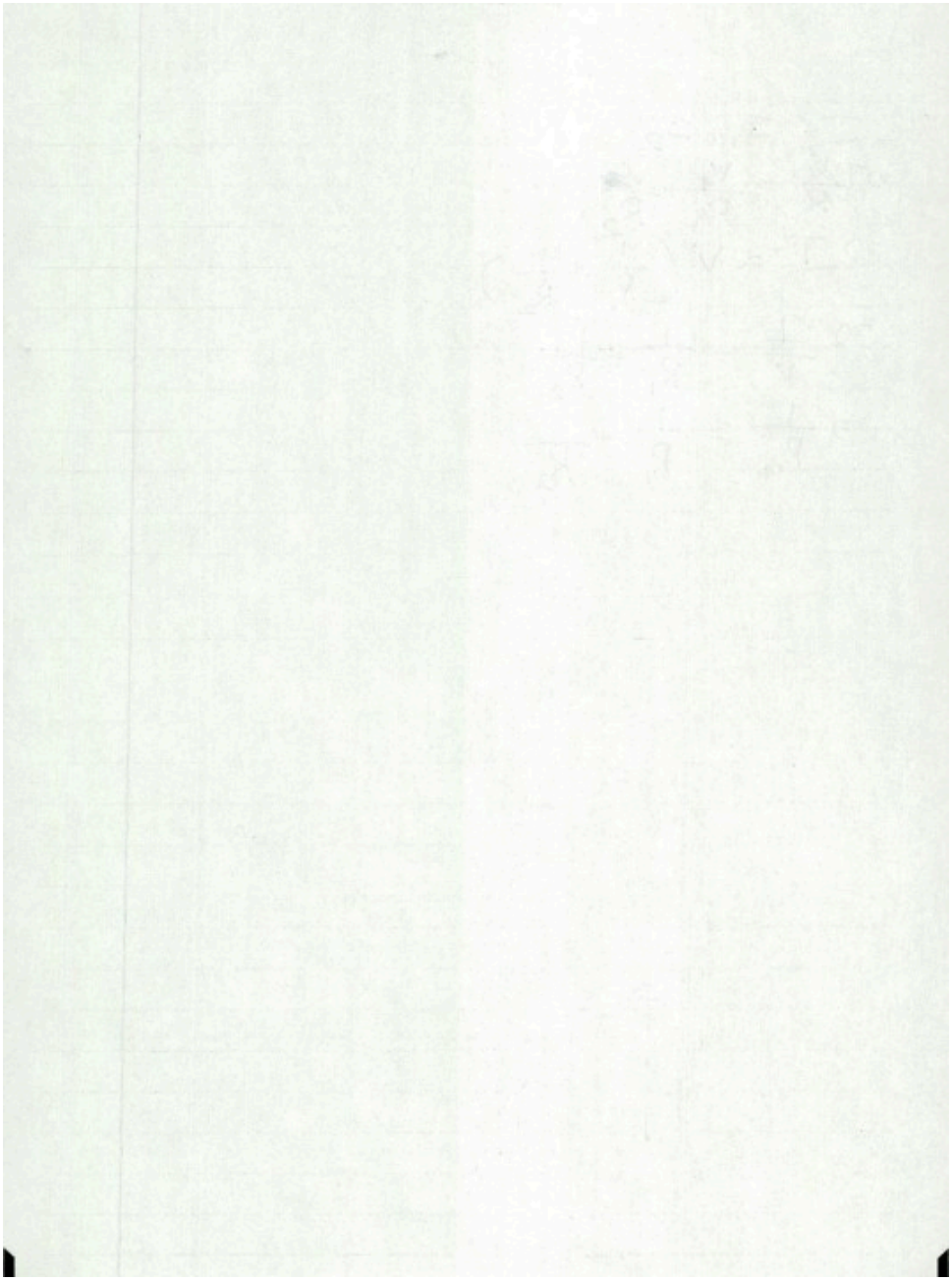


$$I = I_1 + I_2$$

$$\Rightarrow I = \frac{V}{R_1} + \frac{V}{R_2}$$

$$\Rightarrow I = V\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

$$\Rightarrow \frac{I}{V} = \frac{1}{R_1} + \frac{1}{R_2}$$

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

Use for rough work

Q. No. 2 Part (i)

Data:-

$m = 2kg$

$\Delta T = 45°C - 40°C$

$= 5°C = 5K$ (Change in temperature is the same)

$c = 420 J kg^{-1} K^{-1}$.

Solution:-

$Q = mc\Delta T$

$\Rightarrow Q = (2)(420)(5)$

$\Rightarrow \boxed{Q = 4,200 J}$ Ans

Q. No. 2 Part (ii)

Electric field:-

The region around a current carrying conductor in which it attracts or repels other charges due to produced magnetic field is known as an Electric field.

It's formula is: $E = F/q_0$

Affect on a test charge:

The affect of an electric field on a test charge depends on the ~~test~~ charge of the test charge.

If a positive source charge produces the electric field, then it will repel the positive test charge. If a negative source charge produces it, then the negative source charge will attract the test charge.

Q. No. 2 Part (iii)

(a) In series:-

$\mathcal{E}_{net} = \mathcal{E}_1 + \mathcal{E}_2 + \mathcal{E}_3$

$\Rightarrow \mathcal{E}_{net} = 1.5V + 1.5V + 1.5V$

$\Rightarrow \boxed{\mathcal{E}_{net} = 4.5V}$

(b) In parallel:-

$\boxed{\mathcal{E}_{net} = 1.5V}$

This is because in a parallel combination, the net E.M.F is the same as the individual E.M.Fs.

Q. No. 2 Part (iv)

Refractive Index:-

Refractive index is the amount of refraction that occurs when ~~one~~ a light ray travels from one medium to another, such that one medium is a vaccum or air.

It's formula is $\boxed{n = \frac{c}{v}}$.

Numerical:-

Data:-

$v = 2 \times 10^8 \text{ m/s}$

$c = 3 \times 10^8 \text{ m/s}$

$n = ?$

Solution:-

$n = \frac{3 \times 10^8}{2 \times 10^8}$

$\Rightarrow n = 1.5 \times 10^8 \times 10^{-8}$

$\Rightarrow n = 1.5 \times 10^0$

$\Rightarrow \boxed{n = 1.5}$ Ans.

Q. No. 2 Part (v)

Data:-

$I = 2A$

$V = 220V$

$P = ?$

Solution:-

$P = IV$

$\Rightarrow P = (2)(220)$

$\Rightarrow \boxed{P = 440W}$ Ans.

Q. No. 2 Part (vi)

Direct Current (D.C)	Alternating Current (A.C)
• Direct Current travels in one direction only.	• Alternating current travels in both directions due to changing polarity of the battery source.
• Direct current does not change direction at all.	• Alternating current changes every half cycle.
• Direct current works in motors.	• Alternating current works in generators, transformers, etc.

Q. No. 2 Part (vii)

Moisture is an important method for discharging an insulator. Moisture has water molecules which are polar molecules. These bind to the high energy regions of the insulator and allow discharge and removal of charges. The thin moisture ~~layer also~~ layer also allows static charges to move and discharge.

Q. No. 2 Part (viii)

Ohm's Law:-

Ohm's Law states that current is directly proportional to Voltage, provided that temperature and state of matter remain constant.

$V \propto I$

$\Rightarrow V = IR$ -> "R" is the proportionality constant and is known as Resistance.

Numerical:-

Data:

$R = 10\Omega$

$I = 2A$

$V = ?$

Solution:

$V = IR$

$\Rightarrow V = (2)(10)$

$\Rightarrow \boxed{V = 20 \text{ Volts}}$ Ans.

Q. No. 2 Part (ix)

Data:-

$q = 6cm$

$p = 2cm$

(a) $f = ?$

(b) $M = ?$

Solution:-

(a) $\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$

$\Rightarrow \frac{1}{f} = \frac{1}{2} + \frac{1}{6}$

$\Rightarrow \frac{1}{f} = \frac{3+1}{6}$

$\Rightarrow \frac{1}{f} = \frac{4}{6}$

$\Rightarrow \frac{1}{f} = \frac{2}{3}$

$\Rightarrow f = \frac{3}{2}$

$\Rightarrow \boxed{f = 1.5 \text{ cm}}$ Ans.

(b) $M = \frac{q}{p}$

$\Rightarrow M = \frac{6}{2}^{3}$

$\Rightarrow \boxed{M = 3}$ Ans.

Q. No. 2 Part (x)

Real Image	Virtual Image
• Real Images can be caught on a screen.	• Virtual Images can not be caught on a screen.
• Real Images are formed only by Convex lens.	• Virtual Images can be formed by convex lens, concave lens, and mirrors. (plane)
• Real Images are always on the opposite side of the coming light.	• Virtual Images are on the same side as the coming light.

Q. No. 2 Part (xi)

Boiling	Evaporation
• Boiling occurs through the entire liquid.	• Evaporation only occurs on the surface of the liquid.
• Boiling takes place at a specific temperature e.g. for water it is 100°C.	• Evaporation can take place at any temperature below the boiling point.
• Boiling is done by supplying direct heat to the liquid.	• Evaporation uses the heat from the surroundings, leaving the surroundings cooler than before.

Q. No. 3 (Page 1)

Mechanism of Heat Conduction in Solids

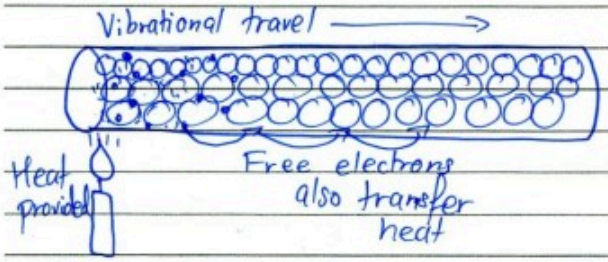
When we heat one end of a solid, the atoms at that end begin to vibrate. This is because they gain vibrational Kinetic Energy due to the heat provided. This vibration produces collisions with other atoms in the solid lattice. In a solid, because the particles are so close together, the heat transfers easily due to lattice vibrations. This occurs largely in metals because of their heat conductance abilities.

Heat Conduction in Metallic Solids due to free electrons

Metals have the speciality of having free electrons. These free electrons are not bound to any specific atoms, therefore can move around in the lattice structure. In fact, paired with vibrations, this movement of free electrons from atom-to-atom also conducts heat.

Diagram: (On the next page)

Q. No. 3 (Page 2)


Vibrational travel
Heat provided
Free electrons also transfer heat
Metallic conductor Showing lattice structure.

Q. No. 4 (Page 1)

(a) **Loudness:-**

Loudness tells us how loud or soft a sound is. The physical factor affecting loudness is the amplitude of a sound wave. The relation is:

$$\text{Loudness} \propto (\text{Amplitude})^2$$

As the amplitude increases, the sound will also be heard as louder. Loudness also depends less on surface area of source, sensitivity of ears, distance, etc.

Pitch:-

Pitch tells us how high/shrill or low/grave a sound is. The physical factor affecting pitch is the frequency of a sound wave. The relation is:

$$\text{Pitch} \propto \text{Frequency}$$

The higher the frequency i.e. the more the vibrations of a sound in unit time, the higher the pitch of the sound.

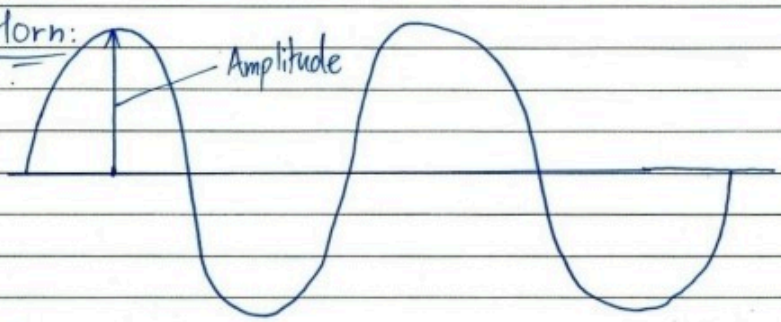
(b) As the amplitude of the sound increases, it carries more energy. This high amount of energy gives a more louder sound. The smaller the amplitude, the softer the sound will be.

Examples: (Next page)

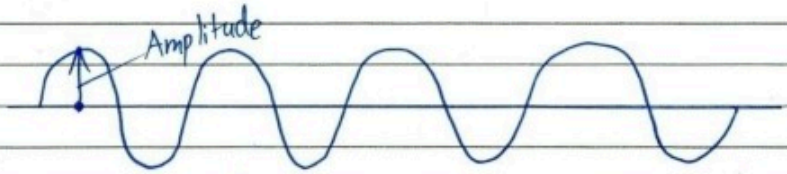
Q. No. 4 (Page 2)

Consider the sound of a horn and a human voice:

Horn:



Human voice:

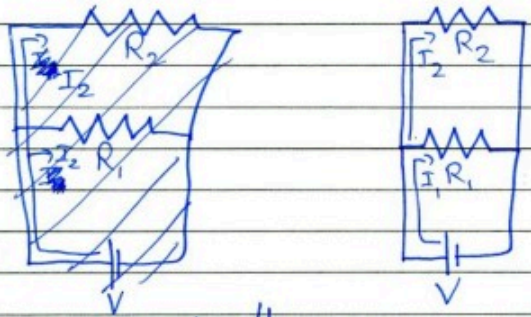


The sound of the horn is obviously louder. This is in relation with the amplitude. The higher / more the amplitude, the louder the sound will be. This proves the relation.

$$\text{Loudness} \propto (\text{Amplitude})^2.$$

Q. No. 5 (Page 1)

Considering the following circuit:-



In such a circut, the current is the same towards each resistor but the voltage is divided.

This tells us,

$$I_{eq} = I_1 + I_2$$

$$\Rightarrow I_{eq} = \frac{V}{R_1} + \frac{V}{R_2}$$

$$\Rightarrow I_{eq} = V\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

$$\Rightarrow \frac{I_{eq}}{V} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\Rightarrow \boxed{\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}} \quad \because \frac{I}{V} = \frac{1}{R}.$$

This is the formula to measure the equivalent resistance of two resistors connected in parallel.

Q. No. 5 (Page 2)

Numerical:-

Data:-

$R_1 = 6\Omega$

$R_2 = 3\Omega$

$R_{eq} = ?$

Solution:-

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

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

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

$$\Rightarrow \frac{1}{R_{eq}} = \frac{3}{6_2}$$

$$\Rightarrow \frac{1}{R_{eq}} = \frac{1}{2}$$

$$\Rightarrow \boxed{R_{eq} = 2\Omega} \text{ Ans.}$$

Q. No. 6 (Page 1)

(a) Transformers work on the principle of Electrostatic Induction. They utilize Alternating current in their working in order to produce a magnetic flux.

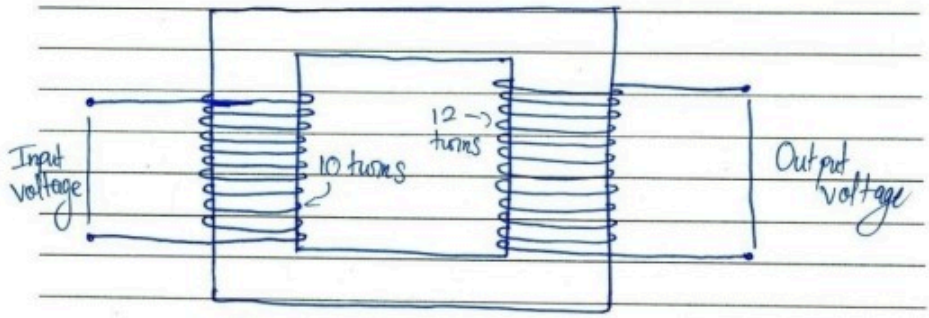
(b) Working of an iron-core transformer:
When the primary coils of wires recieve an Alternating current, they produce a magnetic field i.e. a Magnetic flux. This produces a secondary voltage in the secondary coils on the right of the transformer. This is the output voltage.
Whether the transformer increases or decreases voltage depends on the number of turns in the coils. If the secondary coil has more turns than the primary coil, it increases the voltage and is known as a step-up transformer.
If the secondary coil has less turns compared to the primary coil, the transformer reduces voltage and it is known as a step-down transformer.
Formula:

$$\frac{N_P}{N_S} = \frac{V_P}{V_S}$$

N_P = Primary turns, N_S = Secondary turns
V_P = Primary voltage, V_S = Secondary voltage.

Q. No. 6 (Page 2)

(c)



On the left side, there is the input voltage which is produced from an alternating current. It branches into the primary coils.
On the right side is the secondary coil which branches off and produces the secondary voltage.

In the above figure, a step-up transformer is drawn. This is because the number of turns in the secondary coil is more ~~more~~ than the number of turns in the primary coil. Hence, this increases the voltage as it passes through the transform

This is known as a step-up transformer. Conversely, in our homes, step-down transformers are used to reduce the voltage from WAPDA to