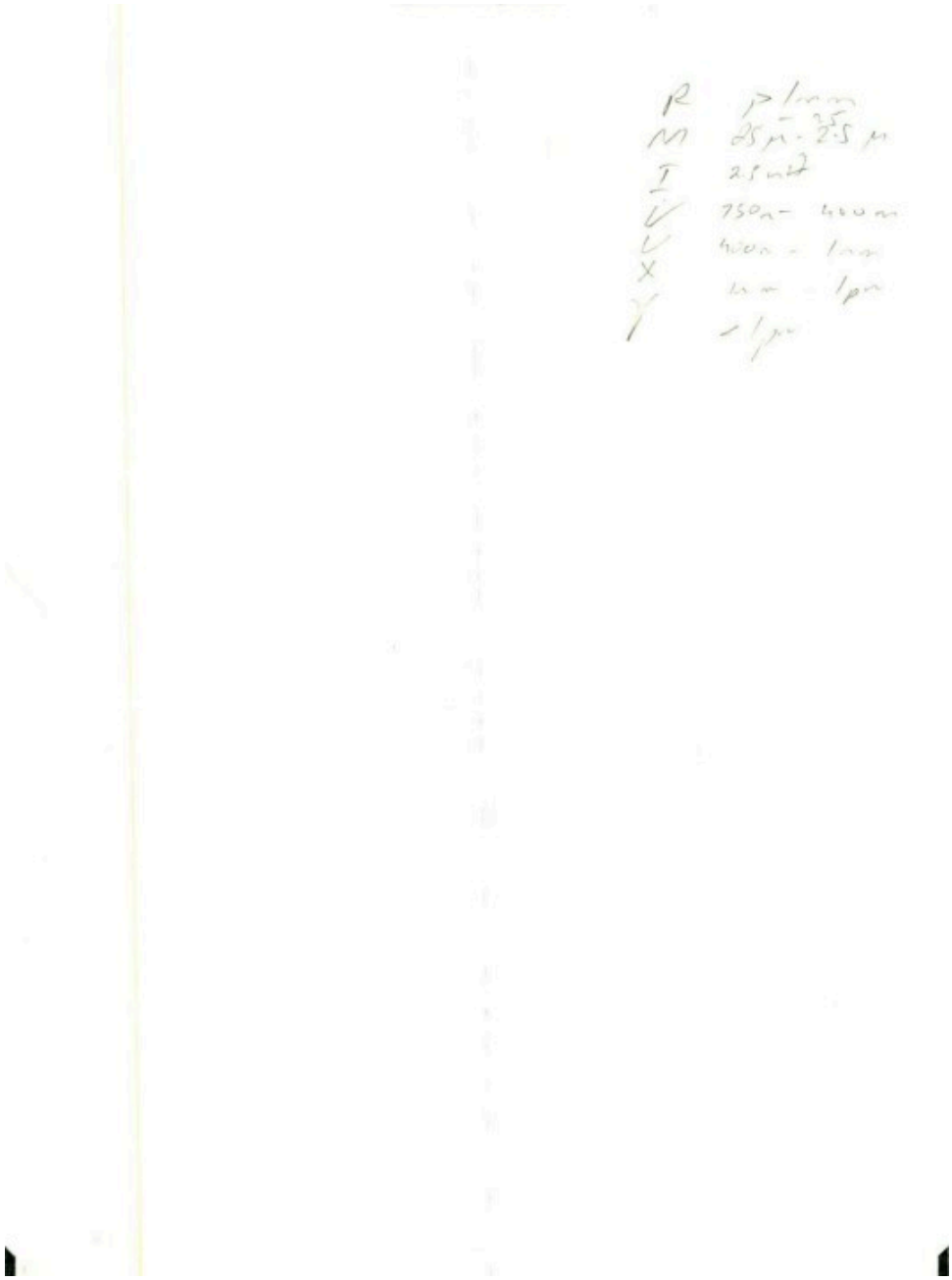




Use for rough work

Q. No. 2 Part (i)

GIVEN DATA

Mass of Substance = m = 2kg

Change in temperature = ΔT = 5°c = 5K

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

TO FIND

Heat energy = Q = ?

SOLUTION

$Q = mc\Delta T$

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

$Q = 4200\ J \Rightarrow 4.2\ kJ$

∴ 4200J of energy is required !

Q. No. 2 Part (ii)

ELECTRIC FIELD

The region around a charge where it exerts a force on another charge is called **electric field**.

1. If electric field is directed outwards (positive), it repels a test charge because like charges repel.
2. If electric field is directed inward (negative), it attracts a test charge due to opposite charges. Electric field strength is given by $E = \frac{F_E}{q}$, measured in Newtons per Coulomb. (N/C)

Q. No. 2 Part (iii)

GIVEN DATA

Number of cells = 3

Voltage of each cell = 1.5 V

SOLUTION

IN SERIES	IN PARALLEL
$\mathcal{E}_{net} = \mathcal{E}_1 + \mathcal{E}_2 + \mathcal{E}_3$	$\mathcal{E}_{net} = \mathcal{E}_1 = \mathcal{E}_2 = \mathcal{E}_3$
$\mathcal{E}_{net} = 1.5 + 1.5 + 1.5$	$\mathcal{E}_{net} = 1.5\,V$
$\mathcal{E}_{net} = 4.5\,V$	

Q. No. 2 Part (iv)

GIVEN DATA

Power of heater = P = 1000W

Time of usage = t = 5 hrs

TO FIND

Cost of all units = ?

SOLUTION

$E = P \times t$

$E = 1000 \times 5$

$E = 5000\ Wh \Rightarrow 5\ kWh$

Cost of 1 unit = Rs 30-/

Cost of 5 units = Rs 150-/

Q. No. 2 Part (v)

GIVEN DATA

Voltage of appliance = V = 220V

Current drawn = I = 2A

TO FIND

Power consumed = P = ?

SOLUTION

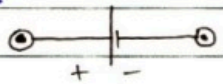
$P = I \times V$

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

$P = 440\ W$

∴ The appliance draws a power of 440 W!

Q. No. 2 Part (vi)

AC	DC
Direction of current	
In alternating current, current flows in forward direction in one half and then in backward direction in the next half.	In direct current, current flows only in one direction or in only forward direction.
Symbols	
The symbol of AC is 	The symbol of DC is 

Q. No. 2 Part (vii)

DISCHARGING INSULATORS

Placing an insulator in damp conditions allows water molecules to adhere to its surface. The polar molecules interact with charged areas, creating a thin conductive layer that promotes discharge. Additionally, the ions in humid air assist in charge neutralization by aid charge movement.

Q. No. 2 Part (viii)

ELECTROMAGNETIC SPECTRUM

X-rays	1×10^{-12} m - 1×10^{-9} m (1pm - 1nm)
Ultraviolet rays	1×10^{-9} m - 400×10^{-9} m (1nm - 400nm)
Visible light	400×10^{-9} m - 750×10^{-9} m (400nm - 750nm)
Infrared waves	2.5μm - 25μm (2.5×10^{-6} - 25×10^{-6} m)
Micro waves	25×10^{-6} m - 1×10^{-3} m (25μm - 1mm)
Radio waves	Greater than 1×10^{-3} m (1mm)

Q. No. 2 Part (ix)

GIVEN DATA

Object Placement = u = 2 cm (p)

Image formation = v = 6 cm (q)

TO FIND

Focal Length = f = ?

Magnification = M = ?

SOLUTION

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q} \qquad M = \frac{I}{O} = \frac{q}{p}$$

$$\frac{1}{f} = \frac{1}{2} + \frac{1}{6} \qquad M = \frac{6\text{cm}}{2\text{cm}}$$

$$f = 1.5\text{cm} \qquad M = 3$$

Q. No. 2 Part (x)

REAL IMAGE	VIRTUAL IMAGE
Screen	
Can be caught on screen.	Cannot be caught on screen.
formation	
Formed by only convex lens.	Formed by concave, convex and plane mirrors.
Intersection	
Formed by actual intersection of light rays.	Formed by imaginary intersection of light rays.

Q. No. 2 Part (xi)

BOILING	EVAPORATION
Occurence	
Occurs throughout the ~~light~~ liquid.	It occurs only on the surface of ~~wa~~ liquid.
Source of Energy	
~~Requires~~ external continuous supply of heat.	It uses the energy of surroundings.
Temperature of surroundings	
Increases the temperature of surroundings.	Decreases the temperature (Provides a cooling sensation.)

Q. No. 3 (Page 1)

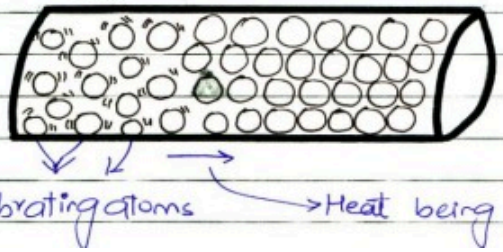
CONDUCTION IN SOLIDS

DEFINITION

"The Process of the transfer of heat due to the collisions of atoms or the movement of electrons."

CONDUCTION VIA VIBRATIONS

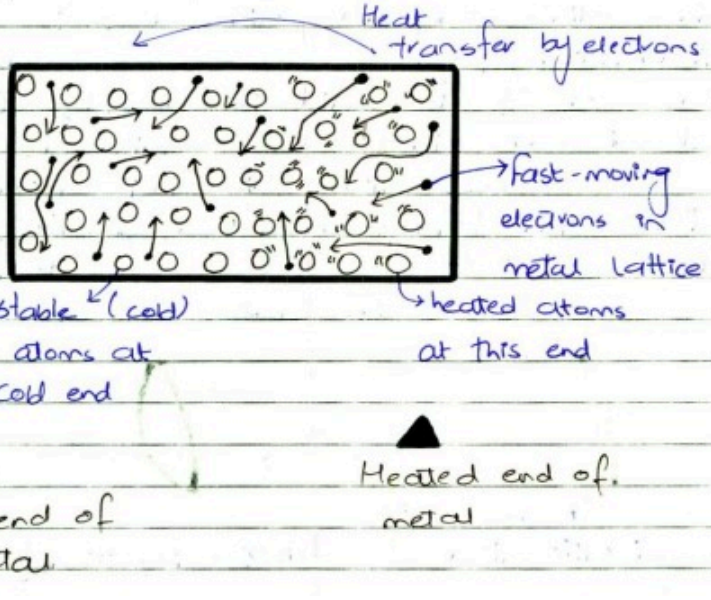
This method of heat transfer takes place in Solids only. In solids, heat is transferred from atoms to atoms. When one end of a solid is heated, atoms at this end start vibrating with a greater amplitude. These atoms hit their neighbouring atoms and transfer them energy. Those atoms also start vibrating vigorously and transfer the heat energy to the next molecules.



Q. No. 3 (Page 2)

CONDUCTION VIA ELECTRONS

Conduction in metallic solids is due to the moving electrons. In conductors, the valence electrons are not tightly bound to the nucleus and hence, they move when metal is heated. The electrons at the heated end immediately absorb energy and quickly move from one end to another, carrying the heat energy. In contrast to vibrating atoms, electrons are fast-moving which makes metals the best thermal and electrical conductors.



Q. No. 4 (Page 1)

TOTAL INTERNAL REFLECTION

DEFINITION

"The phenomenon of reflection of light ray back into the same medium when moving from denser medium to rarer medium in such a way that angle of incidence is greater than critical angle."

EXPLANATION

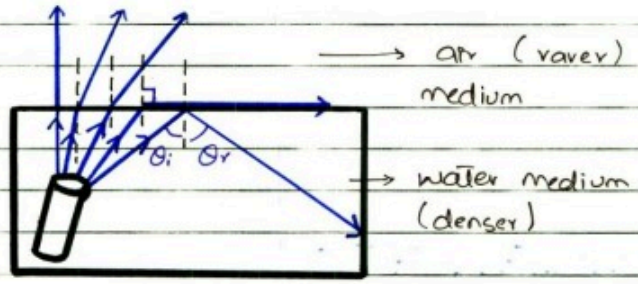
When a ray of light moves from denser medium to rarer medium, increasing the angle of incidence increases the angle of refraction. This causes the ray to bend away from the normal. By doing so, the point is reached when refracted ray moves along on the boundary of two media (away from the normal). This angle is called critical angle.

"The angle of incidence for which the angle of refraction is 90° is called critical angle."

Q. No. 4 (Page 2)

After the critical angle, the ray of light will not refract rather, it will be reflected back completely into the 1st medium. This process is called.

TOTAL INTERNAL REFLECTION.



DERIVATION

From Snell's Law,

$n_1 \sin\theta_i = n_2 \sin\theta_r$

Since $\theta_r = 90°$, $\sin\theta_r = 1$,

$n_1 \sin\theta_i = n_2$

$\sin\theta_i = \frac{n_2}{n_1}$

Since $\angle i = \angle$ critical,

$\sin\theta_c = \frac{n_2}{n_1}$

As $n_2 = 1$ (rarer medium),

$\sin\theta_c = \frac{1}{n}$

$\theta_c = \sin^{-1}\left(\frac{1}{n}\right)$

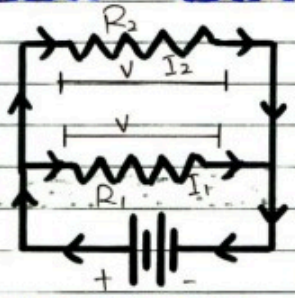
Rearranging for n,

$n = \frac{1}{\sin\theta_c}$

Q. No. 5 (Page 1)

EQUIVALENT RESISTANCE

CIRCUIT DIAGRAM



DERIVATION

Charge is neither accumulating, nor draining out, so Sum of currents will be equal to the total current.

$$I_1 + I_2 = I$$

Voltage remains same in parallel,

$$I = \frac{V}{R_1} + \frac{V}{R_2} \longrightarrow \text{from Ohm's Law}$$

$$I = V\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$$

Since $R_{eq} = \frac{V}{I}$,

Q. No. 5 (Page 2)

$$\frac{1}{R_{eq}} = \frac{I}{V}$$

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

∴ The reciprocal of equivalent resistance will be the sum of reciprocals of resistances !

COMBINED RESISTANCE

GIVEN DATA

Resistors = 2
Resistances 1 = 6 Ω
Resistance 2 = 3 Ω

FORMULA

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

SOLUTION

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

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

$$R_{eq} = 2\ \Omega$$

Q. No. 6 (Page 1)

TRANSFORMER

WORKING PRINCIPLE

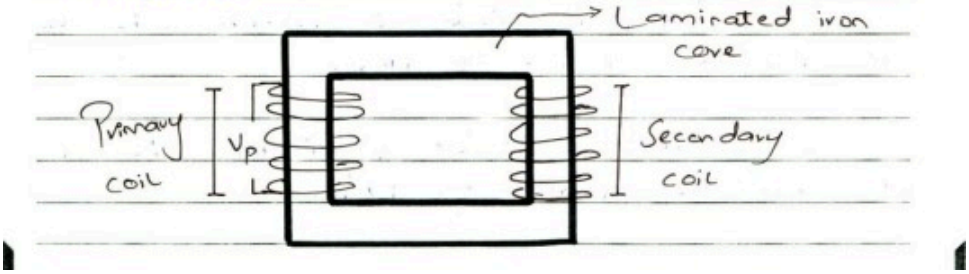
A transformer works on the Principle of Electromagnetic Induction or Mutual Induction.

PROCESS / CONSTRUCTION

A simple iron-core transformer consists of

(i) A Primary coil
(ii) A secondary coil
(iii) A laminated iron core

Both coils are wounded on opposite sides of a laminated iron core. The Primary coil is connected with an AC (source) voltage. The number of turns on coils depend on the type of transformer.



Q. No. 6 (Page 2)

WORKING

The input voltage has to be AC only. The alternating current produces a changing magnetic field that is concentrated through the iron core. This changing magnetic field generates an alternating current at the output. The output of secondary coil depends upon the number of turns and voltage of primary coil.

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

N_p Number of turns on primary coil.
N_{ps} Number of turns on secondary coil.
V_s Voltage of secondary coil.
V_p Voltage of primary coil.

There are two types of transformers :-

Step - up :-

Voltage is greater at secondary coil and so does the number of turns.

Step- down :-

Voltage is greater at primary coil and so does the number of turns.