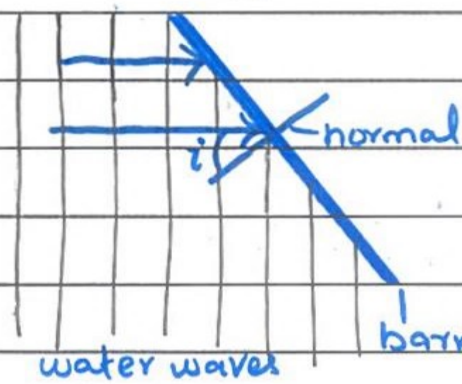
(Section B)

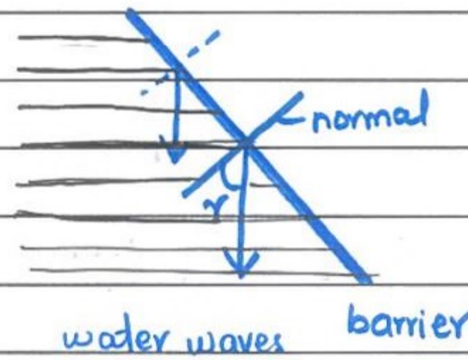
Q. No. 2 (i)

**Reflection of water waves:-**

when water waves travelling in a medium (water) enter in another medium they are reflected back towards the first medium. This is reflection of water waves. ~~in~~ ~~ri~~

i.e $\angle i = \angle r$ (angle of incidence = angle of reflection..



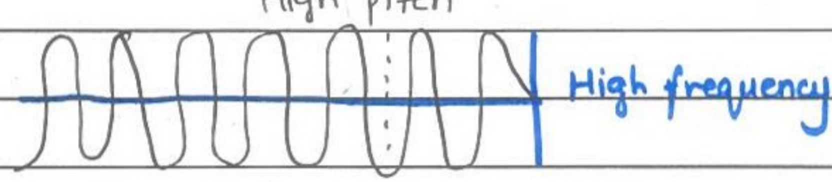

$\hat{\lambda}$ Incident Waves

$\hat{\lambda}$ Reflected Waves

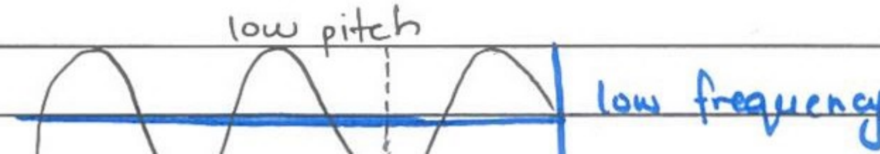
Q. No. 2 (ii)

| Pitch | Quality |
|---|---|
| It is the characteristic of sound by which we can differenciate between a shrill and grave sound. | It is the characteristic of sound that is able to distinguish between sounds of same loudness and pitch. |
| It depends directly with the frequency. (pitch $\propto$ frequency) | E.g:- clarinet and drum having same pitch and loudness can be differenciated by quality. |

High pitch




low pitch



**Q. No. 2 (iii)** Data:-

Lowest frequency $= f_1 = 20\ Hz$
Highest frequency $= f_2 = 20{,}000\ Hz$.
Speed of sound $= V = 332\ ms^{-1}$
Wavelength of $f_1 = \lambda_1 = ?$ , Wavelength of $f_2 = \lambda_2 = ?$

Sol:-

$v = f_1 \lambda_1$

$\lambda_1 = \frac{v}{f_1}$

$\lambda_1 = \frac{332}{20}$

$\boxed{\lambda_1 = 16.6m}$

$v = f_2 \lambda_2$

$\lambda_2 = \frac{v}{f_2}$

$\lambda_2 = \frac{332}{20{,}000}$

$\boxed{\lambda_2 = 0.0166\ m}$

Hence wavelength of 20 Hz of frequency will be 16.6 m and wavelength ($\lambda$) of 20,000 Hz of frequency will be 0.0166 m.

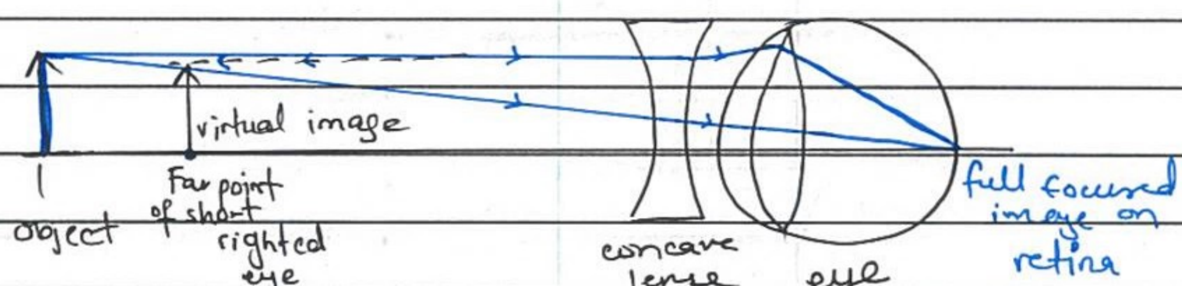
**Q. No. 2 (iv)**

→ Short sightedness:-

The disability of the eye to form clear images of **distant** objects is called as shortsightedness. It results due to the eyeball being too long and image is not fully focused on retina hence formed infront of it.

→ Correction:-

It can be corrected by using spectacles having **concave lense** or **diverging lense**. This focuses the image on retina



Q. No. 2 (v)

**Data:-**

potential at point A = $V_a$ = 100 V

potential at point B = $V_b$ = 50 V.

Charge = Q = 2 C

**Solution:-**

Energy supplied by charge $= q\Delta V \quad \therefore \Delta V = V_a - V_b$

$$= q(V_a - V_b)$$

$$= 2(100-50)$$

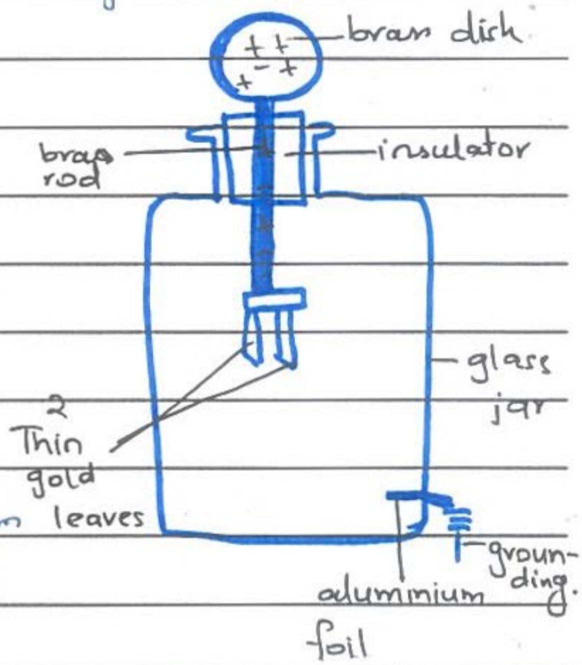
$$= 2(50)$$

$$\boxed{W = 100\ J}$$

Q. No. 2 (vi) **Construction of Gold leaf electroscope:-**

It is an instrument used to detect charges.

Gold leaf electroscope consists of a "**brass disk**" which is connected to the **brass rod** which continues with **two thin gold** leafs placed This whole apparatus is set up in a glass jar. The brass dish enters the glass jar by an **insulating material**. A thin piece of aluminium foil is also connected at the end of glass jar which is earth by a copper wire accordingly. It is to




^ Gold leaf electroscope

**Q. No. 2 (vii)**

→ The live wire is at **high** electric potential. Energy and current in our homes passes through the livewire. It travels from the main distribution board to all appliances in rooms.

→ The earth wire (**E**) is connected to metal casing of appliances for grounding. It usually carries no electricity and is connected to the metal slab placed deep in earth.

→ The neutral wire similarly is applied to appliances but these 3 wires donot cross eachother. Neutral wire (N) is responsible for the return of electricity and it is at **low potential.**

---

**Q. No. 2 (viii)** MUTUAL INDUCTION IN TRANSFORMER

The working principal of a transformer is on "**mutual induction**". It works only with AC voltages.

→ **A.C circuits and transformer:-**

It is used in A.C circuits because it is used to turn voltages up and down. Since A.C circuits allow the current to "**pass over long distances**" hence transformers use A.C circuits for carrying voltages to very large distances i.e (domestic power supply)

→ **Ideal transformer:-**

An ideal transformer dissipates no loss of energy. The power given to the secondary coil is same as power applied to primary. Hence

$$P_p = P_s$$ ($\therefore$ Input of primary = output of secondary)

$$V_p I_p = V_s I_s$$

Q. No. 2 (ix). **NOT OPERATION :-**

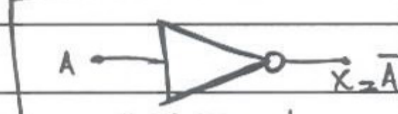
The NOT operation symbol is a bar over the symbol. Its Boolean expression is $X = \overline{A}$ (read as (X equals A not) An electronic circuit that implements NOT operation is called as "NOT gate". It has only 1 input and one output.

**NOT gate as inverter:-**

It is called as "inverter" because it changes the state of input. For example if the input is at high state (1) then the output after the NOT gate will be inverted to low state (0). And if the input is at low state (0) after NOT operation it will appear as high output (1)

Truth table

| A | $X=\overline{A}$ |
|---|---|
| 0 | 1 |
| 1 | 0 |

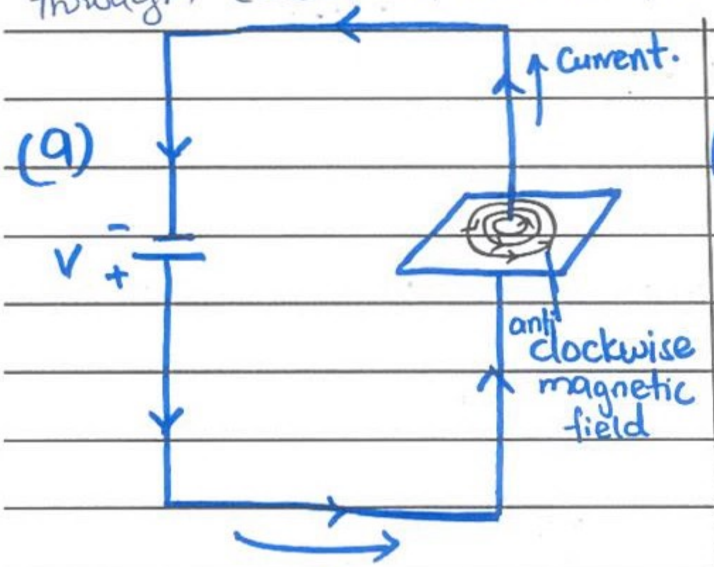


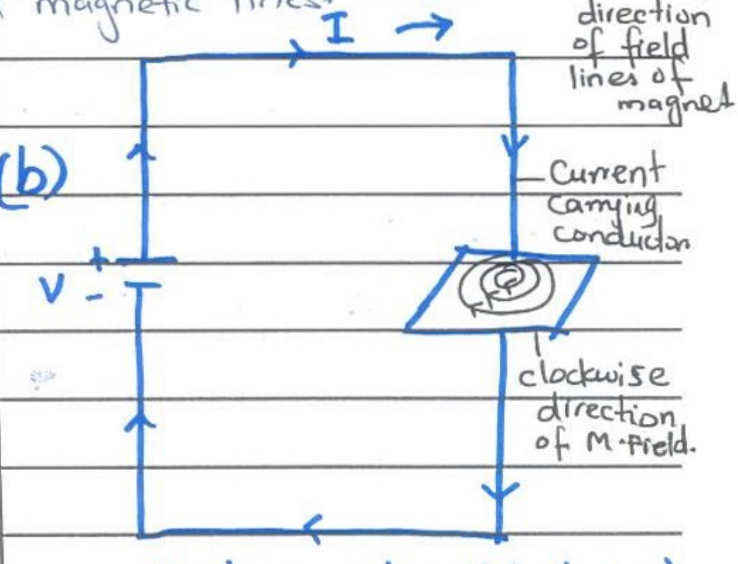
NOT gate

Right Hand Grip Rule:-

Q. No. 2 (x) If we place our right thumb in direction of current, curling fingers will tell the direction of field lines of magnet

(a) By using a straight current carrying conductor which passes through cardboard we can find magnetic lines.




**Electromagnetism (Anticlockwise**

By right hand grip rule when current is in upward direction

**Electromagnetism (Clockwise)**

By right hand grip rule when the current is in downward direction. Magnetic field is in

**Q. No. 2 (xi)**

## Fax Machine:-

A fax machine is used to copy documents from one place to another via telephone lines. It is also called as a "**telefacesmiles**". ~~The curren~~. It has a printer and "scanner" imposed to it when the telephone passes the electrical signal which is picked up by the ~~f~~fax machine the printer produces a copy of the document placed on the transmitting fax machine. It has great importance for buisness work.

**Q. No. 2 (xii)**

## → Nuclear Fusion:-

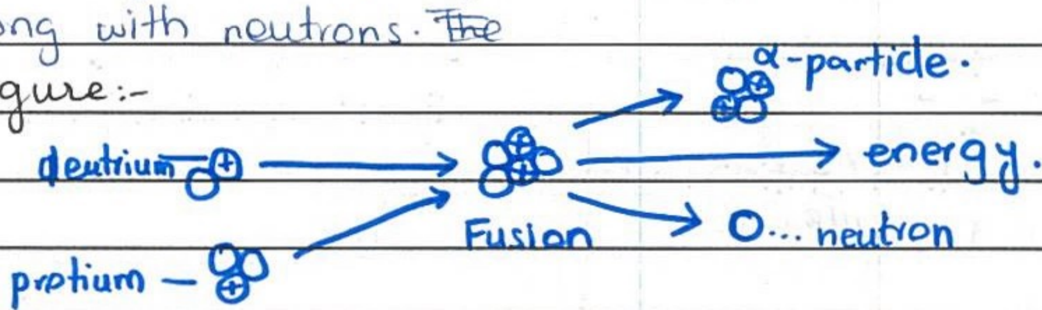
Nuclear fusion is the process when two **light** nuclie combine/fuse to form a **heavy** nuclie by emitting enormous amount of energy.

**Example:-**

$${}^{2}_{1}H + {}^{3}_{1}H \rightarrow {}^{4}_{2}He + {}^{1}_{0}n + energy.$$

When a ~~protiu~~ deutrium and tritium hydrogen atom fuse they emit alpha particles with **25.7 MeV** of energy along with neutrons. ~~The~~

Figure:-



Q. No. 2 (xiii)

**Data :-**

Radius of curvature = $R = 38$ cm.

object distance = $p = 50$ cm.

**Solution:-**

a) focal length = $f = \frac{R}{2} = \frac{38}{2} = 19$ cm.

(b) Using lense formula

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

$$\frac{1}{q} = \frac{1}{19} - \frac{1}{50}$$

$$\frac{1}{q} = \frac{50-19}{(19)(50)}$$

$$\frac{1}{q} = 0.0326$$

$$q = 1/0.0326$$

$$\boxed{q = 30.6 \text{ cm.}}$$ (infront of mirror)

(c) Image will appear infront of mirror and it will be '**inverted**'

Q. No. 2 (xiv)

**Given =**

$C_1 = 3\mu F = 3 \times 10^{-6} F$

$C_2 = 4\mu F = 4 \times 10^{-6} F$

$C_{eq} = \frac{60}{47}\mu F = \frac{60}{47} \times 10^{-6} = 1.27 \times 10^{-6}$

**Solution:-**

In series,

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$\frac{1}{1.27 \times 10^{-6}} = \frac{1}{3 \times 10^{-6}} + \frac{1}{4 \times 10^{-6}} + \frac{1}{C_3}$$

$$\frac{1}{C_3} = \frac{1}{1.27 \times 10^{-6}} - \frac{1}{3 \times 10^{-6}} - \frac{1}{4 \times 10^{-6}}$$

$$\frac{1}{C_3} = 204068.8$$

$$C_3 = \frac{1}{204068.8}$$

$$C_3 = 4.9\mu \approx 5\mu$$

$$\boxed{C_3 = 5\mu}$$

Q. No. 2 (xv)

## Intensity level :-

The difference between loudness of an unkown sound (L) and ~~loud~~ness of reference intensity ($L_o$) is defined as intensity level. It is equal to

$$\underset{(I.L)}{L - L_o} = K \log \frac{I}{I_o} \quad (\because I_o = 10^{-12} Wm^{-2})$$

Units :-

- When K = 1, the unit of intensity level is in (Bel) the intensity level becomes. $I.L = \log \frac{I}{I_o}$ (bel) Bell is a large unit.
- When K = 10, the unit of intensity level is in (dB). 1 decibel is $\frac{1}{10}$th of a bel. (1 bel = 10 dB) The intensity level in decibels becomes $I.L = 10 \log \frac{I}{I_o}$.

Q. No. 3 (Page 1/4)

(a)

**Resistance :-**

The property of a substance that provides opposition to flow of current is called as resistance.

**SI unit :-**

SI unit of resistance is **ohm** ($\Omega$).

It is defined as,

"When a potential difference of one volt is applied across the conductor and a (~~charge of 1 coloumb~~) or current of 1A passes through it. The resistance is said to be 1 ohm.

**Formula :-**

By ohms law, $V = IR$

$$R = \frac{V}{I}$$

~~Other smaller units of resistances are~~

~~$1\mu F = 1\times10^{-6} F$, $1 pF = 1\times10^{-12} F$, $1nF = 1\times10^{-9} F$~~

**Factors Affecting Resistance :-**

Resistance in a metallic conductor depends on the following factors.

- Nature of Conductor
- Temperature of Conductor
- Area of the conductor wire
- length of the conductor (i.e wire).

**• Nature of Conductor :-**

Resistance depends on the nature of the conductor. A metallic conductor that has greater atomic number

**Q. No. 3 (Page 2/4)**

through these metals the resistance gets how because of the increase in number of collisions of electrons with the metals. Thus, resistance is much greater in some conducting metals than others

Steel wire have more resistance than copper wires

- **Temperature:-**

Similarly, the resistance in a conductor is directly related with the increase in temperature. The greater the temperature is the greater is the resistance. This is due to the huge vibratory motion gained by electrons so they start colliding with metal at great rates hence.

Resistance $\propto$ Temperature

$$R \propto T.$$

- If temperature increases, resistance will also increase.
- If temperature decreases, resistance will also decrease.

- **Length of the conductor wire:-**

The Resistance in a conducting wire is directly proportional to the length of the conductor.

$$R \propto L \;\cdots\cdots (i)$$

As the length of the wire increases the resistance in the wire will also increase

- long wires provide more resistance.
- short wires provide less resistance.

- **Area of conductor:-**

The Resistance in a conductor is inversely proportional to the area of the conductor hence

$$R \propto \frac{1}{A} \;\cdots\cdots (ii)$$

Q. No. 3 (Page 3/4)

- Thick wires will give less resistance.
- Thin wires will provide more risistance.

So, As the area of a given conductor increases the resistance decreases.

• **Specific Resistance:-**

By using eq (i) and (ii).

$$R \propto \frac{L}{A}$$

$$R = \rho \frac{L}{A}$$

where 'ρ' is the constant of proportionality called as specific resistance. SI unit is (ohm. metre) Ωm. It depends on nature of the conductor i.e iron, silver, tin, brass, copper.

(b)

**Data:-**

Power = P = 500 MW = $500 \times 10^6$ W

Voltage = V = 250 kV = $250 \times 10^3$ V.

Current = I = ?

**Solution:-**

$$P = VI$$

$$I = \frac{P}{V}$$

$$I = \frac{500 \times 10^6 W}{250 \times 10^3 V}$$

$$I = 2000 A$$

$$\boxed{I = 2 \times 10^3 A}$$

Q. No. 3 (Page 4/4)

Q. No. 4 (Page 1/4)

NUCLEAR DECAY :- -a-

The process in which unstable nuclei changes to/decays to stable nuclei.
There are 3 types of decays ( $\alpha$, $\beta$ and $\gamma$ decays).
We will represent the decays by a parent nuclide $^{A}_{Z}X$ that undergoes decay and forms daughter nuclide $^{A}_{Z}Y$.

1. $\alpha$ decay :-

In alpha decay the radioactive element undergoes changes in its atomic number and mass number.
The atomic mass (A), decreases by 4.
The atomic number (Z) decreases by 2
The neutron number (N) decreases by 2.

Equation:-

$$^{A}_{Z}X \longrightarrow {}^{A-4}_{Z-2}X + {}^{4}_{2}He + Energy.$$

Example:- Radium -226 undergoes $\alpha$-decay.

$$^{226}_{88}Ra \longrightarrow {}^{222}_{86}Rn + {}^{4}_{2}He + Energy$$

(Radium) (Radon) ($\alpha$-particle) (energy)

In $\alpha$-decay, $\alpha$ rays are emitted.

2. $\beta$ decay :-

In $\beta$ decay the following changes are underwent by the parent nuclide and Beta rays are emitted.
The atomic mass (A) remains unchanged
The atomic number (Z) increases by 1.
The neutron number (N) decrease by 1

Equation:-

$$^{A}_{Z}X \longrightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + energy$$

($\beta$-particle).

Q. No. 4 (Page 2/4)

**Example:-** Caubon-14 isotope undergoes beta decay

$$^{14}_{6}C \longrightarrow ^{14}_{7}N + ^{0}_{-1}e + energy$$

(carbon isotope) (nitrogen atom) (β-ray)

**γ- decay (gamma -decay):-**

In gamma decay **no change** occurs within the atomic number and mass number of parent nuclei. it is followed by emission of just γ rays and it is done due to the decay of an excited nuclie. They have no charge

**Equation:-**

$$^{A}_{z}X^{*} \longrightarrow ^{A}_{z}X + ^{0}_{0}\gamma\text{-rays} + energy$$

**Example:-** Cobalt undergoes gamma decay

$$^{60}_{27}Co^{*} \longrightarrow ^{60}_{27}Co + ^{0}_{0}\gamma\text{-particles} + energy.$$

γ-rays are emitted along with α or β particles.

| α-particles | β-particles | γ-particles |
|---|---|---|
| They have a charge of 2e. They have the representation of Helium which are doubly positively charged. They have large mass. In α-decay they are emitted | These have charge of -1. These are basically electrons. They have small mass and are emitted in β-decay of a nuclei. | These have no charge. These are massless photons of light and they are emitted when an atom undergoes γ-decay. |

**Q. No. 4 (Page 3/4)**

(b)

| Data:- | To Find:- |
| --- | --- |
| Resistance of 1st Resistor = $R_1 = 2\,\Omega$ | $R_{eq} = ?$ |
| Resistance of 2nd Resistor = $R_2 = 3\,\Omega$ | $I = ?$ |
| Resistance of 3rd Resistor = $R_3 = 6\,\Omega$ | $I_1 = ?, I_2 = ?, I_3 = ?$ |
| Voltage = 6V. | |

**Solution:-**

(i) Equivalent Resistance = $R_{eq}$

Since the resistors are connected in parallel the equivalent resistance will be.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{2\Omega} + \frac{1}{3\Omega} + \frac{1}{6\Omega}$$

| | |
| --- | --- |
| 2 | 2, 3, 6 |
| 3 | 1, 3, 3 |

$$\frac{1}{R_{eq}} = \left(\frac{3+2+1}{6}\right)\frac{1}{\Omega}$$

$$\frac{1}{R_{eq}} = \frac{6}{6} \times \frac{1}{\Omega}$$

$$\frac{1}{R_{eq}} = \frac{1}{\Omega}$$

$$\boxed{R_{eq} = 1\,\Omega}$$

It is less than the smallest value of an the individual resistor.

(ii)

In parallel combination, the current is divided among the resistances ~~Q = Q1 + Q2 + Q3~~. $I = I_1 + I_2 + I_3$.

Q. No. 4 (Page 4/4)

By $V = IR$. (Ohm's law), We derive the following.

$$I_1 = \frac{V}{R_1} = \frac{6V}{2\Omega} = 3\ A$$

$$I_2 = \frac{V}{R_2} = \frac{6V}{3\Omega} = 2\ A$$

$$I_3 = \frac{V}{R_3} = \frac{6V}{6\Omega} = 1\ A$$

(iii)

The total current in the parallel combination of resistors is the sum of the individual ~~res~~ currents passing through each resistance because the current is divided among.

So,

$$I = \frac{V}{R_{eq}} = \frac{6V}{1\Omega} = 6A \quad \text{or}$$

$$I = I_1 + I_2 + I_3$$

$$I = 3 + 2 + 1$$

$$\boxed{I = 6\ A}$$

Q. No. 5 (Page 1/4) (a)

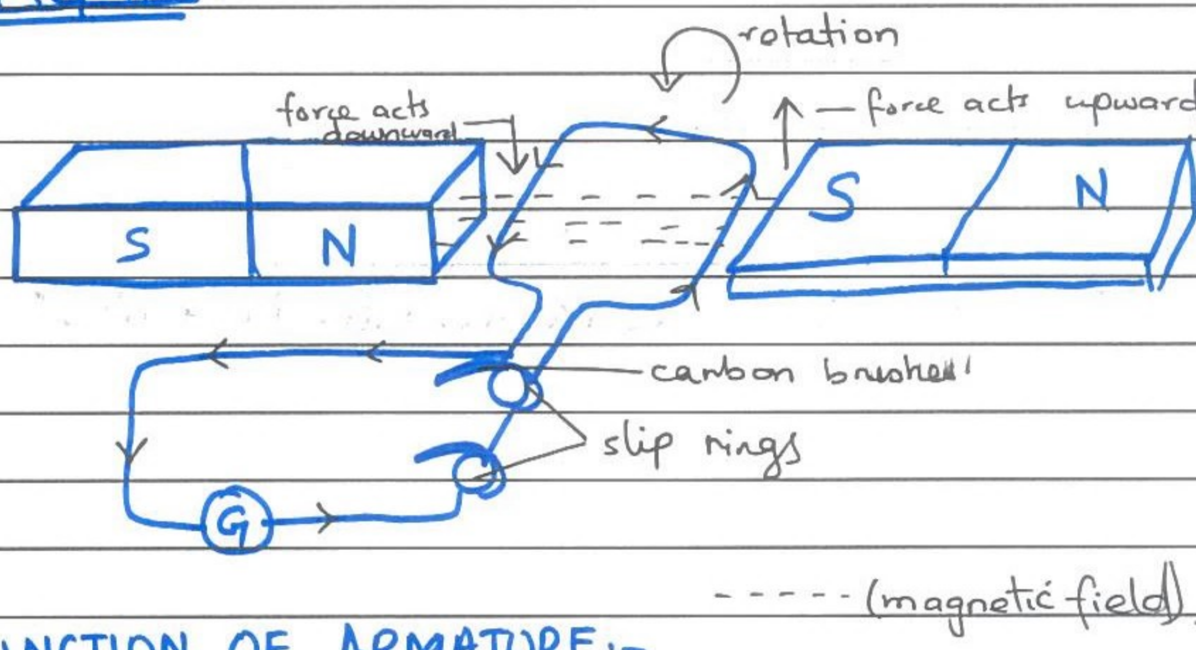
- **AC generator** It is a device used to convert mechanical energy to electrical energy.
- AC generator consists of an armature that rotates inside the magnetic field of either a permanent magnet or bar magnet.
- **GENERATOR:-**

A generator is present in AC generator. The rotational kinetic energy of ~~genera~~ coil (armature) produces an induced current (I) in the generator and it is then used to drive electrical energy to domestic and industrial areas.

- **SLIP RINGS:-**

The armature is connected by slip rings. attached to carbon brushes.

- **FIGURE:-**




→**FUNCTION OF ARMATURE:-**

The coil (armature) rotates inside the magnetic field due to its rotation it leads to the change in the number of magnetic lines of force passing

Q. No. 5 (Page 2/4)

is induced. This leads to the production of current The current is then used to operate the generator.

PRODUCTION OF E·M·F :-

The production of induced e·m·f due to the rotation of the armature depends upon.

- Length of the coil in the field
- Increasing the number of loops.
- No of change in magnetic field line passing.

When the coil is perpendicular to the magnetic field the e·m·f is minimum. The number of lines passing through the trough is maximum so field lines don't change much. When the coil is parallel to the magnetic field the e·m·f induced is maximum due to maximum amount of changing force of magnetic field. The current thus induced is also maximum.

So, we can conclude that;

AC works on " electromagnetic induction" as proposed by Faraday

" The process of inducing a current due to the change in the number of lines of magnetic field passing is called as electromagnetic induction"

Q. No. 5 (Page 3/4) (b)

wavelength = $\lambda$ = 6 cm = 0.06 m.

No of waves = 100

time = t = 20 s.

f = ? , $\lambda$ = ?

T = ?

Solution:-

i) $f = \frac{\text{no of waves}}{\text{time in seconds}}$

$f = \frac{100}{20}$

$f = 50$ Hz.

(ii) Time period = $T = \frac{1}{f}$

$T = \frac{1}{f}$

$T = \frac{1}{50}$

iii) $T = 0.02$ s

v

$v = f\lambda$

$v = (50)(0.06)$

$v = 3\ ms^{-1}$

Q. No. 5 (Page 4/4)