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.**

1996 A/L Physics II (A and B)

Answers

Part - A

01. (a). (i). 25/5 = 5/X (Extension of the rubber string in mm)
X = 1mm ------------------------- (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 x 2N = 0.4 N ------ (01)
Therefore, 0.4 x 5 = 5 x 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 x 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)

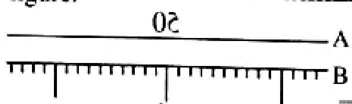
$\dfrac{1}{v} - \dfrac{1}{105} = -\dfrac{1}{5}$ (for the correct substitution) -(01)

v = -5.25 cm

Therefore, the distance between the eye piece and the eye = 5.25 cm ------------------------------ (01)

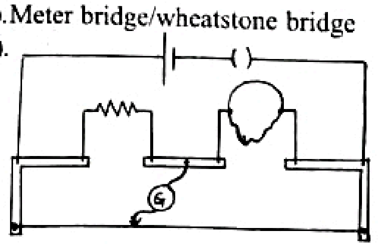
(ii). All of the rays are going through the objective lense comes closer to the eye. (or the object can be observed with maximum brightness) ------------------(01)

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



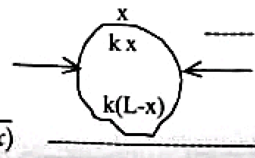
TOTAL 10

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)

(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)

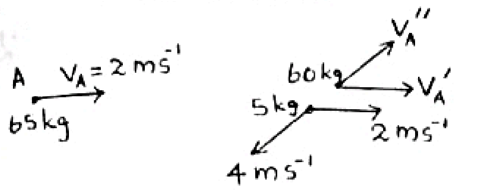
(ii). Diameter of wire ---------- (01)

(f). The wire is broken at a certain place inside the insulating 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

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

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

(2). In the perpendicular direction

$5 \times 4 = 60V_A''$ ---------- (01)

$V_A'' = 20/60$

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

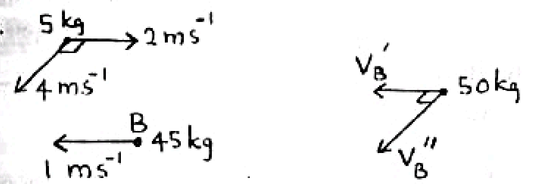
Resultant velocity of A

$V_A^2 = V_A'^2 + V_A''^2$ ---------- 01

$V_A = \sqrt{37}/3$

$= 2.03\,ms^{-1}$ ---------- 01

(ii).



conservation of momentum

(a). In the initial direction of B,

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

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

$= 0.7\,ms^{-1}$ ---------- (01)

(b). In the perpendicular direction, ---------- (01)

$5 \times 4 = 50\,V_B''$

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

$= 0.4\,ms^{-1}$ ---------- (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

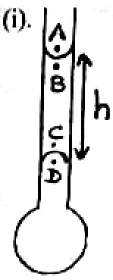
$= A' \times 1 \times 10^3\ 1/10$ ---------- (01)

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

$A' = 6 \times 10^6\ m^2$ —— (01)

TOTAL

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,

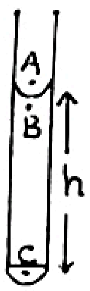
$h\rho g = 4T/R$ ---------- (01)

(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)

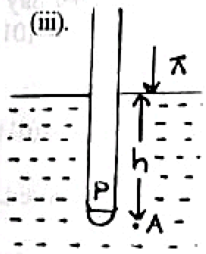
by the above equation

$h\rho g = 4T/r$ -------------- (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)

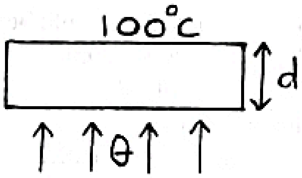
(or by taking $2T/r\sigma g$ as the intercept)

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

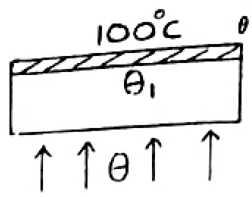
By using $\frac{Q}{t} = KA\frac{(\theta_1 - \theta_2)}{d}$ ------ (01)

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

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

$\theta = 532.4\ ^\circ C$ 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,

$\theta_1 = 316.2\ ^\circ C$

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)

Mass of gas ... under atmospheric pressure

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

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

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

$= \frac{(24.1 - 1.54)}{0.32}$ (01 mark for substraction) - (02) (01 mark for division)

$= 70.5 \quad = 70$ ---------------(01)

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

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

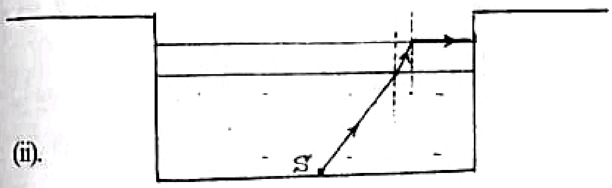
or

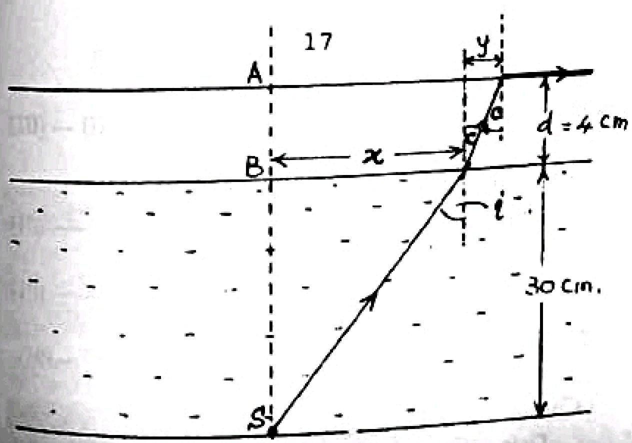
Due to the total internal reflection on the surface

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,

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

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

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

$i = 48° 35'$

By using geometry

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

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

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

But $c = 41° 48'$

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

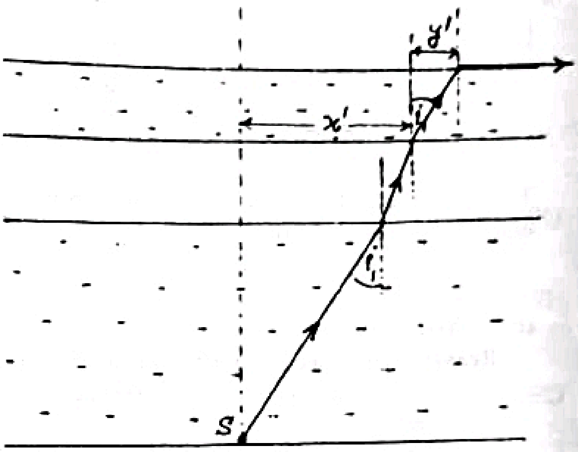
the radius of the light patch

$= x + y = 34.0 + 3.6$

$= 37.6$ 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, $i_1 = 48° 35'$

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

$= 7.4$ cm

$d = \frac{7.4}{\tan(48° 35')}$ (for division) -----(01)

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

TOTAL 15

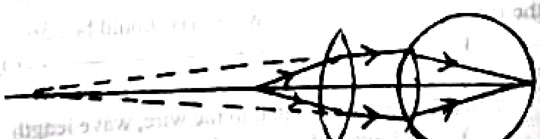
(b). We can observe the total 3-0 image

or

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

(Field depth)

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



For the spectacles,
By using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

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

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

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

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

(ii). For the eye lense,
By using $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

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

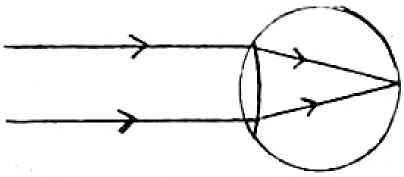
(For identifying u = 275 cm (01) mark)
(For correct substitution (01) mark)

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

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

Therefore focal length of eye piece
$= 2.48$ cm ------------------------ (01)

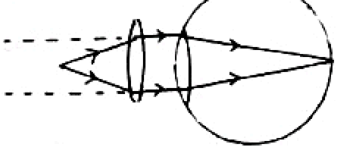
(iii).



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,

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

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)

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

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

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

Velocity of sound inside wire,

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

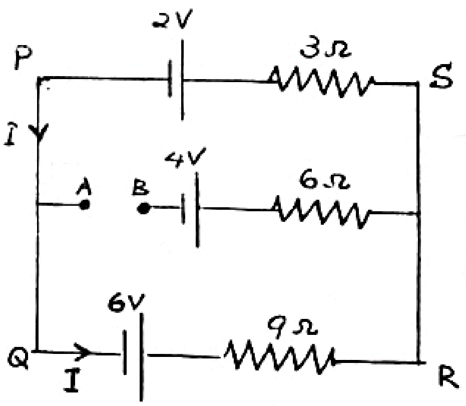
But, frequency of transverse wave, $f = \sqrt{(1/1)}\ W/m$

Mass per unit length $m = A \times 1 \times d$ ------------------------ (01)
Then, $f = \sqrt{W/Ad}$
$= 260$ Hz ------------------------ (01)

Therefore, velocity of sound in the material of the wire,
$V = 20 \times 260$
$= 5200\ ms^{-1}$ ------------------------ (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)



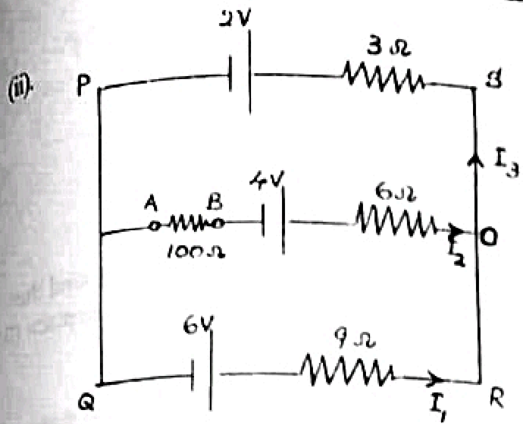
For understanding that no current flows through AB --- (02)

(i). by using Kirchoff's 2[nd] law for PQRS
$6 - 2 = (9+3)I$ ------------------------ (01)
$4 = 12I$
$I = 1/3$ 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)

Potential at B relat...

$= -1\ V$ ---------(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)

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

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). $(1/2)\ mV^2 = e\ V$ ---------------------------(01)

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

$= \dfrac{2 \times 1.6 \times 10^{-19} \times 18.2 \times 10^3}{9.1 \times 10^{-31}}$ ---------(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 $V^2 = u^2 + 2\ ad$

$V^2 = 2eV/m$

(Offer the other 2 marks for the above)

(iii). Magnetic foce 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)

$E = BV$

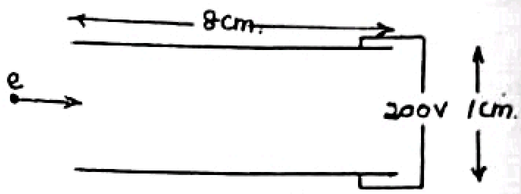
$= 0.2 \times 8 \times 10^7$

$= 1.6 \times 10^7\ NC^{-1}$ (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 $\vec{E} = v/d$

$= \dfrac{200}{(1 \times 10^{-2})}$ --------(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)

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

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)

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

$= 1.76 \times 10^{-3}\ m$ (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.

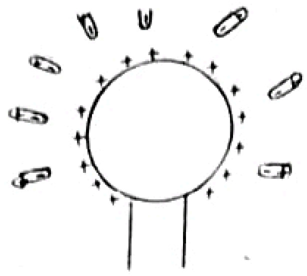
$= (1/2)QV$

(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)

(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

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