A+B'

उत्तराखण्ड विद्यालयी शिक्षा परिषद, रामनगर (नैनीताल)	इण्टरमीडिएट परीक्षा 'अ' (उत्तराखण्ड) 12 पन्ने

Answer-1

(a) (ক)

6.25×10^{18} (✓)

(b) (খ)

$V_P - V_Q > 0$ (✓)

(c) (গ)

Electric charge (✓)

(d) (ঘ)

$\oint B \cdot dl = \mu_0 I$ (✓)

(e) (ঙ)

Convex lens of focal length 500mm (✓)

(f) (চ)

Frequency of incident light and ~~refracted~~ light is same but frequency of ~~reflected~~ light is changed (✓)

(g) (ङ)

$\frac{-13.6}{n^2}$ eV (✓)

(h) (ञ)

~~Ro~~ $R = R_0 A^{1/3}$ (✓)

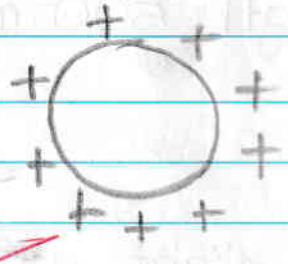
(i) (झ)

Both A and R Is ~~to~~ true and R is correct explanation of A (✓)

(j) (ञ)

A is ~~&~~ correct R is incorrect (✓)

Answer - 2

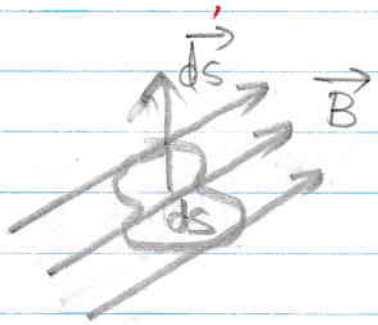


$V_{inside} = V_0$

(V inside is constant for conductor)

Answer - 3

$$\oint \vec{B} \cdot d\vec{s} = 0$$



where $\vec{B}$ is magnetic field

$d\vec{s}$ is an expression for surface (small)

Answer-4

$$E = h\nu$$

where E → energy

h → planck's constant

ν → frequency

$E \propto \nu$

γ rays have highest frequency.

∴ γ rays (gamma rays) have highest energy.

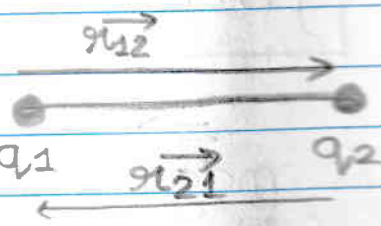
Answer-5

In half wave rectification :-

Input frequency — 50Hz

Output frequency — 50Hz

Answer-6



$\vec{F}_{12} = \frac{kq_1q_2}{(\vec{r}_{21})^2}\hat{r}_{21}$ (Force on q_1 due to q_2)

$\vec{F}_{21} = \frac{kq_1q_2}{(\vec{r}_{12})^2}\hat{r}_{12}$ (Force on q_2 due to q_1)

As $\vec{r}_{12} = -\vec{r}_{21}$

[because of opposite directions]

So we conclude that

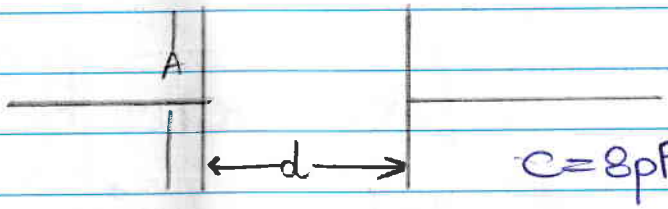
$\vec{F}_{21} = -\vec{F}_{12}$

or

$\vec{F}_{12} = -\vec{F}_{21}$

Hence third law of (action-reaction) Newton is proved.

Answer-7



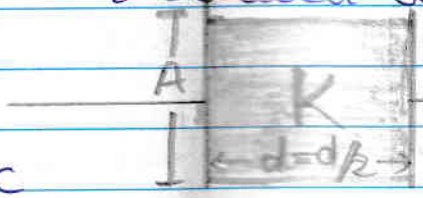
$C = 8pF = 8 \times 10^{-12} F$

As we know,

$$C = \frac{\varepsilon_0 A}{d} \quad \text{---(i)}$$

When, $8 \times 10^{-12} = \frac{\varepsilon_0 A}{d}$ —(i)

When, K introduced and distance is halved



K → dielectric constant

$C' = 96pF$
$= 96 \times 10^{-12} F$

$$C' = K\frac{\varepsilon_0 A}{d/2}$$

$$C' = 2K\frac{\varepsilon_0 A}{d}$$

from (i)

$$\frac{\varepsilon_0 A}{d} = 8 \times 10^{-12} F$$

$$C' = 2 \times K \times 8 \times 10^{-12} F$$

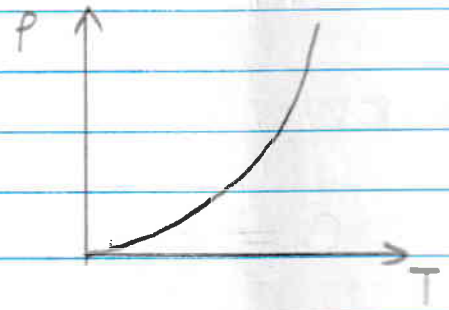
$$96 \times 10^{-12} = 2 \times K \times 8 \times 10^{-12}$$

$$2K = \frac{96 \times 10^{-12}}{8 \times 10^{-12}}$$

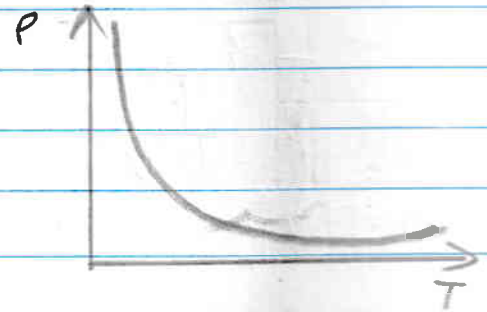
$$K = \frac{96486}{2 \times 8}$$

$$\boxed{K = 6}$$

Answer - 8



This graph is for Conductors



This graph is for semiconductors.

for a conductor;

$$\rho = \rho_0(1 + \alpha \Delta T)$$

$$\rho \propto T$$

Answer - 9

$I_1 = 2\ A$

$I_2 = 1\ A$

$t = 0.1\ s$

$E = 100\ V$

$L = ?$

$\Delta dI = I_2 - I_1$

$= 1 - 2$

$= -1\ A$

using

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

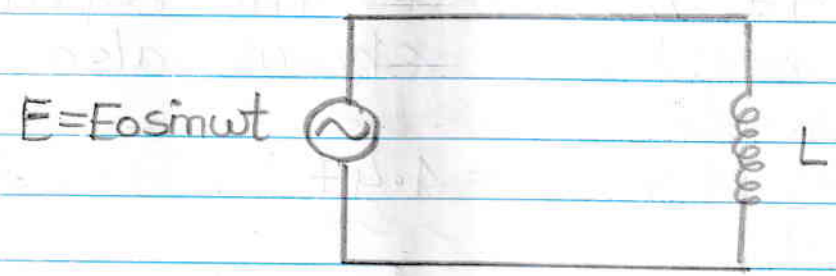
$$100 = -\frac{L(-1)}{0.1}$$

$$100 = L \times 10$$

$$L = \frac{100}{10}$$

$$\boxed{L = 10\ H}$$

Answer-10



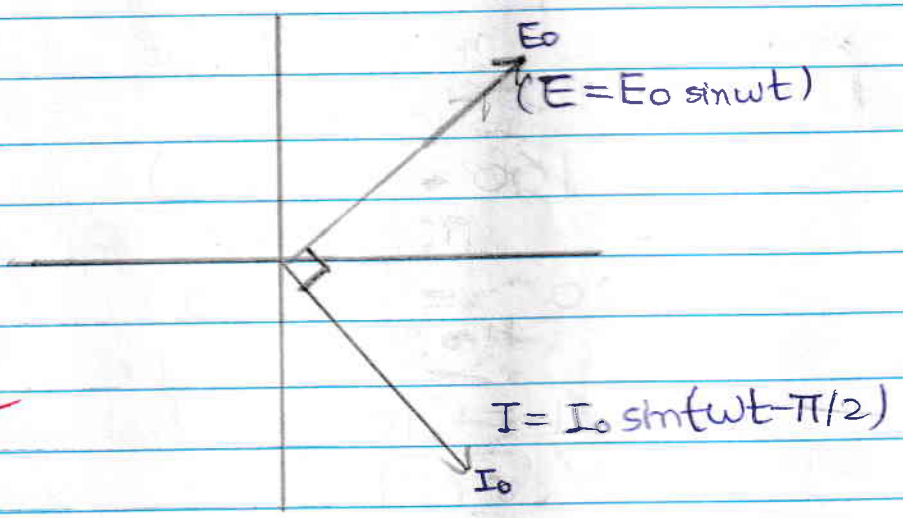
The circuit is an inductive circuit

$$E = E_0 \sin\omega t$$

$$I = I_0\left(\sin\omega t - \frac{\pi}{2}\right)$$

Here current lags voltage by 90° or voltage leads current by 90° ($\pi/2$)

Phasor –



Answer-11

The lens has refractive index of 1.47 therefore the refractive index of liquid should also be 1.47.

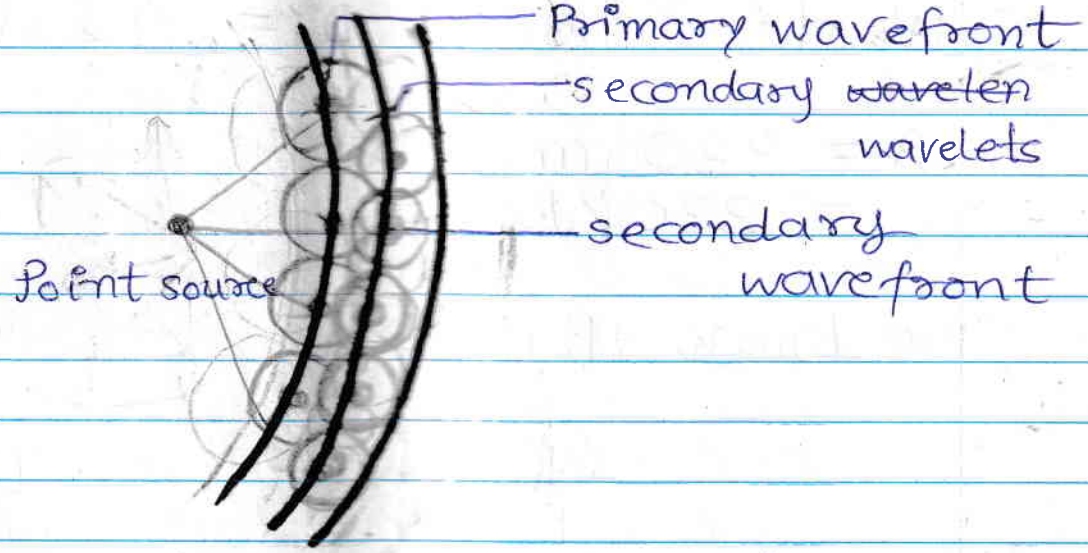
$$n_{Liquid} = 1.47$$

Because of same refractive index the lens become invisible in liquid.

$$n_{liquid} = n_{lens}$$

Because of same refractive index light will not refract and it behaves like a same medium. i.e. one medium.

Answer-12



- A point source makes spherical wavefront.

→ Principle 1

An each point of the wavefront act as a fresh source of disturbance which produce secondary wavelets

- Principle – 2
- Joining the wavelets tangentially at the forward side it gives secondary wavefront

By making wavefronts the waves propagates ~~on~~ from one point source in a medium.

Answer–13

Workfunction = ϕ_0 = 4.2eV

$\lambda = 330\,nm$
$= 330 \times 10^{-9}\,m$

We know that

$$E = h\nu \qquad \left[\nu = \frac{c}{\lambda}\right]$$
$$E = \frac{hc}{\lambda}$$

~~$E = 6.63 \times 10^{-34} \times 330 \times 1$~~

$$E = \frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{330 \times 10^{-9}}$$
110

$$\boxed{E \approx 6 \times 10^{-19}\,J}$$

$$\phi_0 = 4.2 \times 1.6 \times 10^{-19}$$

$$= 6.72 \times 10^{-19} \text{ J}$$

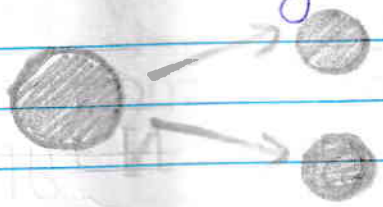
Since

$$\phi_0 > E$$

The metal will not give photo-electric emisson.

Answer-14

Nuclear fission: Nuclear fission is the process where big nuclei break to form two daughter nuclei.



Eg → Uranium form Barium (Ba) and krypton (Kr).

- It could be used for creating electrical energy.
- Steps of creating energy: →

Fission $\xrightarrow{\text{release}}$ Energy $\longrightarrow$ make steam of water

steam rotates turbine $\longrightarrow$ Turbine rotates AC ~~dynamo~~ dynamo (AE generator)

$\longrightarrow$ AC will be produced (alternating current)

Answer-15

$n_e = n_h = 6 \times 10^8 m^{-3}$ (n_i)

After doping $\rightarrow$ $n_e = 9 \times 10^{12} m^{-3}$

(i)

As electron's concentration is raised, it is ~~N-type~~ n-type

(ii)

$$n_h \cdot n_e = n_i^2$$

$$n_h = \frac{(n_i)^2}{n_e} = \frac{(6 \times 10^8)^2}{9 \times 10^{12}}$$

$$n_h = \frac{36 \times 10^{16}}{9 \times 10^{12}}$$

$$= 4 \times 10^{16-12}$$

$$n_h = 4 \times 10^4 \, m^{-3}$$

Answer - 16

- Gauss' Law → It states that the flux passing through the closed surface (ϕ_E) is $1/\varepsilon_0$ times of the charge enclosed by surface.

$$\phi_E = \frac{q_{enclosed}}{\varepsilon_0}$$

$$\left[\because \phi_E = \oint \vec{E} \cdot d\vec{s} \right]$$

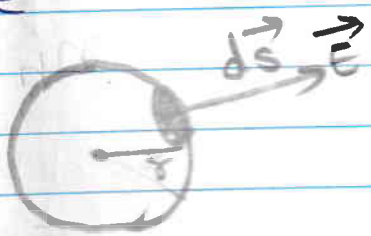
or

$$\oint \vec{E} \cdot d\vec{s} = \frac{q_{enclosed}}{\varepsilon_0}$$

Proof

Let there be a closed ~~sphere~~ surface (sphere) ~~of~~ as a surface where $d\vec{s}$ is the small

area and $\vec{E}$ is the Electric field. r is the radius



$\therefore \oint \vec{E} \cdot d\vec{s} = \Phi_E$

$\oint E ds \cos\theta = \Phi_E$

$\theta = 0°$

$\cos 0° = 1$

$\oint E ds = \Phi_E$

$E \oint ds = \Phi_E$

(surface area of sphere $= 4\pi r^2$)

$E \times 4\pi r^2 = \Phi_E$

$\therefore E = \frac{Kq}{r^2} = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2}$

$\therefore \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2} \times 4\pi r^2 = \Phi_E$

$$\boxed{\Phi_E = \frac{q_{enclosed}}{\varepsilon_0}}$$

Answer-17

(i)

q is the charged particle, v is the velocity, B is the magnetic field and F is the force acting perpendicular to the particle velocity which is making its path circular acting as a centripetal force.

The path is circular as the magnetic field provide centripetal force.

(ii)

$$F_{centripetal} = F_{magnetic}$$

$$\frac{mv^2}{r} = qvB\sin\theta$$

[$\theta = 90^\circ$

$\sin 90^\circ = 1$]

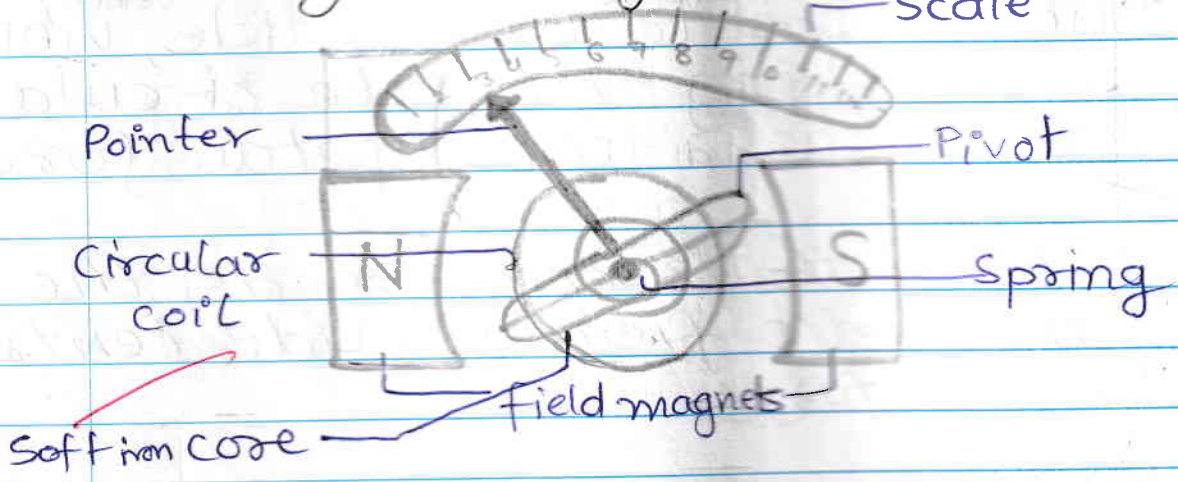
$$\frac{mv^2}{r} = qvB$$

$$\frac{mv}{r} = qB$$

$$\boxed{r = \frac{mv}{qB}}$$

Answer-18

Moving coil Galvanometer:



→ Galvanometer show current (small valzie)

Principle

- The Galvanometer works on a principle on Torque acting on a coil in magnetic field

θ = deflection

N = ~~area of~~ turns of coil

B = Magnetic field
A = Area of coil
K = Torque (Torisonal Constant)

$K\theta = NABI$

$$\theta = \frac{NAB}{K} I$$

as, $\tau = NABI\sin\theta$

$\theta = 90°$ (because of radial magnets)

$\sin 90° = 1$

$\tau_{max} = NABI$ —①

$\tau_{restoring} = K\theta$ —②

equating ① & ②

$\tau_{max} = \tau_{restoring}$

$K\theta = NABI$

$$\theta = \frac{NAB}{K} I$$

- When magnetic field generates in it the coil faces torque and rotate along with it the pointer rotate and show deflection on the scale.
- Galvanometer shows large deflect for small currents.

Answer-19

$n_1 = 1.5$

$n_2 = 1.6$

for lens I

$$\frac{1}{f_1} = [n-1]\left[\frac{1}{R_1} - \frac{1}{R_2}\right] \quad \text{(lens formula)}$$

$$\frac{1}{f_1} = [1.5-1]\left[\frac{1}{R_1} - \frac{1}{R_2}\right] \quad \text{—(I)}$$

for second lens lens (II)

$$\frac{1}{f_2} = [n-1]\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$$

$$\frac{1}{f_2} = [1.6-1]\left[\frac{1}{R_1} - \frac{1}{R_2}\right] \quad \text{—(II)}$$

dividing (I) & (II)

$$\frac{\frac{1}{f_1}}{\frac{1}{f_2}} = \frac{[1.5-1]\left[\frac{1}{R_1} - \frac{1}{R_2}\right]}{[1.6-1]\left[\frac{1}{R_1} - \frac{1}{R_2}\right]}$$

Radii same

$$\frac{f_2}{f_1} = \frac{0.5}{0.6}$$

$$f_2 = \frac{0.5}{0.6} f_1$$

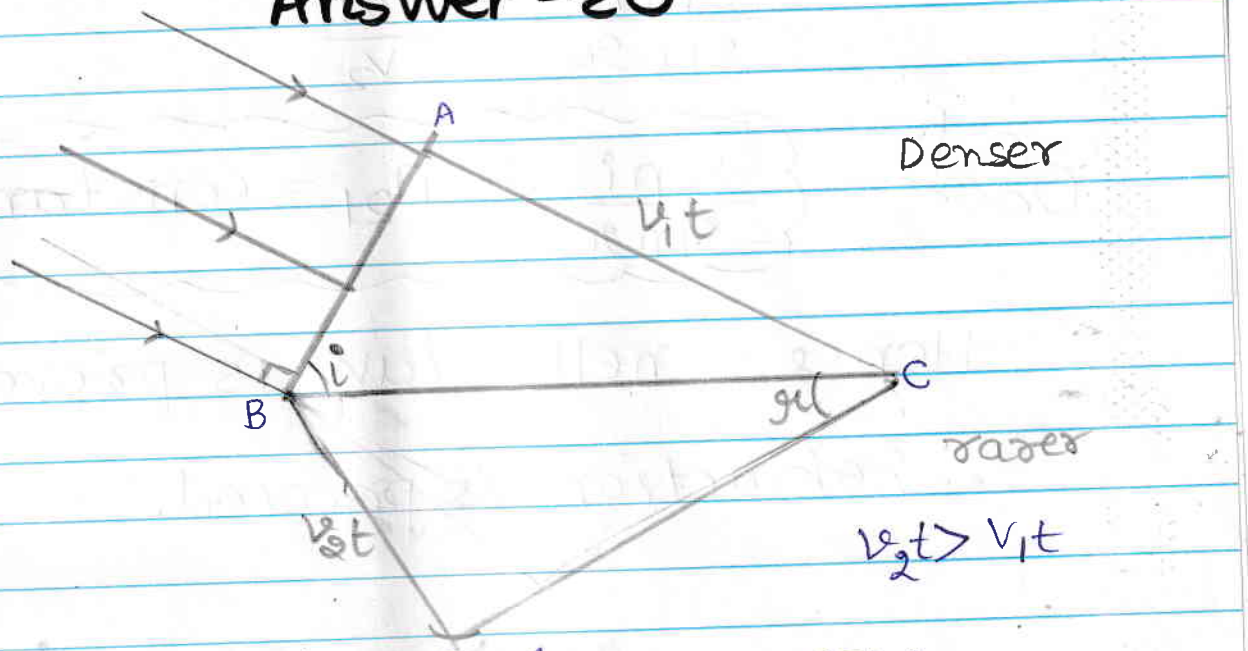
$$f_1 = \frac{0.6}{0.5} f_2$$

$f_1 = 1.2 f_2$

$f_1 > f_2$

$f \propto \frac{1}{n}$

Answer-20



Here AB is a D planar ware front entering the medium
v_1t is the distance travelled by the end at A.
Taking B as centre cut an arc on D of length v_2t

$\left[\sin = \frac{P}{H}\right]$

In Δ ABC

$$\sin i = \frac{v_1 t}{BC}$$

In Δ BCD

$$\sin r = \frac{v_2 t}{BC}$$

$$\frac{\sin i}{\sin r} = \frac{v_1 t}{BC} \times \frac{BC}{v_2 t}$$

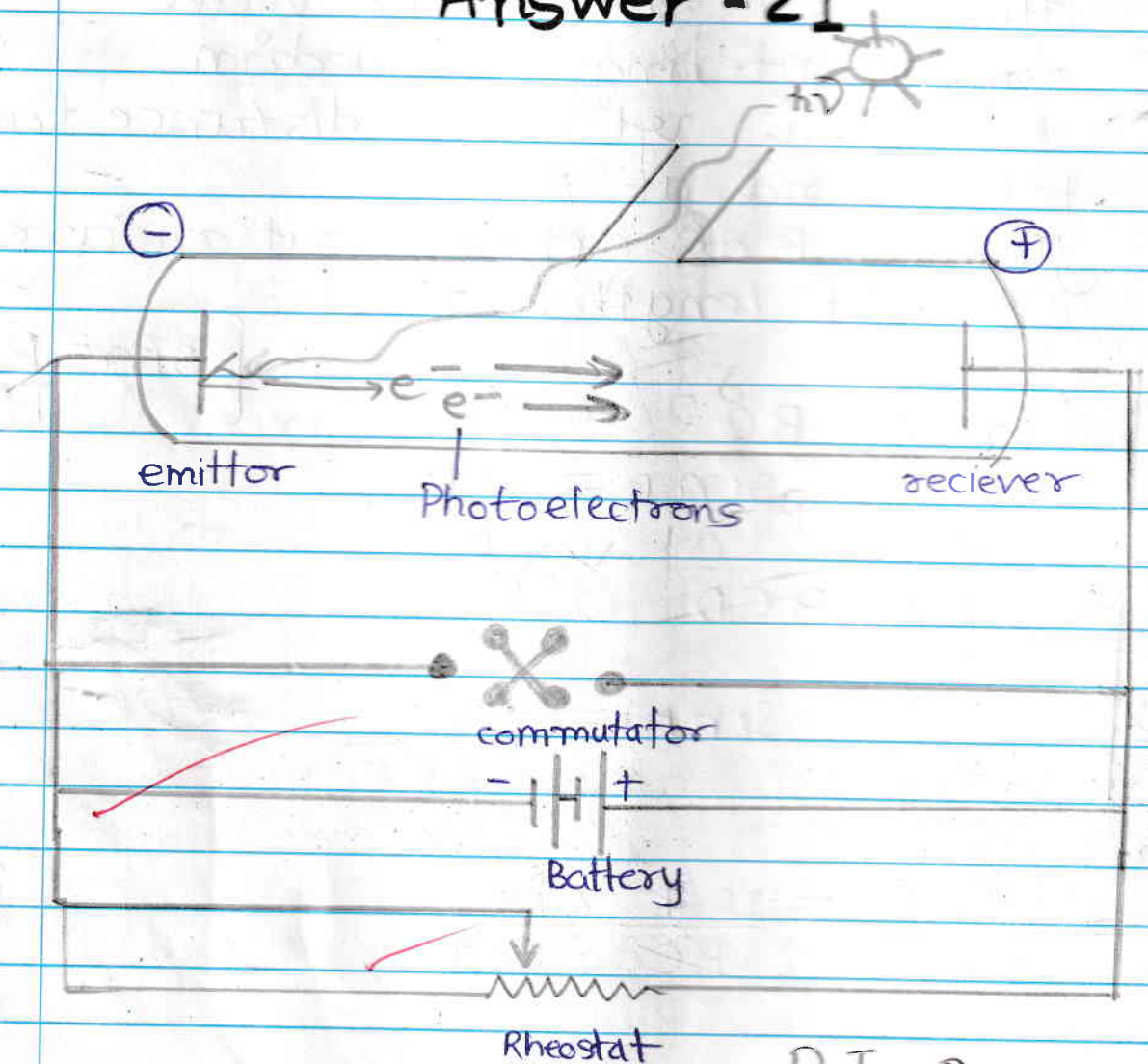
$$\frac{\sin i}{\sin r} = \frac{v_1}{v_2}$$

$$\frac{\sin i}{\sin r} = n_{21} = \text{constant}$$

Hence Snell's law is proved

∴ Refraction is proved.

Answer - 21



P.T.O.

Important conclusions →

1) When ~~in~~ the light falls on the emittor the e⁻ will emit out.

2) They required certain minimum energy work function(ϕ) and minimum frequency threshold frequency (ν_0) to emit out

3) Intensity of light ∝ no. of photo electrons emitted.

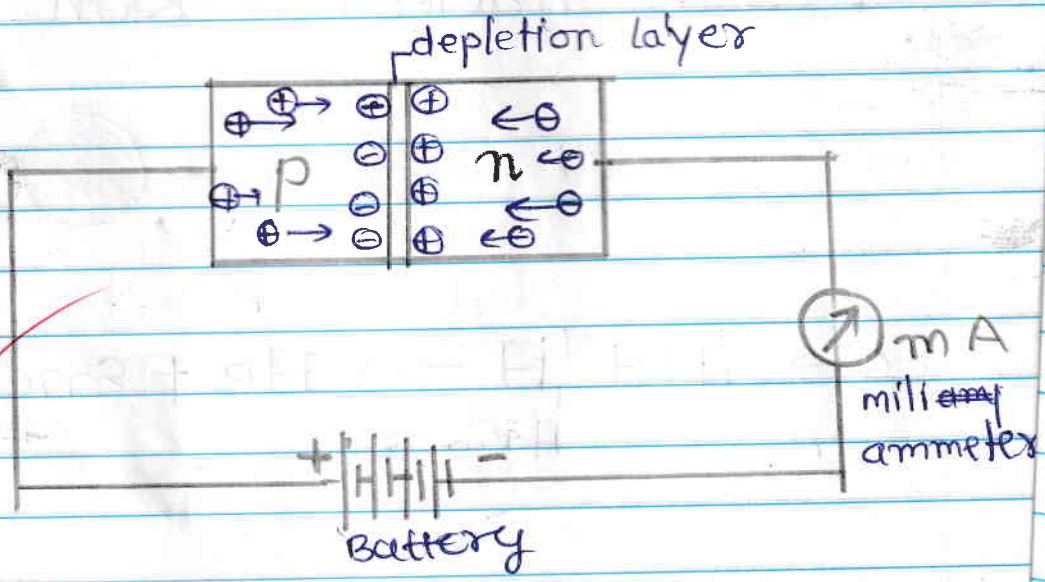
Answer-22

- Nuclear fusion → When two lighter nuclei fuses to form big nuclei is called as nuclear fusion.

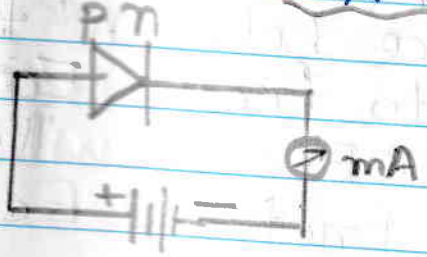
Eg → ${}_1^1H + {}_1^1H \longrightarrow {}_2^4He + Energy$

- Two applications:
- Nuclear Energy — The energy released by fusion could be used as Nuclear fuel.
- Nuclear Reaction → Nuclear in Sun fusions are the source of sun's energy.
- Nuclear weapons → The nuclear fusion is used in making Hydrogen Bomb.

Answer-23

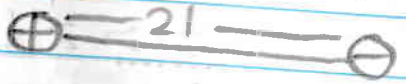


- In forward ~~bi~~ biased condition there is a flow of current
- ~~Deplet~~ Depletion layer is thin.
- Holes move to n reigon and e⁻ move to p reigon.
- p is connected → +ve terminal
- n is connected → -ve terminal
- The current is m mA (miliampere).



Answer-24

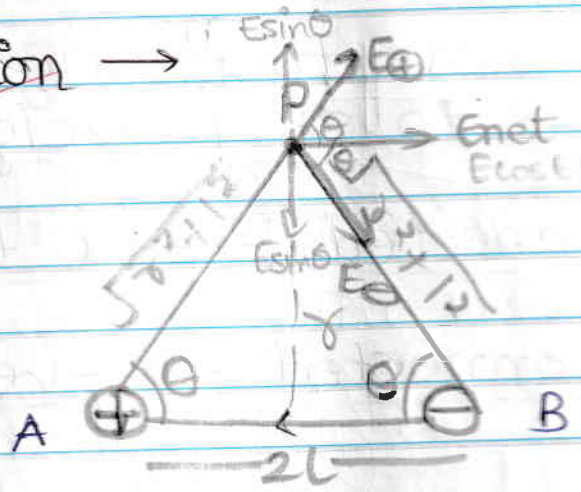
→ Electric dipole : The electric dipole is a pair of two equal and opposite charges seperated by the distance.



- Dipole moment → q × 2l
- Its direction is from

⊖ to ⊕

- Dipoles carry Electric field
- Expression →



Here AB is a dipole with 2l distance between them. We have to find Equitorial field.
($E_+ \sin\theta$ & $E_- \sin\theta$ will cancel out)

$$E_{net} = 2E\cos\theta \qquad \left(\cos = \frac{B}{H}\right)$$

$$= 2 \times \frac{kq}{(\sqrt{r^2+l^2})^2} \times \frac{l}{(\sqrt{r^2+l^2})}$$

$$= \frac{2kql}{(\sqrt{r^2+l^2})^{3/2}}$$

for short dipole

$$r >>> l$$

$$= \frac{q(2l) \times K}{(r^2)^{3/2}}$$

$$= \frac{KP}{r^3} \qquad [P = q \times 2l]$$

$$E_{net} = \frac{KP}{r^3}$$

$$E_{equitorial} = \frac{KP}{r^3}$$

Answer-25

★ Ferromagnetism —

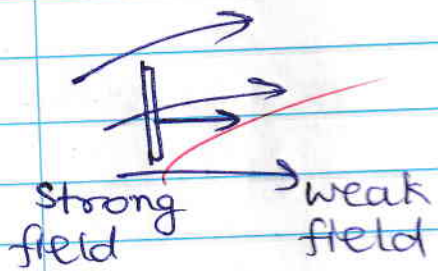
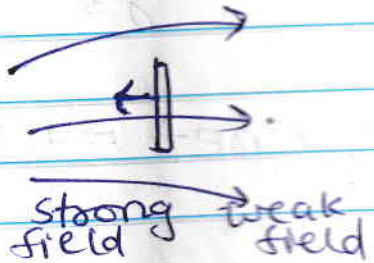
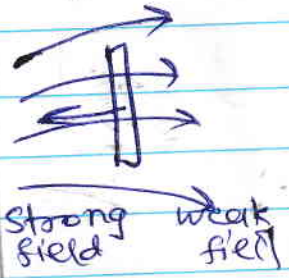
B = 0 (magnetic field)
M ≠ 0
(Magnetic moment)

B ≠ 0
M ≠ 0

- Domains are the ~~areas~~ group of the molecules having net mangnetic dipole moment.

In presence of field (B) they align (dipoles) themselves in the direction

of field.

Diamagnetic	Paramagnetic	Ferro magnetic
		
The materials move away from strong fields to weak fields	The materials move from weak field to strong fields	move from weak field to strong field
Repelled by field	weakly attracted	strongly attracted

Answer-26

(i)

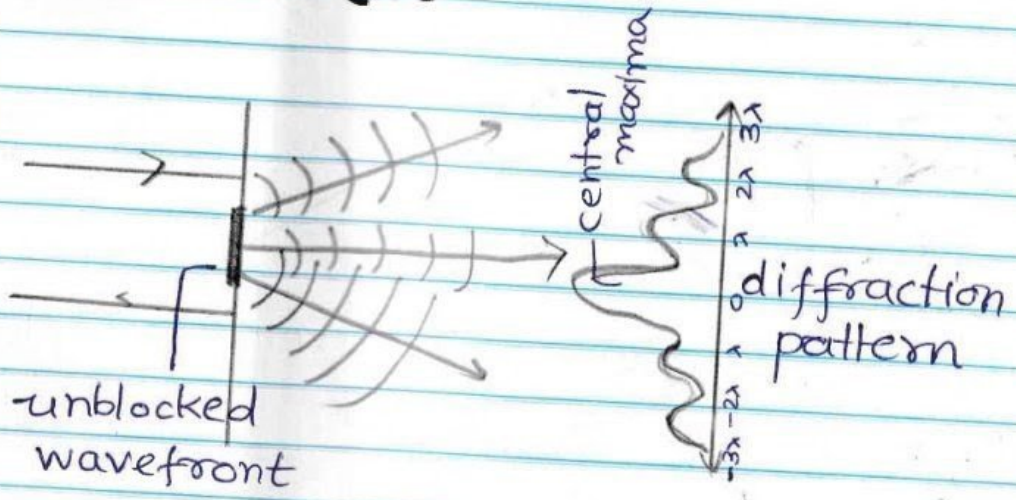
→ The size of the slit ~~so~~ should be comparable to the wavelength of light (700nm - 400nm)

(ii)

- Because ray optics consider light as a ray.

→ Diffraction is shown by wave nature of light.

(iii)



→ The unblocked wavefront create wavelets which super impose and forms the diffraction pattern.