1996 A/L M.C.Q ANSWERS

01	5	11	4	21	3	31	1	41	2	51	2
02	4	12	1	22	5	32	1	42	2	52	3
03	1	13	2	23	3	33	3	43	4	53	1,5
04	3	14	3	24	1	34	4	44	3	54	1
05	5	15	4	25	5	35	ALL	45	4	55	1
06	4	16	5	26	2	36	3	46	1	56	5
07	5	17	3	27	3	37	3	47	4	57	2
08	4	18	1	28	1	38	1	48	4	58	1
09	4	19	2	29	2	39	4,5	49	5	59	4
10	3	20	4	30	4	40	2	50	4	60	5

Explanation

39. **Correct answer is (4). Due to a printing mistake in the tamil paper, (5) was also given as the correct answer.**

53. **Correct shape is (5). But in (1) as the shape doesn't go through the origin, it was also considered as the correct answer.**

Scanned with CamScanner

Answers

Part - A

01. (a). (i). $25/5 = 5/X$ (Extension of the rubber string in mm)
$X = 1$ mm ---------- (01)

(ii). $5 \times 10^{-2} \times P = 10 \times 10^{-2} \times 10 \times 10^{-3} \times 10$
$P = 0.2$ N ---------- (01)

(b). The force in the rubber piece, for a 10 mm scale division in $= 0.2 \times 2$ N $= 0.4$ N ------- (01)
Therefore, $0.4 \times 5 = 5 \times m$ (m = maximum weight)
Therefore, $m = 40$ g
(or $m = 0.4$ N)
(For identifying the place/marking 10 cm as the maximum mass) ---------- (01)

(II method) $5 \times m = 200$ (A maximum torque is required to provide a 10 mm. Scale division) --------- (01)
$m = 40$ g ---------- (01)
(Note) (If a student has derived that the maximum distance that can be taken is 10 cm away from C, then provide (1) mark for 10 cm)

(c). (i). For the stress : Diameter of the fibre
(Let it be 'x') ---------- (01)
For the strain : Natural length (unstretched length) of fibre, (Let it be 'y') ---------- (01)
(No marks for cross section/length)

(ii). x : Travelling microscope
y : Meter ruler (If both are correct) ------ (01)

(iii). Stress $= \dfrac{0.2}{\pi\ (x^2/4)}$ ---------- (01)

Strain $= 1/y$ ---------- (01)

If a student has taken the area of the cross section as X in c (i), give marks for 0.2 X.

(d). $10 \times 10^{-3} \times 10 \times x = 5 \times 2P$
Here, $P = 0.2$ By using that, $x = 20$
Therefore, the place where the pan should be kept
$= 20 + 5$
$= 25$ cm ---------- (01)

TOTAL 10

02. (a). A straight line which is at the top and the bottom of the hole in the lid of the gravitational vessel.
(Any level between A and D) ---------- (01)

(b). Chemical balance ---------- (01)
(or electronic balance)
(No marks for spring balance)

(c). To maintain uniform temperature inside the heater-01)

(d). 1 . Mass of the empty vessel C if (02) answers are correct, the word 'empty' isn't required.
2. Mass of the vessel filled with liquid
3. Initial temperature (of water) ---------- (01)

(e). 1. Final temperature (of the water)
2. Mass of the vessel with remaining liquid
(for both answers) ---------- (01)

(f). Keeping the final temeprature of the constant for a few minutes.
Wiping the vessel (for any answer) ------ (01)

(g). To confirm that a certain volume of the initial expanded liquid was spilled. **or**
To measure the volumes correctly ---------- (01)

(h). X = Initial mass of the vial with the liquid.
Y = Final mass of the vial with the remaining liquid.
Z = Mass of the empty vial (for all) ---------- (02)
(for any 2 ---------- (01))

(i). No.
γ_{ap} depends on the volume expansivity of the material for the vessel. ---------- (01)

TOTAL 10

03. (a). B (or lense with focal length of 100 cm) ------ (01)

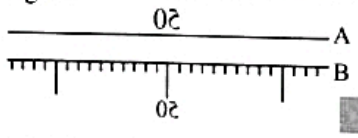
(b). (i). As the eye is at rest or
As the eye muscles are not tired. ---------- (01)

(ii). Infinity or very far ---------- (01)
(iii). 20 ---------- (01)

(c). (i). The required result is given by the image of the objective lense formed on the eye piece.
Object distance $u = 105$ cm ---------- (01)
$\dfrac{1}{v} - \dfrac{1}{105} = -\dfrac{1}{5}$ (for the correct substitution) -(01)
$v = -5.25$ cm
Therefore, the distance between the eye piece and the eye $= 5.25$ cm ---------- (01)

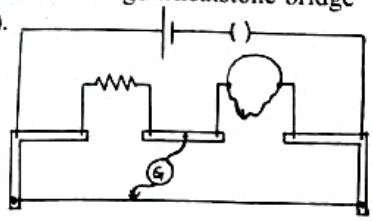
(ii). All of the rays are going through the objective lense comes closer to the eye. (or the object can be observed with maximum brightness) ---------- (01)

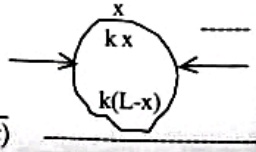
(d). (i). Three (3) ---------- (01)
(ii). Near the second main line of the image (B) of the figure. ---------- (01)



TOTAL 10

04. (a). Meter bridge/wheatstone bridge ---------- (01)

(b).  ---------- (02)
(02 marks, meter bridge ------ 01)
other connections-(01)
key is not necessary --- (01)

(c). 

------ (01)

$\dfrac{1}{R} = \dfrac{1}{kx} + \dfrac{1}{k(L-x)}$ ---------- (01)

Scanned with CamScanner

(d). (i). $R = \frac{kx \times k(L-x)}{kL}$

$\frac{R}{x} = -\frac{k}{L}x + k$ ——————— (01)

(ii). for axis :- R/x
for x axis (If both the answers are correct) -- (01)

(e). (i). k = intercept

$L = \frac{\text{intercept}}{\text{gradient}}$ ——————— (01)

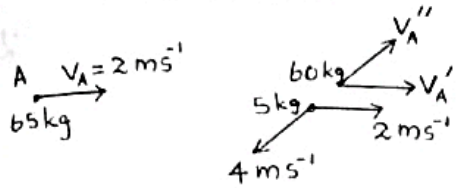
(ii). Diameter of wire ——————— (01)

(f). The wire is broken at a certain place inside the insultating box.
(or the wire is too long) ——————— (01)

TOTAL 10

Part - B

01. (a).



(i). In this system, as the addition of the momentums remains unchanged and as it exists in this direction, the velocity of A in the initial direction doesn't change. Or
The conservation of linear momentum,

(1). In the initial direction of motion

$65 \times 2 = 60 V_A' + 5 \times 2$ ——— (01)

Therefore, $V_A' = 120/60 = 2\ ms^{-1}$ ——— (01)

(2). In the perpendicular direction

$5 \times 4 = 60 V_A''$ ——————— (01)

$V_A'' = 20/60$

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

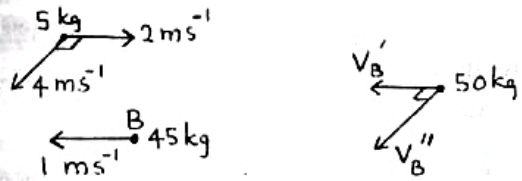
Resultant velocity of A

$V_A^2 = V_A'^2 + V_A''^2$ ——————— 01

$V_A = \sqrt{37/3}$

$= 2.03\ ms^{-1}$ ——————— 01

(ii).



conservation of momentum

(a). In the initial direction of B,

$45 \times 1 - 5 \times 2 = 50 V_B'$ ——————— (01)

$V_B' = \frac{35}{50} = \frac{7}{10}$

$= 0.7\ ms^{-1}$ ——————— (01)

(b). In the perpendicular direction,

$5 \times 4 = 50 V_B''$ ——————— (01)

$V_B'' = \frac{20}{50} = \frac{2}{5}$

$= 0.4\ ms^{-1}$ ——————— (01)

(iii). Total kinetic energy of B and the helmet a moment before catching the helmet.

$= \left(\frac{1}{2}\right) \times 5 \times 4^2 + \left(\frac{1}{2}\right) \times 5 \times 2^2 + \left(\frac{1}{2}\right) \times 45 \times 1^2$ ——— (01)

$= 40 + 10 + \frac{45}{2} = \frac{145}{2}$

$= 72.5$ J ——————— (01)

(iv). Total kinetic energy after catching the helmet.

$= \left(\frac{1}{2}\right) \times 50 \times (0.7)^2 + \left(\frac{1}{2}\right) \times 50 \times (0.4)^2$

$= 25\,(0.49 + 0.16)$

$= 16.25$ J ——————— (01)

(v). When B catches the helmet, the velocity of the helmet reduces. The change in energy is remained on the palm of B as heat. Or
As the collision is inelastic, the kinetic energy is lost as heat. ——————— (01)

(vi). There is no change in the velocity of B. As the total momentum of the system (B + helmet) doesn't change ——————— (01)

TOTAL 15

(b). (i). The general value of power obtained by sri lanka.

$= 1 \times 10^3 \times 65000 \times 10^6$ ——————— (01)

$= 65 \times 10^{12}$ W

$= 65 \times 10^6$ MW ——————— (01)

(ii). The energy consumed by electric lamps in a house per day $= 40 \times 5 \times 3 \times 3600$ J ——————— (01)

$= 1.4 \times 10^3 \times 3600$ J ——————— (01)

The energy consumed by other equipments per day

$= 40 \times 5 \times 3 \times 3600 + 1.4 \times 3600 \times 10^3$ J —(01)

$= 7.2 \times 10^6$ J

Daily energy requirement for 100 such houses.

$= 7.2 \times 10^8$ J ——————— (01)

(iii). Let A be the total area of the solar panels required.
The energy stored in the panels a day.

$= A \times 1 \times 10^3 \times 5 \times 3600$ ——————— (01)

$= A \times 1.8 \times 10^7$ J

Electricity produced $= A \times 1.8 \times 10^7 \times 1/10$ -- (01)

The electrical energy that can be given for the equipments

$= A \times 1.8 \times 10^6 \times 80/10$ ——— (01)

Therefore, $7.2 \times 10^8 = A \times 1.8 \times 10^6 \times 80/100$ ——— (01)

$A = \frac{(7.2 \times 10^8)}{(1.8 \times 8 \times 10^5)}$

$= 500\ m^2$ ——————— (01)

(iv). The additional energy that should be produced by the scale panels $= 2000 - 1400$

$= 600$ MW ——————— (01)

Let A' be the required area.
The energy produced by the panels

$= A' \times 1 \times 10^3\ 1/10$ ——————— (01)

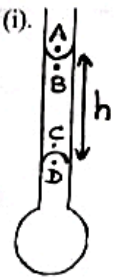
Therefore, $A' \times 1 \times 10^3 \times 1/10 = 600 \times 10^6$ ——— (01)

$A' = 6 \times 10^6\ m^2$ ——— (01)

TOTAL

Scanned with CamScanner

02. (i).



$P_A = \pi$ = Atmospheric pressure
r = radius of the tube
R = radius of the bubble

$P_A - P_B = 2T/r$ ——— (01)
$P_C = P_B + h\rho g$ ——— (01)
$P_D - P_C = 2T/r$
$P_D - \pi = 4T/R$ ——— (01)

Using the above equations,

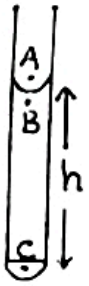
$h\rho g = 4T/R$ ——— (01)

(If the derivation or the argument is not given only 02 marks are awarded.)

Therefore, $1 \times 10^{-2} \times 10^3 \times 10 = \frac{4T}{0.1} \times 10^{-2}$ ——— (01)

(For the correct substitution) $T = 2.5 \times 10^{-2}$ Nm^{-1} ——— (01)

(ii).



When the length of the liquid column is maximum, the radius of the bottom meniscus is equal to the radius of the tube.

$P_A - P_B = 2T/r$
$P_C = P_B + h\rho g$
$P_D - \pi = 2T/R$ ——— (01)

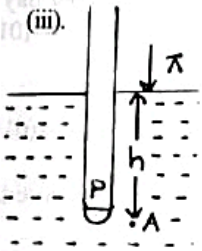
by the above equation

$h\rho g = 4T/r$ ——— (01)

Therefore, $3 \times 10^{-2} \times 10^3 \times 10 = \frac{(4 \times 0.025)}{r}$

$r = 3.3 \times 10^{-4}$ m ——— (01)

(iii).



The maximum pressure inside the tube can be obtained when a semi-sphericular air bubble is created at the bottom end of the tube.

Then $P - P_A = 2T/r$ ——— (01)
$P_A = h\rho g + \pi$
$P = H\sigma g + \pi$ ——— (01)

(σ is the density of the manometer liquid.)

$H\sigma g - h\rho g = 2T/r$ ——— (01)

According to the graph $h = 0$, $H = 8$ cm ---- (01)

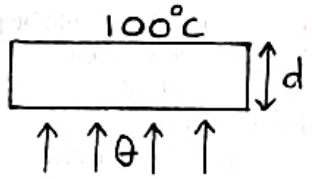
(or by taking $2T/r\sigma g$ as the intercept)

$8 \times 10^{-2} \times 6.0 \times 10^2 \times 10 = \frac{(2 \times T)}{(3.3 \times 10^{-4})}$ ——— (01)

$T = 8 \times 10^{-2}$ Nm^{-1} ——— (01)

TOTAL 15

03. (i).



The rate of conductance of heat from the bottom
= Rate of absorption of heat by water
$= 40 \times 10^{-3} \times 2.27 \times 10^6$ ——— (01)

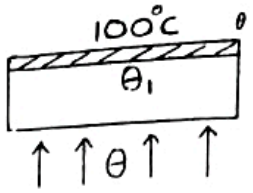
By using $\frac{Q}{t} = KA \frac{(\theta_1 - \theta_2)}{d}$ ——— (01)

$40 \times 10^{-3} \times 2.27 \times 10^6 = \frac{2.1 \times 10^2 \times 10^2 \times 10^{-4} (\theta - 100)}{1 \times 10^{-2}}$ ——— (02)

(For the correct substitution of the right handside --- (01)
For the derivation of the equation (01)

$\theta = 532.4$ °C or 532 ——— (01)

(ii).



The rate of conductance of heat through the bottom
$= 20 \times 10^{-3} \times 2.27 \times 10^6$ ——— (01)

By using $\frac{Q}{t} = KA \frac{(\theta_1 - \theta_2)}{d}$

$20 \times 10^{-3} \times 2.27 \times 10^6 = \frac{2.1 \times 10^2 \times 10^{-4} (532.4 - \theta_1) - 10^2}{1 \times 10^{-2}}$ ——— (01)

$20 \times 10^{-3} \times 2.27 \times 10^6 = \frac{K \times 10^2 \times 10^{-4} (\theta_1 - 100)}{0.1 \times 10^{-2}}$ — (01)

From the above equation,

$\theta_1 = 316.2$ °C

Therefore,

$20 \times 10^{-3} \times 2.27 \times 10^6 = \frac{K \times 10^2 \times 10^{-4} (316.2 - 100)}{0.1 \times 10^{-2}}$ - (01)

For the correct substitution) $K = 21$ Wm^{-1} K^{-1} ——— (01)

(iii). Rate of absorption of heat by water
$= m \times 4.18 \times 10^3 \times (60 - 30)$ ——— (01)

(m - Maximum rate of taking hot water out rate of heat conductance through the bottom)

$= \frac{2.1 \times 10^2 \times 10^2 \times 10^{-4} (532.4 - 60)}{1 \times 10^{-2}}$ — (01)

Therefore,

$m \times 4.18 \times 10^3 \times (60 - 30) = \frac{2.1 \times 10^2 \times 10^2 \times 10^{-4} (532.4 - 60)}{0.1 \times 10^{-2}}$ ——— (01)

$m = 0.79$ kg s^{-1} ——— (02)

(If the correct units are not given, deduct 01 mark)

TOTAL 15

04. (i). By using, $PV = (m/M) RT$ ——— (01)

Mass of air inside the balloon.

$m = \frac{1 \times 10^5 \times 2 \times 10^{-3} \times 4}{8.3 \times 300}$ (for correct substitution) -(01)

$m = \left(\frac{8}{24.9}\right)$ g
$= 0.32$ g ——— (01)

Or $m = 3.2 \times 10^{-4}$ kg

(If the units are not given, deduct 01 mark)

(ii). Total mass of the gas $= \frac{1.5 \times 10^6 \times 0.01 \times 4}{8.3 \times 300}$ ——— (01)

$= 200/8.3$ g
$= 24.1$ g ——— (01)

Scanned with CamScanner

Mass of gas under atmospheric pressure

$$= \frac{1 \times 10^5 \times 0.01 \times 4}{8.3 \times 300} \quad \text{---------- (01)}$$

$$= \left(\frac{40}{25.9}\right) g = 1.54\ g$$

Therefore, no. of balloons which can be filled by the cylinder

$$= \frac{(24.1 - 1.54)}{0.32} \quad \begin{matrix}(01 \text{ mark for substraction}) - (02)\\ (01 \text{ mark for division})\end{matrix}$$

$$= 70.5 = 70 \quad \text{---------- (01)}$$

(iii). Using $\frac{V_1}{T_1} = \frac{V_2}{T_2}$ ---------- (01)

Volume of balloon at $2^0C = \frac{(2 \times 10^{-3} \times 275)}{300}$ —(01)

$= (11/6) \times 10^{-3}$

$= 1.83 \times 10^{-3}\ m^3$ ——(01)

(iv). Total weight of the balloon

$= (1.5 + 0.32) \times 10^{-3} \times 10$ ——(01)

$= 1.82 \times 10^{-2}\ N$

Upthrust on the balloon

$= 1.83 \times 10^{-3} \times 1.3 \times 10\ N$ ——(01)

As upthrust is greater than the weight of the balloon, the balloon moves up. ---------- (01)

TOTAL 15

05. **(a).** (i). Light can appear from the surface if the incident angle is equal or lesser than the ------- angle angle (C).

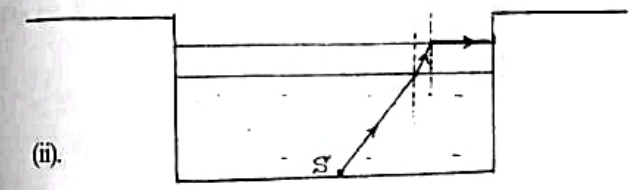
or

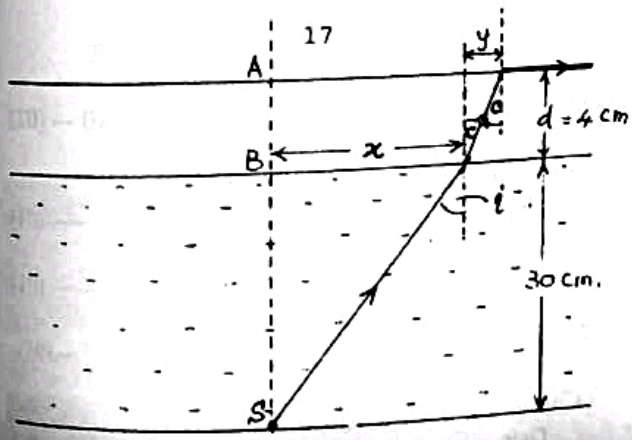
Due to the total internal reflection on the surface

or

The given diagram below ---------- (01)

(ii).





By using $n \sin i$ = constant at the water-glass medium for the ray,

$(4/3) \sin i = (3/2) \sin c$ ---------- (01)

At the glass-air medium,

Therefore, $(3/2) \sin c = 1$ ---------- (01)

$(4/3) \sin i = 1$

$\sin i = 3/4$ ---------- (01)

$i = 48^0\ 35'$

By using geometry

$x = 30 \tan i$ ---------- (01)

Therefore, $x = 34.01$ (or 34) cm ——(01)

$y = 4 \tan c$ ---------- (01)

But $c = 41^0 48'$

Therefore, $y = 3.58$ (or 3.6) cm ——(01)

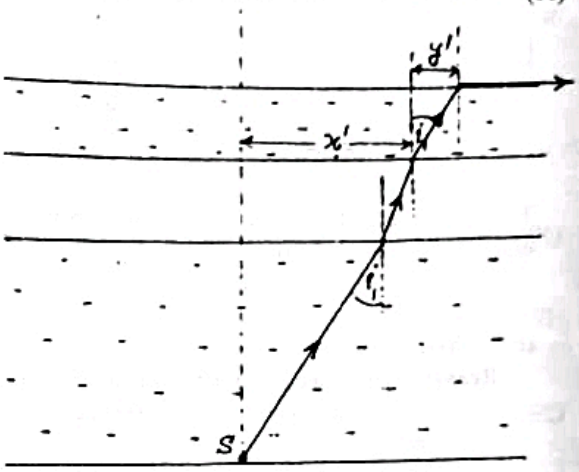
the radius of the light patch

$= x + y = 34.0 + 3.6$

$= 37.6$ cm ---------- (01)

(iii). The diameter of the light patch increases. ——(01)

Because at the water-air interface, before undergoing total internal reflection, the light ray, deviates far from the medium. ---------- (01)



(iv).

Let 'd' be the thickness of the water layer required.

$(4/3) \sin i_1 = 1$ ---------- (01)

At the water-air interface. This is equal to the incident angle (i) found in (ii).

Therefore, $i_1 = 48^0\ 35'$

Therefore, $y' = 45 - 37.6$ (for substraction) ——(01)

$= 7.4$ cm

$d = \frac{7.4}{\tan(48^0\ 35')}$ (for division) ——(01)

$= 6.53$ (or 6.5) cm ---------- (01)

3 - Dimensional

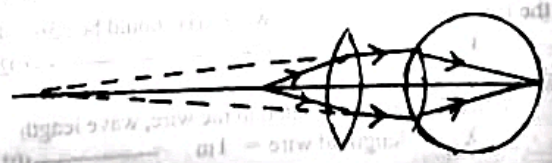
(b). We can observe the total 3-D image **TOTAL 15**

or

Distance from the eye to the object can be observed correctly. ---------- (02)

(Field depth)

(i). Convex lens ---------- (01)



Scanned with CamScanner

For the spectacles,

By using $^1/_v - {}^1/_u = {}^1/_f$

$$\left(\frac{1}{275}\right) - \left(\frac{1}{25}\right) = \frac{1}{f} \quad \text{---------- (01)}$$

$$f = -\frac{(275 \times 25)}{250}$$

$$= -27.5 \text{ cm} \quad \textbf{or}$$

focal length = 27.5 cm ---------- (01)

(ii). For the eye lense,

By using $^1/_v - {}^1/_u = {}^1/_f$

$$-\left(\frac{1}{2.5}\right) - \left(\frac{1}{275}\right) = \frac{1}{f'} \quad \text{---------- (02)}$$

(For identifying u = 275 cm (01) mark)

(For correct substitution (01) mark)

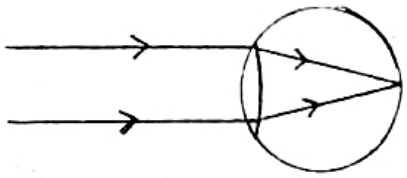
$$f' = \frac{(-2.5 \times 275)}{277.5}$$

$$= -2.48 \text{ cm}$$

Therefore focal length of eye piece

= 2.48 cm ---------- (01)

(iii).



The focal length of the lense that should be used to observe, far objects clearly

= 2.5 cm ---------- (02)

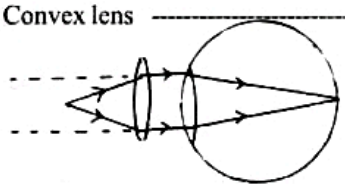
(iv). Yes.

Reason - The shape (or focal length) of the artificial lens cannot be changed to see near objects.

or

The lense cannot be interchanged. ---------- (02)

(v). Convex lens ---------- (01)



The focal length of the reading lense = 30 cm --- (01)

TOTAL 15

06. Velocity of sound $V = \sqrt{E/d}$ ---------- (01)

(i). 256 Hz. As the tuning fork with the transverse frequency produces, 4 beats per second. The frequency of the transverse waves should be 256+4 or 256-4 ---(01)

When the weight W is slowly drowned inside water the tension of the wire gradually decreases. Therefore frequency decreases. ---------- (01)

Because of that the beat frequency decreases. Therefore the frequency of transverse waves (f) should be 256 + 4

f = 260 Hz ---------- (02)

When 2 loops are created in the wire, wave length

λ = length of wire = 1 m ---------- (01)

Therefore, frequency of transverse wave,

$$f = \frac{1}{\lambda} \times \sqrt{\frac{T}{m}} \quad \text{---------- (01)}$$

Tension T = W ---------- (01)

(ii). Let A be the cross-sectional area of wire.

Then, stress in wire = W/A ---------- (01)

strain in wire = 0.25/100 ---------- (01)

Young's modul, $E = \frac{\text{stress}}{\text{strain}}$ ---------- (01)

$$= \frac{W/A}{0.25/100}$$

$$= \left(\frac{W}{A}\right) \times \frac{10000}{25}$$

Velocity of sound inside wire,

$$V = \sqrt{\frac{E}{d}} = 20\sqrt{\frac{W}{Ad}} \quad \text{---------- (01)}$$

But, frequency of transverse wave, $f = \sqrt{(1/1)}\, W/m$

Mass per unit length $m = A \times l \times d$ ---------- (01)

Then, $f = \sqrt{W/Ad}$

= 260 Hz ---------- (01)

Therefore, velocity of sound in the material of the wire,

$V = 20 \times 260$

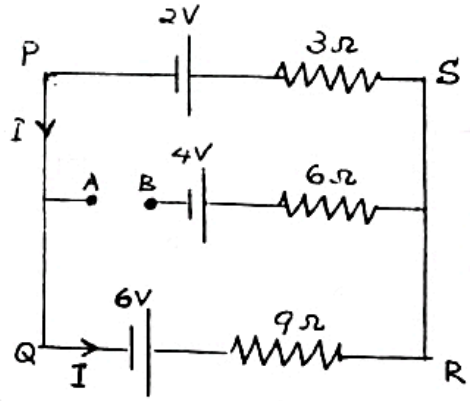
$= 5200 \text{ ms}^{-1}$ ---------- (01)

TOTAL 15

07. (a). Kirchoff's law.

1. At any node in an electrical circuit the algebraic sum of currents flowing into that node is zero. ---------- (01)

2. The algebraic sum of the IR products (voltage drops) in any closed electric circuit loop is equal to the alegebraic sum of the electro motive forces. ---------- (01)



For understanding that no current flows through AB --- (02)

(i). by using Kirchoff's 2nd law for PQRS

$6 - 2 = (9+3)I$ ---------- (01)

$4 = 12\,I$

$I = 1/3$ A ---------- (01)

Considering branch QROB,

The potential at O relative to Q = $6 - (1/3) \times 9$ --(01)

= 3V

(Considering BOSP branch)

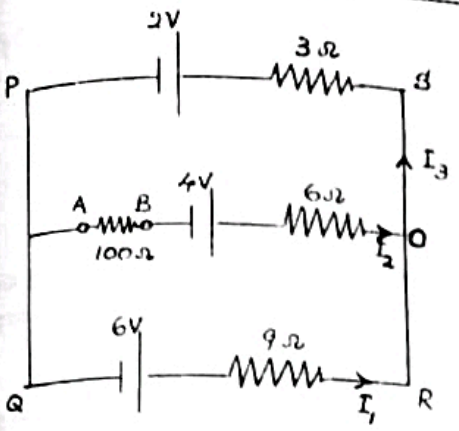
Then, $V_{OQ} = 2 + (1/3) \times 3$ ---------- (01)

Scanned with CamScanner

Potential at B [illegible]

$= -1\ V$ ——— (01)

(ii).



By applying Kirchoff's law.

$I = I_1 + I_2$ ——————— (01)

QROA $6 - 4 = 9I_1 - 106I_2$ ---- (A) ——— (01)

AOSP $4 - 2 = 106I_2 + 3(I_1 + I_2)$ ---- (B) ——— (01)

(or PQRS $6 - 3 = 9I_1 + 3(I_1 + I_2)$)

From (A), $2 = 9I_1 - 106I_2$ ----- (C)

From (B), $2 = 3I_1 + 109I_2$

$6 = 9I_1 + 327I_2$ ----- (D)

(D)-(C) $4 = 433\ I_2$

$I_2 = 4/433$ ——————— (01)

The potential difference through AB $= I_2 \times 100$ ——— (01)

$= \frac{4 \times 100}{433}$

The value calculated by the voltmeter reading

$= 0.924$ V (or 0.92 V) ——— (01)

(iii). Yes.

As the voltmeter is connected parallel to the other parts in the circuit. ——————— (01)

TOTAL 15

(b). (i). Work done on the electron $= eV$ ——— (01)

$= 1.6 \times 10^{-19} \times 18.2 \times 10^3$

$= 29.12 \times 10^{-16}$ J ——————— (01)

(ii). $(1/2)\ mV^2 = eV$ ——————— (01)

$V^2 = \frac{2eV}{m}$

$= \frac{2 \times 1.6 \times 10^{-19} \times 18.2 \times 10^3}{9.1 \times 10^{-31}}$ ——— (01)

$= 64 \times 10^{14}$

$V = 8.0 \times 10^7\ ms^{-1}$ ——————— (01)

Another method

Acceleration of electron,

$a = eE/m$

$= eV/md$ ——————— (01)

substituting $V^2 = u^2 + 2ad$

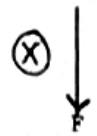
$V^2 = 2eV/m$

(Offer the other 2 marks for the above)

(iii). Magnetic force $F = eVB$

$= 1.6 \times 10^{-19} \times 8 \times 10^7 \times 0.2$

$= 2.56 \times 10^{-12}$ N ——— (01)



(Direction of the force is as shown above) ——— (01)

Magnitude of the electric field intensity,

$eE = eVB$ ——————— (01)

$E = BV$

$= 0.2 \times 8 \times 10^7$

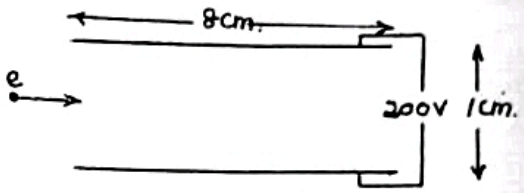
$= 1.6 \times 10^7\ NC^{-1}$ (or Vm^{-1}) ——— (01)

(As the electron has a negative charge, the direction of the electric field should be downwards.)



(the direction of E as shown) ——— (01)

(iv).



Force on the electron $= e\vec{E}$

But $\vec{E} = v/d$

$= \frac{200}{(1 \times 10^{-2})}$ ——— (01)

$= 2 \times 10^4\ NC^{-1}$

Acceleration of electron $= eE/m$ ——— (01)

Time taken to exit the sheets

$= 8 \times 10^{-2}/v$ ——————— (01)

$= \frac{8 \times 10^{-2}}{8 \times 10^7} = 10^{-9}$ s

If the deflection is h, by using $h = ut + (1/2)\ at^2$

$h = 0 + \left(\frac{1}{2}\right) \times \left(\frac{eE}{m}\right) \times (10^{-9})^2$ ——— (01)

$= \frac{1 \times 1.6 \times 10^{-19} \times 2 \times 10^4 \times 10^{-18}}{9.1 \times 10^{-31}}$

$= 1.76 \times 10^{-3}$ m (1.76 mm) ——— (01)

TOTAL 15

08. (i). $V = Ea$

$= 1.2 \times 10^8 \times 0.9$ ——————— (01)

$= 1.08 \times 10^8$ V ——————— (01)

$Q = 4\pi\varepsilon_0 aV$

$= (1/9 \times 10^9) \times 0.9 \times 1.08 \times 10^8$ —(01)

$= 1.08 \times 10^{-2}$ ——————— (01)

The energy stored in the sphere.

$= (1/2)\ QV$

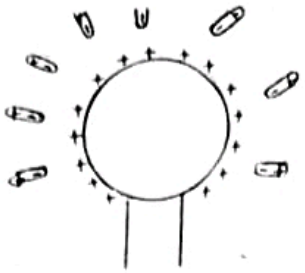
(or $(1/2)\ CV^2$, $Q^2/2C$) —(01)

$= 1/2 \times 1.08 \times 10^{-2} \times 1.08 \times 10^8$

$= 5.83 \times 10^5$ J ——————— (01)

Scanned with CamScanner

(ii).



The gas molecules (water droplets, dust) around the sphere get polarized. Charge seperation takes place (01)

or

As shown in the diagram.
Then, they get attracted to the sphere. When they come in contact with the sphere, their charges become partically inactive. ----------(01)

(iii). Because, even though anything happens to the potential of the source the total charge can be migrated in to the shell.

(iv). The charge of the sphere after 1 s

$= 1.08 \times 10^{-2} - 8.0 \times 10^{-4}$ (for the substitution) --- (01)

$= 1.0 \times 10^{-2}$ C ----------(01)

The energy started after 1 s

$$= \frac{1}{2} \times \frac{9 \times 10^9 \times (10^{-2})^2}{0.9} \text{ ----------(01)}$$

$= 5 \times 10^5$ J ----------(01)

Rate of electric energy supplied,

$= (5.83 - 5)\, 10^5$ ----------(01)

$= 8.3 \times 10^4$ W ----------(01)

[In the method of charging if a student assumes that the potential remains unchanged, the energy supplied in a second. $= 8 \times 10^{-4} \times 1.08 \times 10^8$

$= 8.64 \times 10^4$ W ----------01]

TOTAL 15

Scanned with CamScanner