

PHYSICS-

- 1) de Broglie wave
- 2) Geographic meridian

2) (a) bends towards the normal

4) Angular momentum.

(5) (c) Microwave & visible

(b) λ decreases (note: no change in frequency)

(7) $q = Ne \Rightarrow n = \frac{q}{e} = \frac{1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18}$

(8) Lyman

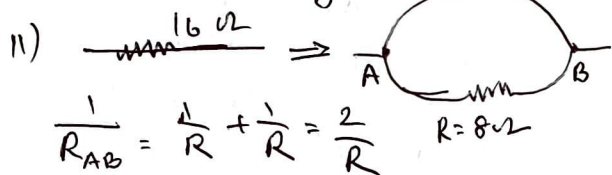
9) a) work done to bring unit +ve charge from infinity to a point.

$$V = \frac{W}{q}$$

b) $E = -\frac{\Delta V}{\Delta x}$ (intensity is -ve gradient of potential)

10) a) $v \propto l$ or $E \propto l$.

b) Metre bridge



$$\frac{1}{R_{AB}} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$$

$$R_{AB} = \frac{R}{2} = \frac{8}{2} = 4 \Omega$$

(12) a) false

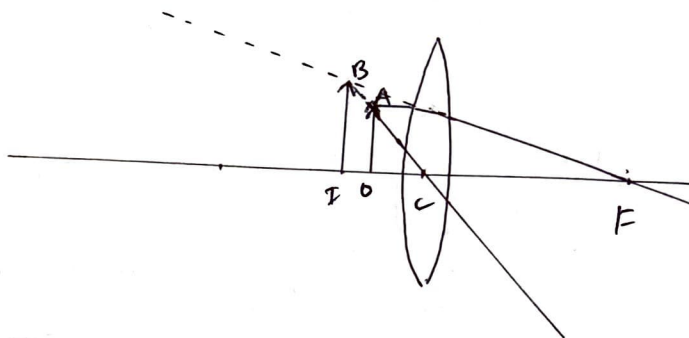
b) $F = qvB \sin \theta$ OR $\vec{F} = q(\vec{v} \times \vec{B})$

(13) a) It is the measure of extent of magnetisation

b) $B = \mu_0 H$

14) statement

15)



(16) (i) Angular momentum $L = \frac{n h}{2\pi}$

(ii) $h\nu = E_2 - E_1$

OR

Any two complete postulate

(17) a) $\frac{dN}{dt} \propto N$ OR $\frac{dN}{dt} = -\lambda N$

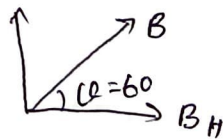
b) No. of protons = $Z = 92$
 No. of neutrons = $A - Z$
 $= 238 - 92$
 $= 146$

(18) $B_H = 0.26 G$

$\theta = 60^\circ$

$B_H = B \cos \theta$

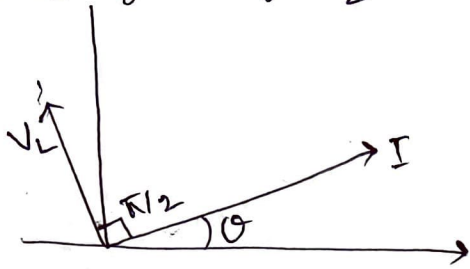
$B = \frac{B_H}{\cos 60} = \frac{0.26 G}{0.5} = 0.52 G$
 $= 0.52 \times 10^{-4} T$



(19) a) Mutual induction

- b) Copper loss
- eddy current loss
- Flux leakage loss
- Heat loss

20) a) V_L lags I by $\pi/2$



b) $\pi/2$

21) (i) Fusion is the process of combining smaller nuclei.

Fission - splitting of heavy nucleus into lighter nuclei

(ii) Fusion is controlled reaction

Fission is generally an uncontrolled reaction.

22) a) It is the energy gap between valance band and conduction band.

b) Voltage regulation

23) a) statement or $\Phi_E \approx \frac{q}{\epsilon}$

$$b) \Phi = \vec{E} \cdot \vec{AS}$$

$$= EAS \cos 45$$

$$= \frac{EAS}{\sqrt{2}}$$

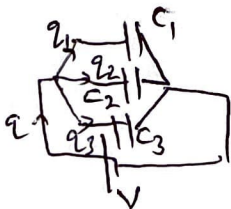
c) If the surface is parallel to the lines, $\theta = 90^\circ$
 $\Phi_E = 0$

24) For parallel combination, V is same, but charge q is divided among the capacitors

$$q = q_1 + q_2 + q_3$$

$$CV = C_1V + C_2V + C_3V$$

$$C = C_1 + C_2 + C_3$$



25) $L = 0.5 \text{ m}$

$$r = 1 \text{ cm}$$

$$N = 500$$

$$I = 5 \text{ A}$$

$$B = \mu_0 n I$$

$$= \mu_0 \frac{N I}{L}$$

$$= \frac{4\pi \times 10^{-7} \times 500 \times 5}{0.5}$$

$$= 6.28 \times 10^{-3} \text{ T}$$

26) a) dip angle

b) i) inclination - Angle between magnetic and geographic meridian
 (ii) dip

(iii) Horizontal intensity - It is the component of earth's magnetic field in the horizontal direction

27) a) electromagnetic induction

b) If N is the number of turns of the coil,

Total magnetic flux

$$\Phi_B = N \vec{B} \cdot \vec{A} \quad (\omega = \frac{d\theta}{dt})$$

$$= NBA \cos \theta$$

$$= NBA \cos \omega t$$

Induced emf,

$$E = - \frac{d\Phi}{dt}$$

$$= - \frac{d(NBA \cos \omega t)}{dt}$$

$$= - NBA \omega \times - \sin \omega t$$

$$= NBA \omega \sin \omega t$$

$$E_t = E_0 \sin \omega t$$

- 28) (i) Velocity equal to velocity of light
 (ii) medium not required for propagation
 (b) Radio communication
 TV transmission
 mobile phone communication

29) Tangent of angle of polarisation is equal to refractive index of the medium.

$$\tan \theta_p = \mu$$

$$\tan \theta_p = 1.60$$

$$\theta_p = \tan^{-1}(1.60)$$

$$= 58^\circ$$

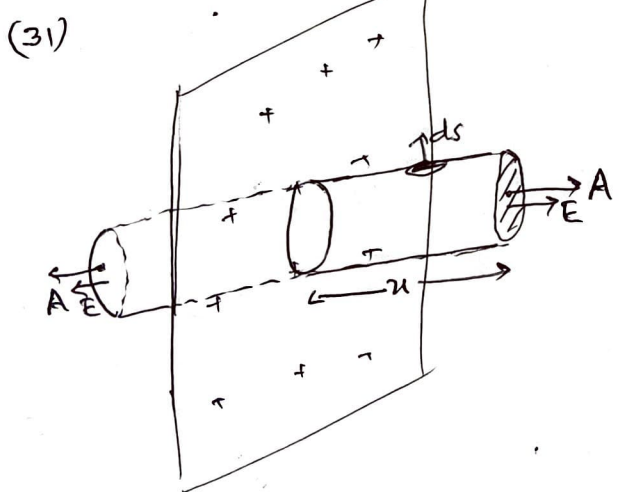
30) $\lambda = 6800 \times 10^{-10} \text{ m.}$

$$\phi_0 = h\nu_0$$

$$= \frac{hc}{\lambda_0}$$

$$= \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{6800 \times 10^{-10}}$$

$$= 2.925 \times 10^{-19} \text{ J} = 1.89 \text{ eV}$$



Consider an infinite sheet of surface charge density $\sigma = \frac{q}{A}$.

~~Electric flux~~ The gaussian surface is a cylinder of length $2x$ and base area A

The curved surface does not contribute of flux as $E \perp ds$

For the two end flat surface,

$$\phi_1 = \phi_2 = \vec{E} \cdot \vec{A}$$

$$= EA$$

Total flux $\phi = \phi_1 + \phi_2$
 $= 2EA$

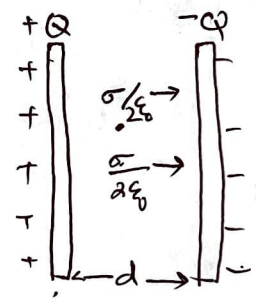
According to Gauss law

$$\phi = \frac{Q}{\epsilon_0}$$

$$2EA = \frac{\sigma A}{\epsilon_0}$$

$$E = \frac{\sigma}{2\epsilon_0}$$

32)



Surface charge density $\sigma = \frac{Q}{A}$
 charge $Q = \sigma A$ — (1)

Electric field between plates,

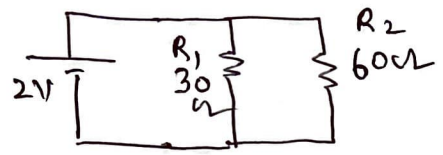
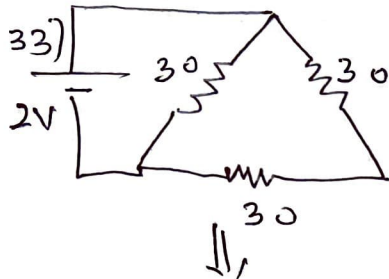
$$E = \frac{\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0} = \frac{\sigma}{\epsilon_0}$$

potential difference, $V = Ed$

$$= \frac{\sigma d}{\epsilon_0} \text{ — (2)}$$

Capacitance, $C = \frac{Q}{V} = \frac{\sigma A}{\frac{\sigma d}{\epsilon_0}}$

$$C = \frac{\epsilon_0 A}{d}$$



$$R = \frac{R_1 R_2}{R_1 + R_2} = \frac{30 \times 60}{30 + 60} = 20 \Omega$$

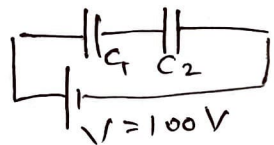
$$I = \frac{V}{R} = \frac{2}{20} = 0.1 \text{ A}$$

34) a) $\int \vec{B} \cdot d\vec{l} = \mu_0 I_{\text{enclosed}}$ or statement

b) Derivation of $B = \mu_0 n I$

35) a) Farad (F)

b) $C_1 = 2 \text{ MF} = 2 \times 10^6 \text{ F}$
 $C_2 = 4 \text{ MF} = 4 \times 10^6 \text{ F}$



$$Q = C_1 V = V = V_1 + V_2$$

$$V_1 = \frac{Q}{C_1} ; V_2 = \frac{Q}{C_2}$$

$$C = \frac{C_1 C_2}{C_1 + C_2} = \frac{(2 \times 4)}{2 + 4} \times 10^6 \text{ F}$$

$$= \frac{8}{6} \times 10^6 \text{ F}$$

$$Q = CV$$

$$= \frac{8}{6} \times 10^6 \times 100$$

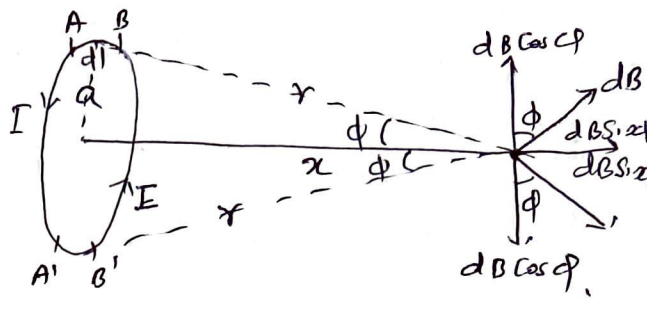
$$= \frac{8}{6} \times 10^8 \text{ C}$$

$$V_1 = \frac{8 \times 10^8}{6 \times 2 \times 10^6} = 66.67 \text{ V}$$

$$V_2 = V - V_1 = 33.33 \text{ V}$$

(A)

36)



Magnetic field due to AB of length dl,
 $dB = \frac{\mu_0 I dl}{4\pi r^2} \sin \theta = \frac{\mu_0 I dl}{4\pi r^2} \sin 90^\circ = 1$

Magnetic field components due to AB and A'B' are $dB \sin \phi$ and $dB \cos \phi$, two are out. The vertical components $dB \cos \phi$'s cancel out and horizontal components $dB \sin \phi$ adds up.

Total magnetic field,
 $\therefore B = \int dB \sin \phi$ $\sin \phi = \frac{a}{r}$

$$= \int \frac{\mu_0 I dl}{4\pi \frac{r^2}{r}} \frac{a}{r}$$

$$r^3 = (x^2 + a^2)^{3/2}$$

$$= \frac{\mu_0 I a}{4\pi (x^2 + a^2)^{3/2}} \int dl$$

$$= \frac{\mu_0 I a}{4\pi (x^2 + a^2)^{3/2}} \times 2\pi a$$

$$= \frac{\mu_0 I \times 2\pi a^2}{4\pi (x^2 + a^2)^{3/2}}$$

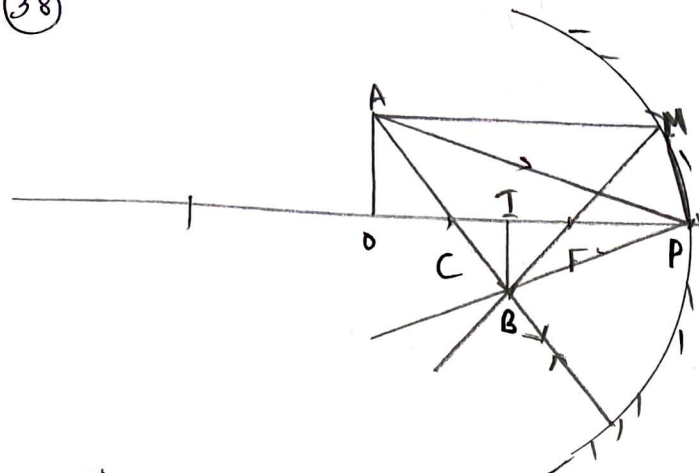
$$\pi a^2 = A, \text{ area}$$

$$B = \frac{\mu_0 2IA}{4\pi (x^2 + a^2)^{3/2}}$$

37) a) It is the magnetic field induced emf produced in a conduction when it is moving in a magnetic field.

b) Derivation of $e = Blv$

38



Δ es OAP & IBP are similar

$$\frac{IB}{OA} = \frac{IP}{OP} = \frac{v}{u} \quad \text{--- ①}$$

Δ es PMF and IBF are similar

$$\frac{IB}{PM} = \frac{IF}{FP} = \frac{IP-FP}{FP} = \frac{v-f}{f}$$

But $PM = OA$

$$\therefore \frac{IB}{OA} = \frac{v-f}{f} \quad \text{--- ②}$$

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

$$uv = uv - vf$$

$$uv - uf = vf$$

\div ing by uvf

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

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

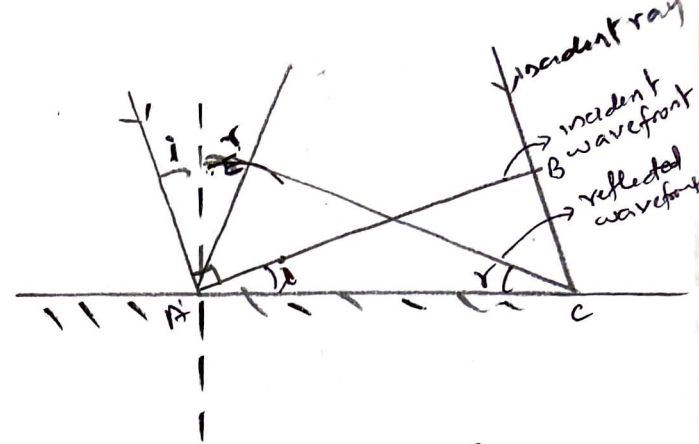
Applying signs, $u, v,$ and f -ve

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

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

39 a) statement.

5



Time taken by the wave front to move from B to C is T , then

$$BC = \text{Velocity} \times \text{time} = v \times T \quad \text{--- ①}$$

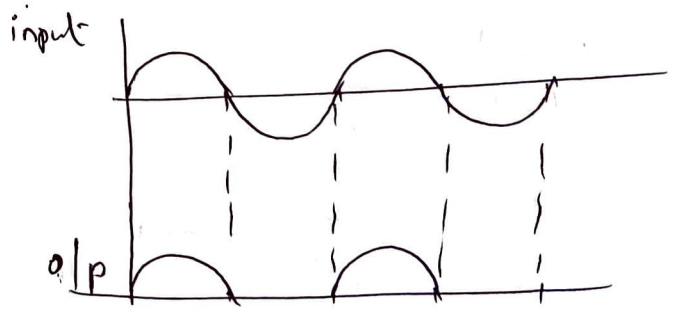
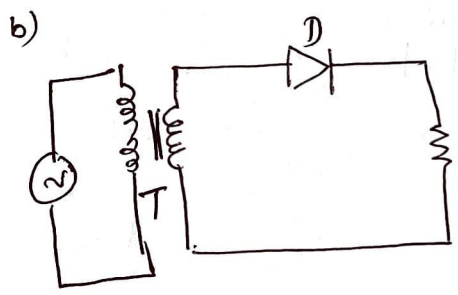
draw a reflected wavefront of radius $BC = vT$, and let CE be the tangent plane at C.

$$\therefore AE = BC = vT.$$

Δ es EAC and BAC are congruent

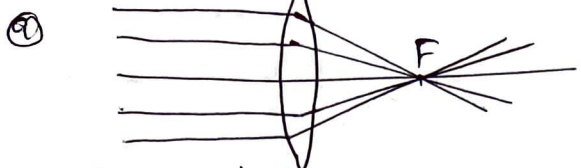
implies, $i = r$

A) a) It is used to convert AC into unidirectional current. (OR) AC to DC



+ explanation.

41)



When parallel beam of light incident on a convex lens parallel to principal axis, they converge to a point on the principal axis \Rightarrow principal focus.

b) Refraction

c) $f_1 = +10\text{cm}$

$f_2 = -15\text{cm}$

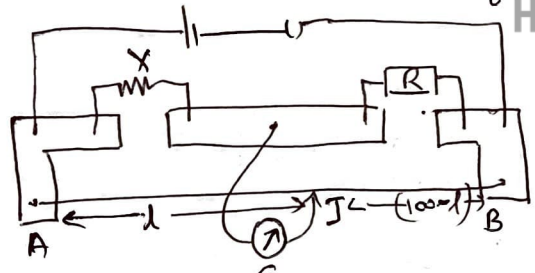
$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$f = \frac{f_1 f_2}{f_1 + f_2} = \frac{10 \times -15}{10 + -15} = \frac{-150}{-5} = +30\text{cm}$$

42) $p = 2 \times 2\lambda$

Derivation of $E_{\text{axial}} = \frac{1}{4\pi\epsilon_0} \frac{2p}{r^3}$

43)



When the bridge is balanced $AJ = l$

Wheatstone's principle

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

$$\frac{X}{R_{AJ}} = \frac{R}{R_{BJ}} \quad \text{--- ①}$$

$$R_{AJ} = \frac{\rho l}{A}$$

$$R_{BJ} = \frac{\rho(100-l)}{A}$$

6)

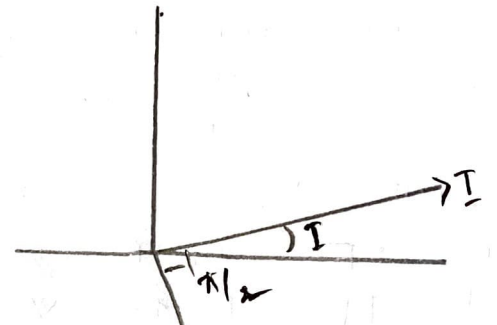
$$\frac{R_{AJ}}{R_{BJ}} = \frac{l}{100-l}$$

① $\Rightarrow X = \frac{R_{AJ}}{R_{BJ}} \times R$

$$X = \frac{l}{100-l} \times R$$

44) a) $I_{\text{rms}} = \frac{I_0}{\sqrt{2}} = 0.707 I_0$

b)



Let $V = V_m \sin \omega t$ --- ①

For Capacitor, $V = q/C$ --- ②

$$V_m \sin \omega t = q/C$$

then $I = \frac{dq}{dt} = \frac{d(V_m C \sin \omega t)}{dt}$

$$= V_m C \omega \times \cos \omega t$$

$$= \frac{V_m}{(1/C\omega)} \times \sin(\omega t + \pi/2)$$

$$I = I_m \sin(\omega t + \pi/2) \quad \text{--- ③}$$

Or ② $\Rightarrow I$ leads V by phase $\pi/2$

45) Derivation,

$$n = \frac{\sin(A+D)}{\sin(A/2)}$$

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