



Use for rough work

Q. No. 2 Part (i) $C = 420\ J\,kg^{-1}K^{-1}$

$\Delta T = 45 - 40 = 5^{\circ}C$

$m = 2kg$

$Q = ?$

$Q = m\,c\,\Delta T$

$Q = 2(420)(5)$

$Q = 4200\ J$

So heat required is, $Q = 4200\ J$.

Q. No. 2 Part (ii) Electric field of a current carrying conductor is the region area in which it can exert force on other charges. It can either attract or repel other charges. It's range is technically infinite but its strength decreases with distance. If we place a test charge in electric field of conductor, it will either attract the test charge if it is charged with different sigh. Or it will repel it if it is charged with same sigh. Formula for electric field intensity :- $E = \frac{F_e}{q_e}$

Q. No. 2 Part (iii)

a) In Series :-	b) In parallel :-
$\mathcal{E}_{net} = \mathcal{E}_1 + \mathcal{E}_2 + \mathcal{E}_3$	$\mathcal{E}_{net} = \mathcal{E}_1 = \mathcal{E}_2 = \mathcal{E}_3$
$\mathcal{E}_{net} = 1.5 + 1.5 + 1.5$	$\mathcal{E}_{net} = 1.5\ V.$
$\mathcal{E}_{net} = 4.5\ V$	
So, total e.m.f in series is 4.5 V.	So, total e.m.f in parallel is 1.5 V.

Q. No. 2 Part (iv)

1000 W = 1×10^3 W
= 1 KW
t = 5 hours

no. of units = 1 kW x 5
= 5 kWh
since 1 unit = Rs. 30.

So, 5 units = 30 x 5
= Rs. 150

So, cost is Rs. 150.

Q. No. 2 Part (v)

V = 220 V
I = 2 A
P = ?

P = I V

P = 2 x 220
P = 440 W

So, power consumed is 440 W.

Q. No. 2 Part (vi)

DC	AC
• In direct current (DC) current only flows in one direction. • DC is mostly used in batteries for current flow.	• In alternating current (AC), current flows in both directions. It goes forward half the time and backward other half of time. • AC is used to increase voltage before long distance transmission to minimize energy loss.

Q. No. 2 Part (vii)

Echo happens when a sound wave is reflected by a body (atleast 17m away from original source) which then produces a second sound wave which reaches the ears of listener. Echo is heard 0.1 seconds after original sound wave. Echo works on principle of sound reflection phenomenon. Echo is used to detect things under water or find depth of ocean floor. It's formula is:-

$$d = \frac{v \times t}{2}$$

Q. No. 2 Part (viii) Ohm's law states that current across two points in a conductor is directly proportional to potential difference applied across these points.

$V \propto I$

$V = IR$

$\Rightarrow I = 2\ A,\ R = 10\ \Omega,\ V = ?$

$V = IR$

$V = 2 \times 10$

$V = 20\ V$

Q. No. 2 Part (ix) The time period required for half of radioactive sample nucleas to decay into daughter nucleas (with emmision of α, β or γ radiations) is called half life of sample radioactive element.

Half life $= \left(\frac{1}{2}\right)^n \times N_0$

When N_0 is grams of radioactive element at start.

e.g, If 40g of Iodine has half life of 8 days. After 24 days mass of Iodine will be $= \left(\frac{1}{2}\right)^3 \times 40 = \frac{40}{8} = 5g.$

Q. No. 2 Part (x) If the wavelength of incoming wave is higher than the gap, diffraction will be more.

If the wavelength of incoming wave is less than gap, diffraction will be less. The wave just mostly passes straight through.

Q. No. 2 Part (xi)

Evaporation	Boiling
→ Evaporation is a slow, gradual process of water releasing into the air.	→ Boiling is a rapid, vigorous process of water releasing into the air.
→ Evaporation occurs at any temperature below boiling point.	→ Boiling occurs only at specific boiling point of liquid.
→ Evaporation occurs at surface of liquid.	→ Boiling occurs throughout whole liquid.

Q. No. 3 (Page 1)

Nuclear Fusion:-

When two relatively light nuclei fuse together to make a heavier nucleas. It is called as nuclear fusion.

Some of the mass is lost (mass defect) as energy. By einstein's equation:-

$$E = mc^2$$

Let's see the steps of a nuclear fusion reaction:-

Step 1:- $_{1}^{1}H + _{1}^{1}H \longrightarrow _{1}^{2}H + _{-1}^{0}\beta$

protons — deuterium

Step 2:- $_{1}^{1}H + _{1}^{2}H \longrightarrow _{2}^{3}He + \gamma$

Step 3:- $_{2}^{3}He + _{2}^{3}He \longrightarrow _{2}^{4}He + _{1}^{1}H + _{1}^{1}H + \gamma$

Two He-3 nuclei fuse to make $_{2}^{4}He$ which is α particle and two protons and some energy (γ particles).

Q. No. 3 (Page 2)

The energy required for a self-sustainable nuclear fusion reaction is very high which is typically found in stars like sun.

So, nuclear fusion reaction only occurs on stars like our sun.

The reason for this high energy requirement is because two nuclei have to be fused together and form a new nucleas. The reaction also releases two protons and alot of energy. This fusion of nuclei requires alot of energy.

(b)

$m = 55.56\ kg$

$c = 3 \times 10^8\ ms^{-1}$

$E = mc^2$

$E = 55.56 \times (3 \times 10^8)^2$

$E = 5.0004 \times 10^{18}\ J$

Q. No. 4 (Page 1)

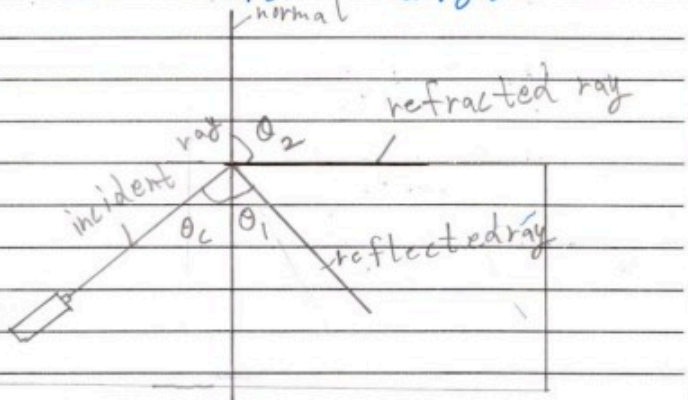
Total Internal Reflection

When light enters from denser to rarer material, it bends away from normal.

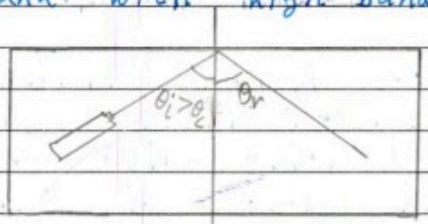
When light ray goes from denser to rarer medium, one light ray is reflected back into same medium, and one ray is refracted in other medium.

When we increase, incidence angle, the refracted angle also increases. And a point will come when, refracted ray will move along border of two media and refracted angle becomes 90°.

At this point angle of incidence is called critical angle.



Q. No. 4 (Page 2) If we continue to increase incidence angle, angle of incidence becomes greater than critical angle and the whole light ray is reflected back into the original medium. This is the basic principle of total internal reflection. Optical fibers use total internal reflection to transmit light rays very fast and with high bandwidth.



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

$\theta_r = 90°$, $\sin 90 = 1$

$n_2 = 1$, and $\sin\theta_i = \sin\theta_c$

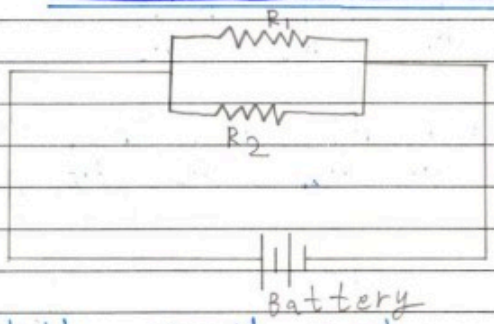
$$\frac{n}{1} = \frac{1}{\sin\theta_c}$$

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

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

Q. No. 5 (Page 1)

Resistor combination in parallel.



Household circuit systems also use parallel combination. So all appliances get 220V. And even if one light bulb turns off others can still run. So parallel combination allows for individual switch control.

Formula derivation :-

$$I_1 = \frac{V}{R_1} \; , \; I_2 = \frac{V}{R_2} \; , \; I_3 = \frac{V}{R_3}$$

combining all three, we get :-

$$I = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\frac{I}{V} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

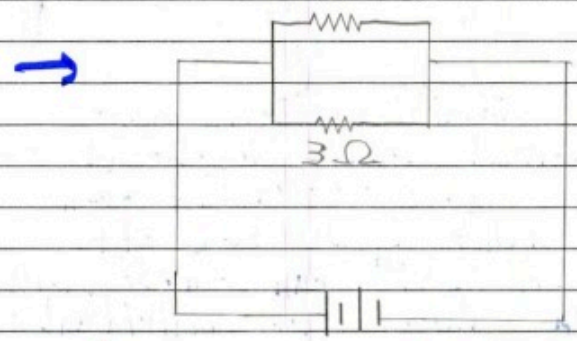
Q. No. 5 (Page 2)

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

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

So,

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} \cdots + \frac{1}{R_n}$$



So,

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

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

$$= \frac{3}{6}$$

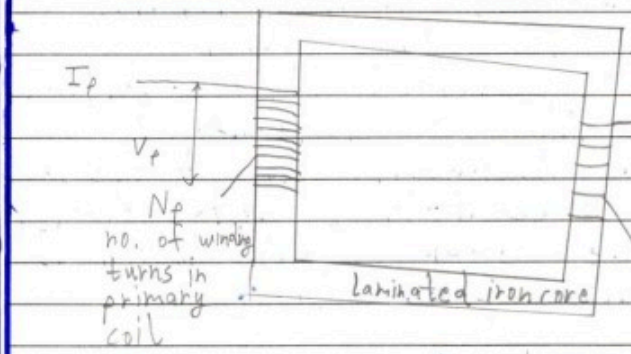
$$\frac{1}{R_{eq}} = \frac{1}{2}$$

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

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

Q. No. 6 (Page 1)

Transformer :-



The primary coil is connected to a current source (battery) and has N_p number of turns. The current passes through primary coil and induces an induced e.m.f in iron core which then reaches secondary coil with N_s no. of turns and passes through and out of secondary coil.

Formula :- $\frac{V_s}{V_p} = \frac{N_s}{N_p}$

Types of Transformer :-

There are two types of transformers :-

Q. No. 6 (Page 2)

1- Step-up transformer:-

The number of turns in primary coil (N_p) is less than number of turns in secondary coil (N_s). This transformer is used to increase the voltage. before transmitting power through power lines over long distances to minimize power loss.

2- Step-down transformer:-

The number of turns in primary coil (N_p) is greater than number of turns in secondary coil (N_s). This transformer is used to decrease the voltage.

Ideal transformer:-

In this, power in primary coil is equal to power received in secondary coil.

power in primary = power in secondary

OR $I_s V_s = I_p V_p$