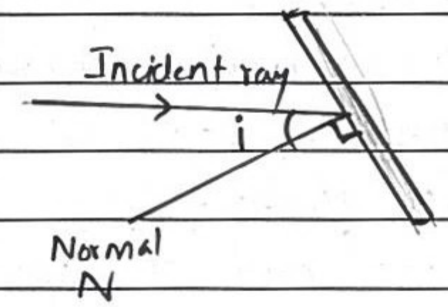
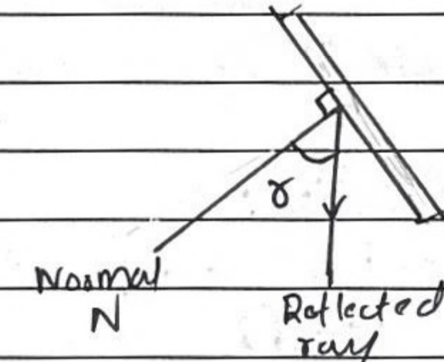
(Section B)

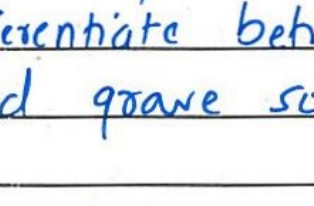
Q. No. 2 (i) Reflection of water waves:- "When water waves travelling in one medium fall on the surface of another medium, they reflect back into the first medium such that angle of incidence is equal to angle of reflection. This is called reflection of water waves". => When we place a barrier parallel to water waves, they reflect back. If we place a barrier at an angle to the wave front, the water waves are clearly seen to obey law of reflection i.e the angle of incident ray along normal is equal to angle of reflected ray along normal.

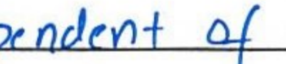


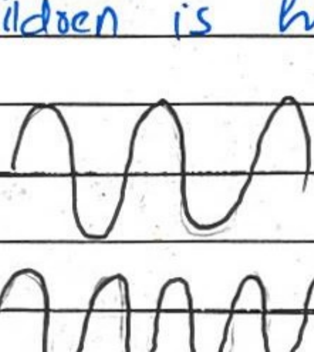


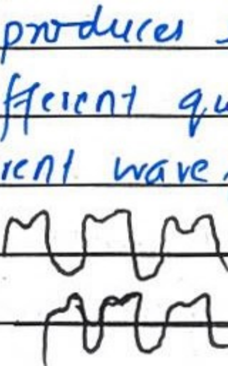
Q. No. 2 (ii)

Pitch	Quality of Sound
1. Pitch is the characteristic of sound by which we can differentiate between shrill and grave sound.	Quality is the characteristic of sound by which we can differentiate between two sounds of same loudness and pitch.
2- Dependent on frequency	3- Independent of frequency.
3- Pitch of women and children is higher than men	4- Flute, harmonium and clarinet produces sounds having different quality because of different wave forms.









Q. No. 2 (iii) Given:

Lowest audible frequency = 20 Hz
Highest audible frequency = 20,000 Hz
Speed of sound = v = 332 ms^{-1}

To find:
Wavelength of sound at lowest audible frequency and highest audible frequency = ?

Solution:
=> λ at lowest audible frequency –

$v = f\lambda$

$\lambda = \frac{v}{f} = \frac{332}{20} = 16.6\ m$

=> λ at highest audible frequency: –

$v_0 = f_0 \lambda_0$

$\lambda_0 = \frac{v}{f_0}$

$\lambda_0 = \frac{332}{20,000}$

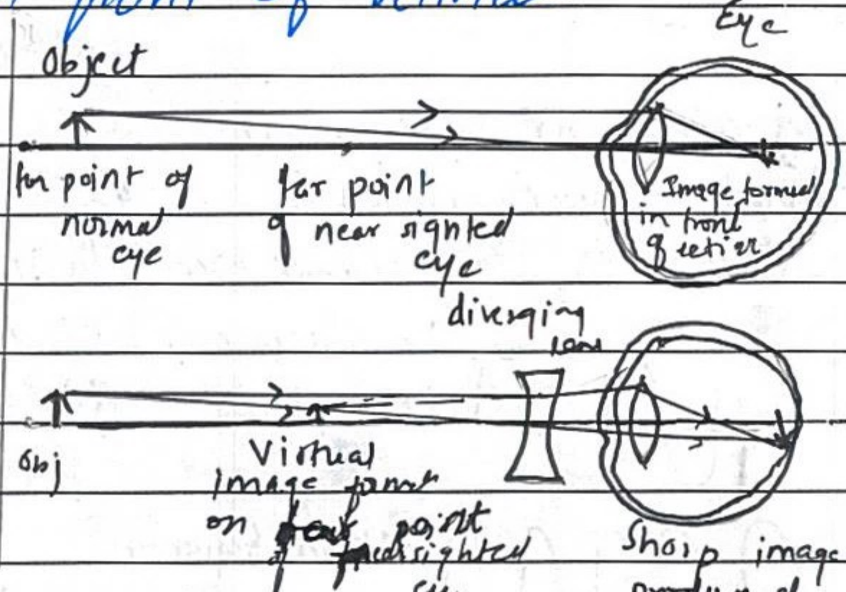
$\lambda_0 = 0.0166\ m.$

Result: – Thus, the wavelength of sound of lowest audible frequency is ~~0.0~~16.6 m and that of highest audible frequency is of 0.0166 m.

Q. No. 2 (iv) Myopia: – The inability of the eye to form distinct image of distant object on retina is called myopia (short-sightedness).

Cause: – It's due to the eyeball being too long. Image is formed in front of retina.

Correction: – It can be corrected by using a concave lens. The light rays are now diverged by concave lens before forming an image on retina. Thus, sharp



Q. No. 2 (v) Given:-

Charge = q = +2 C

Higher potential = V_A = 100 V

Lower potential = V_B = 50 V

To find:

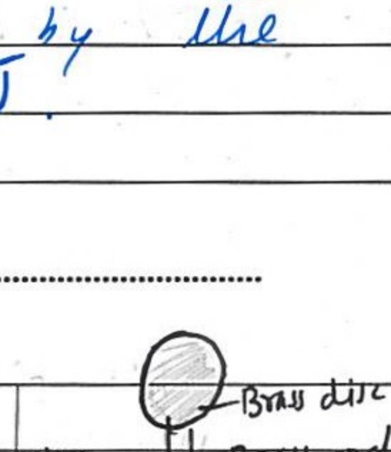
Energy supplied by charge = $\mathcal{E}$ = ?

Solution:-

$$\mathcal{E} = q\Delta V$$
$$= 2 \times (100-50)$$
$$= 2 \times 50$$
$$\mathcal{E} = 100\ J$$

Result:- Thus, the energy supplied by the point charge would be 100 J.

Q. No. 2 (vi) A gold leaf electroscope is an instrument which is used to detect charges.



Construction: Brass rod passes through an insulator to keep it in place.
A gold leaf electroscope consists of brass rod with a brass disk at the top and two thin leaves of gold foil hanging at the bottom of rod. Charges can easily flow from brass disc to the gold leaves via the brass rod. On the bottom of the jar, an aluminium foil is present which has been earthed by means of a copper wire. This protects the leaves from external

Q. No. 2 (vii)
1- **Live wire**: The live wire is represented by red or brown colour. It is maintained at very high potential 220 V and is used to carry current. It is connected separately to each appliance using a fuse.
2. **Neutral wire**: The neutral wire is represented by black or blue colour. It is maintained at zero potential by connecting it to the power station itself. It provides potential difference for current to flow and provides return path for current.
3 - **Ground wire**: It is maintained at zero potential. It's connected to a large metal plate buried near the house. It provides a safe path for current to flow to ground in case of large unsafe current

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Q. No. 2 (viii) **Transformer**:- Transformer is used to increase or decrease AC voltages.
Working principle:- Transformer works on the principle of mutual induction which states:- "The production of induced current in a coil due to the change in current in neighbouring coil is called mutual induction".
Use in AC circuits:- It's used to increase or decrease AC voltages. They can only work with AC current as changing current produces varying magnetic field which induces current in secondary coil. With the help of transformer we can transmit current over long distances with little loss of energy.
Ideal transformer:- Ideal transformer is the one in which input

Q. No. 2 (ix) NOT operation:- It converts a logic level into its opposite logic level. It inverts the state of Boolean variable"

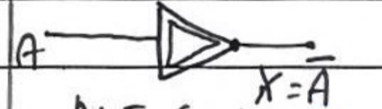
Symbol: • Represtented by a bar or line over the output

Boolean expression: $X = \bar{A}$, read as X equals A NOT".

A	$X = \bar{A}$
0	1
1	0

Truth table:- Set of inputs and outputs in binary form.

NOT gate:- The gate which implements NOT operation is called NOT gate. It has one input and one output.



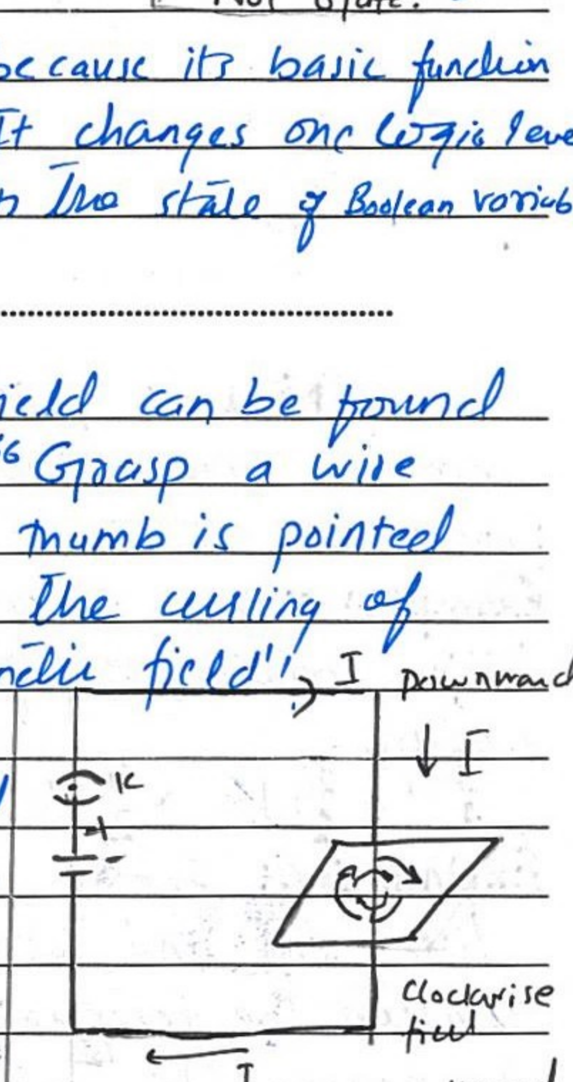
NOT Gate.

Inverter: NOT gate is called inverter because its basic function is inversion or complementation. It changes one logic level into opposite logic level. It inverts the state of Boolean variable.

Q. No. 2 (x) The direction of magnetic field can be found with the right hand rule :- "Grasp a wire with your right hand such that thumb is pointed in direction of current then the curling of finger indicates direction of magnetic field".

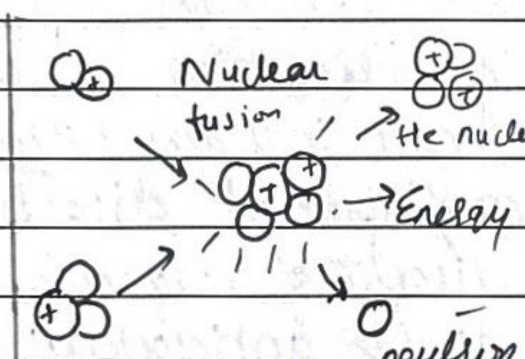
(a) Upward direction: The direction of magnetic field would be in anticlockwise direction

(b) Downward direction: The direction of magnetic field would be in clockwise direction



Q. No. 2 (xi)

Q. No. 2 (xii) **Nuclear fusion**: "When two lighter nuclei combine to form a heavier nucleus, the process is called nuclear fusion".



Example:- When deuterium and tritium combine, the form Helium nucleus.

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

Explanation: Energy coming from the sun and stars is the result of fusion reaction. The temperature in the centre of Earth is nearly 20 million Kelvin which makes fusion favourable. In this reaction, four hydrogen nuclei combine to form a Helium nucleus along

Q. No. 2 (xiii) Given:

$R = 38$ cm

$p = 50$ cm

To find:

$f = ?$, $q = ?$, nature of image.

Solution:

(a) $f = \frac{R}{2}$

$f = \frac{38}{2}$

$f = 19$ cm

(b)

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

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

$\frac{1}{q} = \frac{1}{19} - \frac{1}{50} \Rightarrow \frac{1}{q} = \frac{50-19}{950}$

$\frac{1}{q} = \frac{31}{950} \Rightarrow q = \frac{950}{31}$

$q = 30.64$ cm

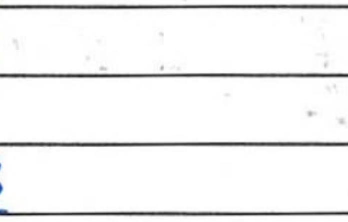
(c) The image will be inverted as image distance is positive.

Q. No. 2 (xiv) Given:–

$C_{eq} = \frac{60}{47}\ \mu F$

$C_1 = 3\mu F$

$C_2 = 4\mu F$



To find: $C_3 = ?$

Solution:–

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

$\frac{47}{60} = \frac{1}{3} + \frac{1}{4} + \frac{1}{C_3}$

$\frac{47}{60} = \frac{4+3}{12} + \frac{1}{C_3}$

$\frac{47}{60} = \frac{7}{12} + \frac{1}{C_3}$

$\frac{1}{C_3} = \frac{47}{60} - \frac{7}{12}$

$\frac{1}{C_3} = \frac{47\cancel{0} - 329}{564}$

$\frac{1}{C_3} = \frac{391}{564}$

$C_3 = \frac{564}{391}\ \mu F$

C_3

Q. No. 2 (xv) Intensity Level: The difference between the loudness L of an unknown sound and loudness L_0 of the faintest audible sound, is called the intensity level of the unknown sound.

Formula and unit: - It has 2 units. One is Bel. It is the larger unit.

$$\text{Intensity level} = \log \frac{I}{I_0} \quad (1\ \text{Bel})$$

Decibel (dB) is relatively a smaller unit and is SI unit of Intensity level. 1 Bel = 10 dB

$$\text{Intensity level} = 10 \log \frac{I}{I_0} \quad (1\ \text{dB})$$

$$I.L = k \log \frac{I}{I_0}$$

$$= \log \frac{I}{I_0}$$

Q. No. 3 (Page 1/4)

(a) **Resistance:** "The property of a substance which offers opposition to the flow of current / charge through it is called resistance."

Cause:- The moving electrons collide with the atoms of the substance which causes resistance.

Formula:-

$$V \propto IR$$

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

Here, R is the constant of proportionality called the resistance.

SI unit:- SI unit of resistance is Ohm (Ω)

$$V = IR$$

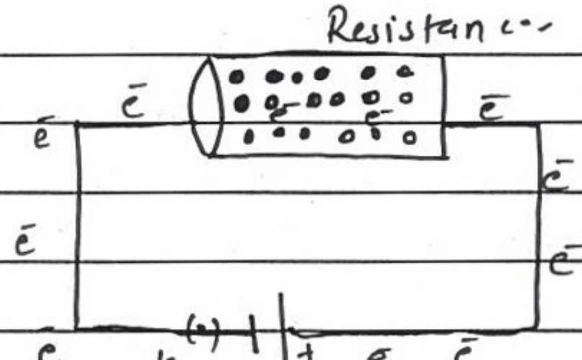
$$R = \frac{V}{I} = \frac{1V}{1A}$$

$$R = 1\,VA^{-1}$$

$$R = 1\,\Omega$$

Definition:-

When a potential difference of 1 Volt is applied across the conductor and 1 Ampere of current passes through it, the resistance will be 1 ohm (1Ω)



Q. No. 3 (Page 2/4)

Factors affecting Resistance:-

Introduction:

- Pipes with long length offer more opposition to water flow as compared to a shorter pipe
- Similarly, pipes with large cross-sectional area offer less resistance to water flow as compared to the pipe with smaller cross-sectional area
- In the same way, the resistance offered by wires depend on their length and cross-sectional area. Thick wires offer less resistance than thin pipes.
- It also depends on the **nature of metal**. Copper wires of same length as silver wires have less resistance.
- Resistance of conductor also depends on **temperature**.

Derivation of formula of specific resistance:

(i) $R \propto L \longrightarrow (i)$

If we double the length of conductor, then the resistance is doubled. If the length is halved, the resistance is also halved. Thus, resistance and length are directly related with eachother.

Q. No. 3 (Page 3/4)

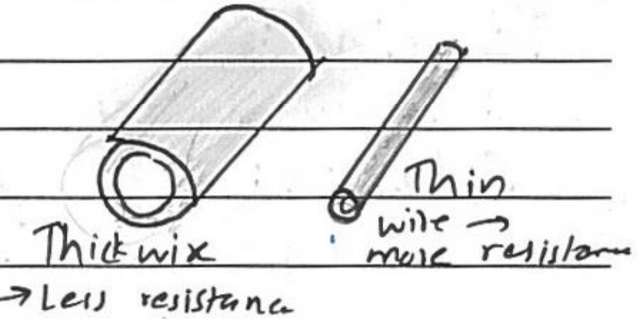
(ii) $R \propto \frac{1}{A}$ → (ii)

The resistance is inversely related with Area. Thick wires have less resistance than thin wires.

→ Combining eq (i) & (ii) :-

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

$R = \rho \frac{L}{A}$ → (a)



Specific resistance :-

In eq (a), ρ is constant and is called the specific resistance.

Dependence :-

Specific resistance of a substance depends on the nature of metal

i.e. ρ of Cu = $1.69 \times 10^{-8}\ \Omega m$

ρ of Fe = $9.8 \times 10^{-8}\ \Omega$

Definition :-

The resistance of 1 m^3 of a substance is called specific resistance.

Unit :-

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

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

$\rho = \frac{\Omega \cdot m^2}{m} = \Omega m \Rightarrow \rho = \Omega m.$

Q. No. 3 (Page 4/4)

(b) Given:-

Input power $= 500\ MW$

$= 500 \times 10^6\ W$

Input voltage $= 250\ KV$

$= 250 \times 10^3\ V$

To find:

Primary current $= I_p = ?$

Solution:

$P_{input} = I_p V_p$

$I_p = \frac{P_{in}}{V_p}$

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

$= 2 \times 10^{6-3}$

$= 2 \times 10^3\ A$

$I_p = 2000\ A$

or $2\ KA$

$I_p = 2000\ A$

or

$I_p = 2\ KA$

Result:-

The current flowing in the transmission line should be 2000 A.

Q. No. 4 (Page 1/4)

(a)
Nuclear Transmuttation :
The process,

(a) Nuclear Transmuttation:
The spontancous process in which an unstable parent nuclide changes into more stable daughter nuclide with the emission of radiations is called nuclear transmuttation."

RADIOACTIVE DECAY

The unstable parent nuclide decays into more stable parent nuclide by emitting Alpha(α), Beta(β) or gamma (γ) particles.

(i) α - decay :- "The radio-active decay which produces alpha particles is called alpha decay''.

Decay equation:

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

Unstable Parent nuclide — Stable daughter nuclide — α-particle.

Explanation:
In alpha decay, the atomic mass of the parent(A) nuclide decreases by 4 while the atomic number decreases by 2. The α-particles are doubly

Q. No. 4 (Page 2/4)

Example:

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

α-particle

(ii) Beta decay (β):- "The radioactive decay which produces or releases β-particles is called Beta-decay"

Decay equation:-

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

Parent nuclide — Stable daughter nuclide — Beta-particle

Explanation:

In Beta decay, the Atomic mass of the parent nuclide remains same while atomic number Z increases by 1. Beta particles are a stream of high energy electrons ejected at various speeds as close as to the speed of light. A nucleus with excess of neutrons may decay by emitting β-particles.

Example:-

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

β-particle.

Q. No. 4 (Page 3/4)

(iii) Gamma-decay (γ):

Definition

The radioactive decay which released γ-rays is called gamma decay.

Decay equation:-

$${}^{A}_{Z}X^{*} \longrightarrow {}^{A}_{Z}X + \gamma\text{-rays} + \text{Energy}$$

Unstable parent nuckide   Stable daughter nuclide.

Explanation:-

γ-decay leaves the number of protons, neutrons and electrons unchanged. and the atomic mass (A) also remains the same. γ-rays are usually emitted along with α-particles and β-particles. γ-rays are massless and chargeless. γ-rays are high energy light photons with high frequency with extremely short wavelength.

Example:-

$${}^{60}_{27}Co^{*} \longrightarrow {}^{60}_{27}Co + {}^{0}_{0}\gamma\text{-ray} + \text{Energy}$$

Parent nuclide.   Daughter nuclide

$\Rightarrow$ Thus, in γ-decay the excited parent nuclide changes into more stable daughter nuclide.

Q. No. 4 (Page 4/4)

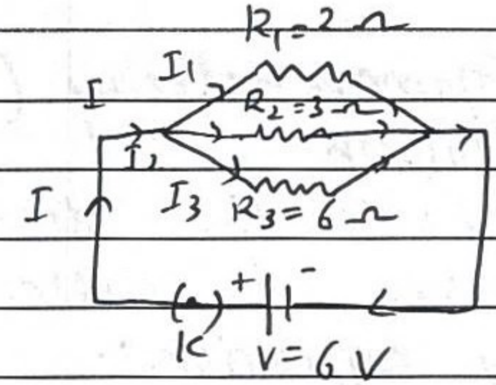
(b) Given:

$R_1 = 2\,\Omega$

$R_2 = 3\,\Omega$

$R_3 = 6\,\Omega$

$V = 6\,V$



To find:

$R_{eq} = ?$

$I_1 = ?,\ I_2 = ?,\ I_3$

$I = ?$

Solution:

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

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

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

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

$R_{eq} = \frac{6}{6}$

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

(ii) $V = IR$

$I_1 = \frac{V_1}{R_1} \Rightarrow I_1 = \frac{6}{2}$

$I_1 = 3\,A$

$I_2 = \frac{V_2}{R_2} \Rightarrow I_2 = \frac{6}{3}$

$I_2 = 2\,A$

$I_3 = \frac{V_3}{R_3} \Rightarrow I_3 = \frac{6}{6}$

$I_3 = 1\,A$

(iii) $I = \frac{V}{R_{eq}}$ | $I = I_1 + I_2 + I$

$I = 3+2+1 = 6$

$I = 6 \Rightarrow I = 6\,A$

Q. No. 5 (Page 1/4)

Q. No. 5 (Page 2/4)

Q. No. 5 (Page 3/4)

Q. No. 5 (Page 4/4)