent of angle of incidence should be equal to the relative refractive index of the separating media. Then the light will be plane polarized.

$$\tan i_B = \mu_{21}$$

(b)



rel. index of glass = $\frac{3}{2} = 1.5$

rel. index of water = $\frac{4}{3} = 1.33$

now, $\theta_{ic} = \sin^{-1}\left(\frac{1}{\mu}\right)$

Using Snell's law, $r = 90^\circ$

$$\mu_g \sin i_c = \mu_w \sin r$$

$$\Rightarrow \mu_g \sin i_c = \mu_w \sin 90^\circ$$

=

$$\frac{3}{2} \sin i_c = \frac{4}{3}$$

$$\sin i_c = \frac{8}{9} \Rightarrow i_c = \sin^{-1} \frac{8}{9}$$

$$= \sin^{-1} 0.9$$

$$\text{i.e. } > 30^\circ$$

$\Rightarrow$ as angle of i

as critical angle $>$ incident angle

$\Rightarrow$ TIR does not take place





Given, R = Rad. of curvature, $\mu_g = 1.5$

$$\Rightarrow \frac{1}{f} = (\mu - 1) \left[\frac{1}{R} - \left(-\frac{1}{R} \right) \right]$$

$$= (1.5 - 1) \frac{2}{R}$$

$$= \frac{1}{R} \Rightarrow \boxed{f = R}$$

0902

Fictitious Roll No.
(To be entered by Board)

01103906

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

अतिरिक्त उत्तर-पुस्तिका (ओं) की संख्या

Supplementary Answer-Book(s) No.

Now, ~~the object~~When image is formed at R then only
it is of same sizein case of liquid ~~is~~ $x = uR$ — (1)

When liquid is removed,

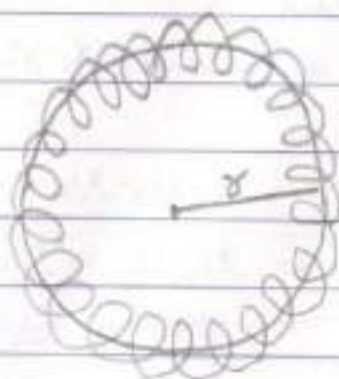
$$y = R$$
 — (2)

$$\Rightarrow \frac{x}{y} = \frac{uR}{R}$$

$$\Rightarrow \boxed{\frac{x}{y} = u}$$

2018

Q.19 (a)



Given no. of turns = n
per unit length

Current flowing = I

relative permeability = μ_r

Now, using Ampere's circuital law

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 \mu_r n I \quad (1)$$

I' = total current

$$= n I \quad n(2\pi r) I$$

Now, $\mu = \mu_0 \mu_r$ where

where $n(2\pi r)$ = No. of turns

eqn ① becomes.

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 \mu_r \times n \lambda 2\pi r \times I$$

$$B(2\pi r) = \mu_0 \mu_r \times n \times 2\pi r \times I$$

$$\Rightarrow \boxed{B = \mu_0 \mu_r n I}$$

2018

(b) Given $\chi = 0.9853$, material is paramagnetic



Magnetic field lines tend to pass through it then through

A-20 Given $M = 6 \text{ J/T}$

$$\theta = 60^\circ$$

$$B = 0.44 \text{ T}$$

(a) (i) $\theta_1 = 60^\circ$ $\theta_2 = 90^\circ$

$$W = \mu_B [\cos \theta_1 - \cos \theta_2]$$

$$= MB [\cos \theta_1 - \cos \theta_2]$$

$$= 6 \times 0.44 [\cos 60^\circ - \cos 90^\circ]$$

$$= 6 \times 0.44 \times \frac{1}{2}$$

$$= 3 \times 0.44$$

$$= \underline{1.32 \text{ J}}$$

(ii) opposite to magⁿ field $\Rightarrow \theta_1 = 60^\circ$ $\theta_2 = 180^\circ$

$$\Rightarrow W = \mu_B [\cos 60^\circ - \cos 180^\circ]$$

$$= 6 \times 0.44 \times \left(\frac{1}{2} + 1\right)$$

$$= 3 \times 6 \times 0.44 = 3 \times 1.32 = \underline{3.96 \text{ J}}$$

81

7/10/2020

(b) Torque on magnet when $\theta = 180^\circ$

$$= \cancel{m} B \sin \theta$$

$$= m B \sin 180^\circ$$

$$= 0$$

It is in unstable equilibrium.

21

(a)

Use Rmn that

$$V = IR$$

$$V = \rho \frac{l}{A} I$$

$$\sigma V = \frac{l}{A} I$$

$$\sigma = \frac{I}{V} \frac{l}{A}$$

Conductivity of metallic wire may be defined as ability to allow electric current to pass through. Its SI Unit is $\Omega^{-1} m^{-1}$

10/05/2017 - 18

7

(b) Consider a conductor of length l and cross section area A .

Now, we know that

$$I = n A e v_d$$

$$I = \frac{n A e^2 E \tau}{m}$$

$$\therefore v_d = \frac{e E \tau}{m}$$

$$I = \frac{n A e^2 (E l) \tau}{m l}$$

$$I = \frac{n A e^2 \tau V}{m l}$$

$$V = \frac{m l}{n A e^2 \tau} \times I$$

$$\text{or } R = \frac{m l}{n A e^2 \tau}$$

$$\text{But } R = \frac{\rho l}{A}$$

$$\Rightarrow \frac{\rho l}{A} = \frac{m l}{n e^2 \tau A}$$

$$f = \frac{m}{ne^2 \tau}$$

$$\frac{1}{\rho} = \frac{m}{ne^2 \tau}$$

$$\Rightarrow \boxed{\sigma = \frac{ne^2 \tau}{m}}$$

Now, $V = IR$

$$V = I \frac{\rho l}{A}$$

$$V = J \rho l$$

$$\frac{V}{l} = \frac{J}{\sigma}$$

$$E = \frac{J}{\sigma}$$

$$\Rightarrow \boxed{J = \sigma E}$$

0902

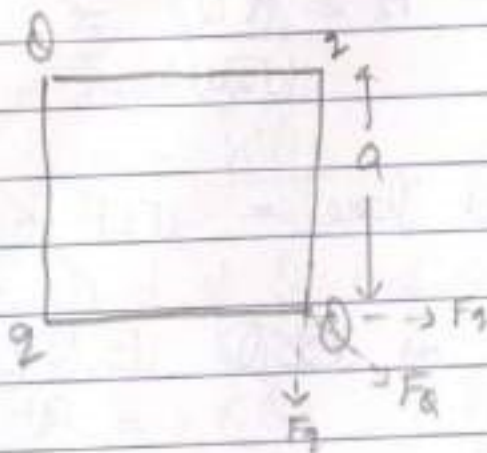
Fictitious Roll No.
(To be entered by Board)

01103906

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

अतिरिक्त उत्तर-पुस्तिका (ओं) की संख्या

Supplementary Answer-Book(s) No.



Force on Q acts due to 1, 2 and 4

as the force due to 1 and 2 are equal with angle of 90°

$\Rightarrow$ Resultant Force F is given by

$$\sqrt{F^2 + F^2} = \sqrt{2} F \quad (\text{acts along diagonal})$$

$$\text{where } F = \frac{K Q q}{a^2}$$

Now, force due to Q acts along diameter

$$\Rightarrow F_a = \frac{KQ^2}{(\sqrt{2}a)^2} = \frac{KQ^2}{2a^2}$$

$\Rightarrow$ Net force = $\sqrt{2}F + F_a$ (as they act along diameter)

$$\Rightarrow \cancel{500d} \frac{\sqrt{2}QqK}{a^2} + \frac{KQ^2}{2a^2}$$

$$= \frac{K(2\sqrt{2}Qq + Q^2)}{2a^2}$$

$$= \frac{KQ}{2a^2} [2\sqrt{2}q + Q] \text{ N}$$

where $K = \frac{1}{4\pi\epsilon_0}$

along the diameter away from charge Q.

(i) Potential ~~energ~~ energy of system is given by,
 let first Q be brought
 $\Rightarrow F_Q = 0$ — (1)

when q is brought in field of Q ,
 $W_1 = \frac{KQq}{a}$ — (2)

when q is brought in field of Q and q

$$W_2 = \frac{KQq}{a} + \frac{Kq^2}{\sqrt{2}a} \text{ — (2)}$$

when Q is brought in field of q , q and Q

$$W_3 = \frac{KQ^2}{(\sqrt{2}a)} + \frac{KQq}{a} + \frac{KQq}{a} \text{ — (3)}$$

Now, Net work done $= W_1 + W_2 + W_3$

$$= \frac{4KQ_2}{a} + \frac{Kq^2}{\sqrt{2}a} + \frac{KQ_2}{\sqrt{2}a}$$

where $K = \frac{1}{4\pi\epsilon_0}$

A-23 (a) Transformer can be used to step up and step down voltages.

Loss in the form of heat due to current in the copper windings called copper loss given by I^2R as even copper windings have some resistance and heat is dissipated.

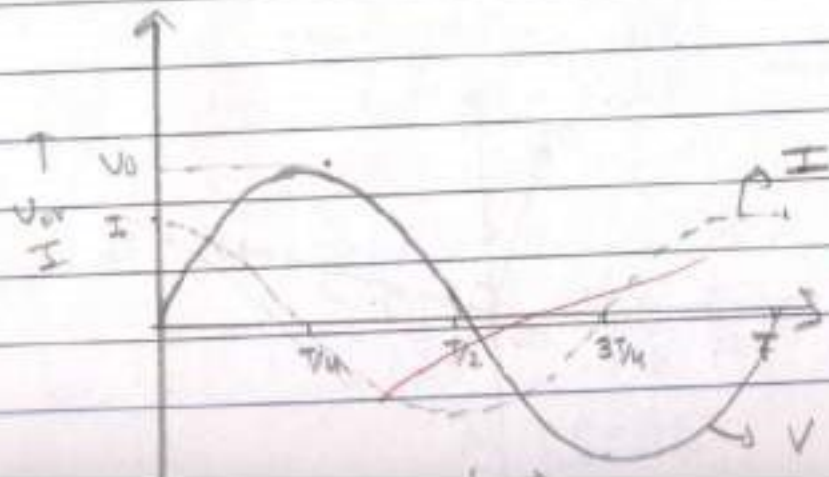
(b) As AC voltage can be stepped up and step down we step up AC voltage such that V increases and I as power remains constant I decreases and as loss of power is given by I^2R as I decreases loss of power also decreases but DC voltage on the

other hand can't be stepped up or stepped down and
loss of power or energy is maximum.

- (C) Greta was curious and a patient listener while ~~Greta's~~ Greta's teacher was generous and ~~two~~ knowledgeable. ✓

24(a) As current leads the applied voltage, X is a capacitor. ✓

(b)



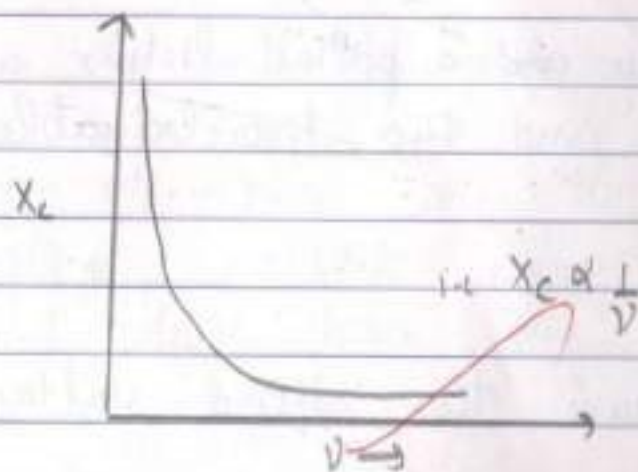
$$V = V_0 \sin \omega t$$

$$I = I_0 \sin(\omega t + \frac{\pi}{2})$$

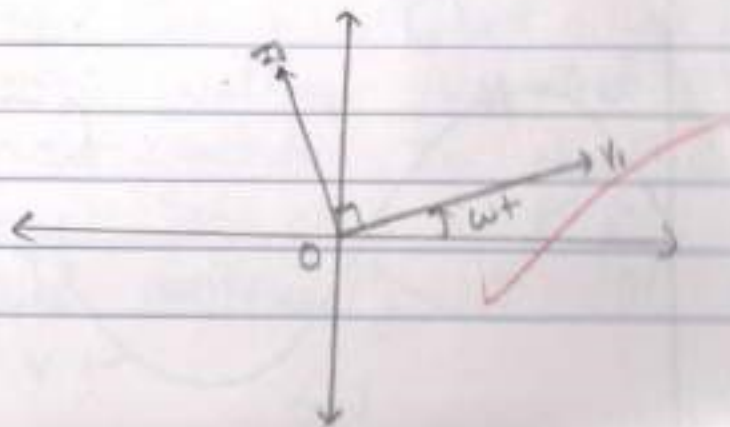
$$= I_0 \cos \omega t$$

(c) We know that $X_c = \frac{1}{\omega C} = \frac{1}{2\pi\nu C}$

i.e. $X_c \propto \frac{1}{\nu}$

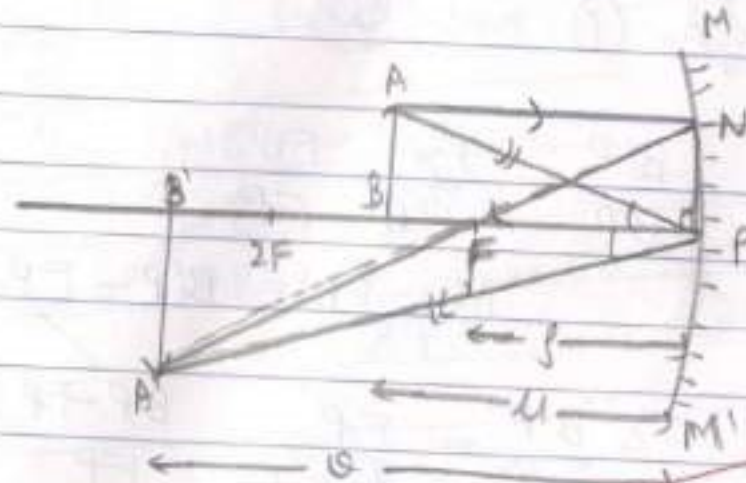


(d)



A-25

(10)



(b) In order to derive the mirror formula consider the above ray diagram,

Now, $\Delta ABP \sim \Delta A'B'P$ (By AA)

$$\Rightarrow \frac{A'B'}{AB} = \frac{B'P}{BP}$$

(1)

Also from $\Delta FNP \sim \Delta A'B'F$ (By AA)

$$\frac{A'B'}{NP} = \frac{FP}{FB'}$$

(2)

As $NP = AB$

from ① and ②

$$\frac{B'P}{BP} = \frac{\cancel{FP}}{\cancel{FB'}} \frac{FB'}{FP}$$

$$\text{Also } FB' = B'P - FP$$

$$\Rightarrow \frac{B'P}{BP} = \frac{\cancel{FP}}{\cancel{B'P - FP}} \frac{B'P - FP}{FP}$$

$$\text{Now, } B'P = -v, \quad FP = -f$$

$$BP = -u$$

$$\Rightarrow \frac{-v}{-u} = \frac{\cancel{-f}}{\cancel{-v + f}} \frac{-v + f}{-f}$$

$$vf = uv - uf$$

$$(v+u)f = uv$$

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

0902

Fictitious Roll No.
(To be entered by Board)

01103906

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

अतिरिक्त उत्तर-पुस्तिका (ओं) की संख्या

Supplementary Answer-Book(s) No.

Also from (1)

$$\frac{A'B'}{AB} = \frac{B'P}{BP}$$

$$A'B' = -h' \quad , \quad AB = h$$

$$B'P = -u \quad , \quad BP = -u$$

$$\Rightarrow \frac{-h'}{h} = m = \frac{-u}{-u}$$

$$\Rightarrow m = \frac{h'}{h} = \frac{-u}{-u}$$

CBSE

2

(i) In reflecting telescope, chromatic aberration is reduced as use of mirror doesn't scatter colour.

(ii) Spherical aberration is reduced by use of parabolic mirror as they converge rays to focus.

(iii) Mirror requires grinding and polishing only on one side.

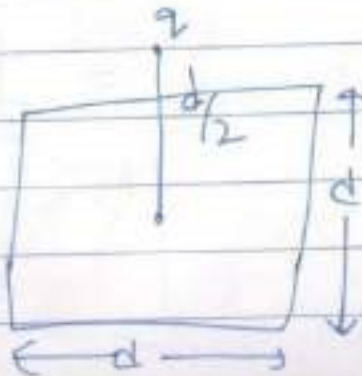
A-26

(a)

Electric flux may be defined as the number of field lines passing through a closed surface. ~~or~~
 Or mathematically, it may be defined as the surface integral of electric field over a closed surface.

i.e. $\Phi_e = \oint \vec{E} \cdot d\vec{s}$

It is a scalar quantity.



Consider a cube of side a with base as the square
such that q lies on its center

Now, acc. to Gauss law.

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

$$\Rightarrow E(6a^2) = \frac{q}{\epsilon_0} \quad \therefore \int ds = 6a^2$$

$$\Rightarrow \Phi_E = \frac{q}{\epsilon_0} \quad (\text{from entire cube})$$

As square is only one face

$$\Rightarrow \Phi_{\text{face square}} = \frac{1}{6} \Phi_E$$

$$= \frac{1}{6} \frac{q}{\epsilon_0}$$

$$\boxed{\Phi = \frac{q}{6\epsilon_0}}$$

Now As it is moved to a distance d from centre
and new square has side $2d$

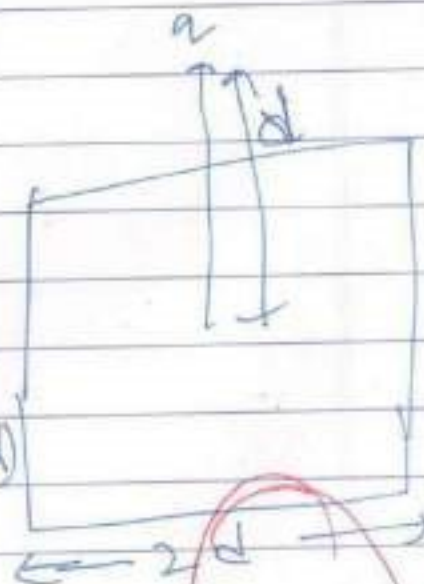
Charge q still lies at centre of new square

Again a ~~cube~~ cube of side ~~$2d$~~ can
be assumed such that

q lies at its centre

Flux through cube

$$= \phi = \frac{q}{\epsilon_0} \text{ (charge enclosed)}$$



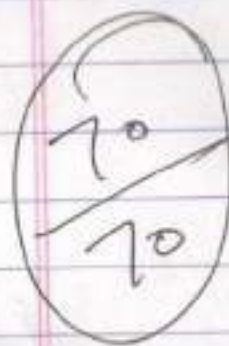
Flux through one face

$$= \frac{1}{6} \phi$$

$$= \frac{q}{6\epsilon_0}$$

$$\frac{q}{6\epsilon_0}$$

i.e. flux through square remains unchanged.



Seventy only.

