1995 A/L Answers of MCQ's

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

Explanation

34. **Even though the question reffers to the value of the heat wastage, the answer is given in "W". So consider all 5 answers are correct.**

38. **All the 5 answers are considered correct since the correct answer was not printed.**

1995 A/L Physics II (A and B)

Part - A

Answers

01. (a). Micrometer screw gauge ---------------------------- (01)

(b). Check the zero error or check the coincidence of the 'O' mark of the main scale with the circular scale. --- (01)

(marks given for the correct answer in (b) even if the answer in (a) is incorrect)

(c). 1. External jaws / Outside jaws ---------------------- (01)
2. Internal jaws / Inside jaws ---------------- (01)

(d). Chemical balance ----------------------------------- (01)

(e). $m / (a^2 - b^2)\, t$ ----------------------------------- (01)

(f). (i). 0.01 mm (Unit is not considered) ------------ (01)
(ii). $\dfrac{(1.10 + 1.11 + 1.12 + 1.12 + 1.11)}{5}$

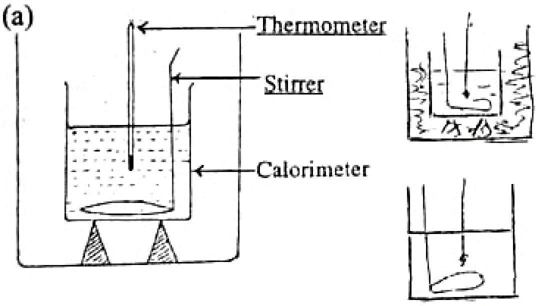
$= 1.11$ mm or 1.112 mm
(unit is not considered) --------------------- (01)

(iii). upto two decimal places.
Measurement is correct upto two decimal places or the least count is limited upto two decimal places. ------- (01)
(Give marks for an explanation)

(g). Displaced amount of water is very low. ------(01)

TOTAL 10

02. (a)



For the diagram and for naming the underlined words --- (01)

(b). (i). Small pieces ------------------------------------- (01)
(ii). Large pieces are not used :-
The final temperature of the mixture cannot be controlled. **Or**
The final temperature of the mixture can be lower than the dew point **Or**
The amount of water may be not enough to dissolve the ice **Or**
The average temperature of ice may not be 0^0C.
(For any above given answer) ------------------ (01)

The powered ice cannot get without having any moisture.

(c). (i). Mass of the calorimeter
(ii). Calorimeter + mass of water
(iii). Temperature of water
(If all the responses are correct) —(01)

(d). Increasing the initial temperature of water a few degrees than the room temperature and add ice until the temperature of the water decreases than the room temperature by the above amount. ------------------------(01)

(e). Final temperature of water.

Calorimeter + mass of the mixture
(If both the answers are correct) --------------(01)

(f). (i). It takes a long time to melt ice or the heat wastage is high or the method given in (d) cannot be used. ------- (01)

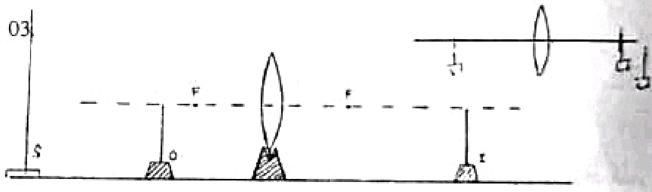
(ii). Dew is deposited on the outer surface of the calorimeter (since the temperature is very low) ----------(01)

(g). $\dfrac{2.2 \times 10^3 \times 2}{3.3 \times 10^5} \times (100)$ or $\dfrac{4}{3}$ % ----------(01)

(Not necessary to show as a percentage)

TOTAL 10

03

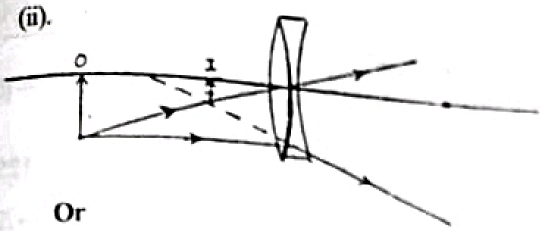


For the coorect positions of S , O and I ------------(01)
For the correct positions of focal points ------------(01)
(Marks are not given for a ray diagram or if O and I are positioned on the main axis.)

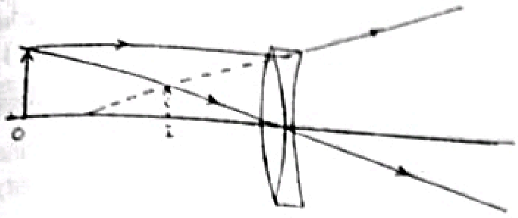
(b). Place the eye behind the I pin and move in perpendicular to the main axis. --------------------(01)
Adjust I until the image of O which is formed by the lense moves together with the I pin. ---------------------(01)

(c). (i). The lense combination works as a concave lense or the image formed by the lense combination is virtual - (01)

(ii).



Or



------ (01)

(d). (i) . the place at which the virtual image of O is made by the lense combination or the origination as indicated in the diagram ------------------------ (01)

(ii). U = 20 cm , V = (20 - 10) ------------ (01)
= 10 cm

Therefore, $\frac{1}{V} - \frac{1}{U} = \frac{1}{F}$

$\frac{1}{10} - \frac{1}{20} = \frac{1}{F}$

Therefore, F = 20 cm ------------------ (01)

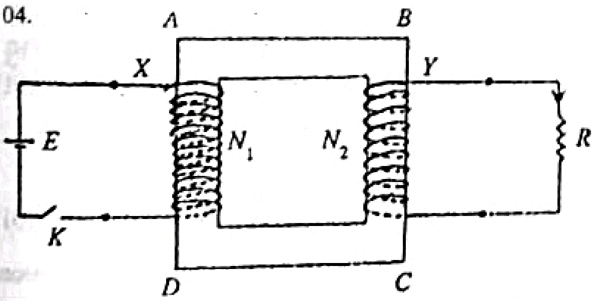
(iii). $\frac{1}{f_1} + \frac{1}{f_2} = \frac{1}{F}$

$-\frac{1}{20} + \frac{1}{f_2} = \frac{1}{20}$

Therefore, f_2 = 10 cm ------------------ (01)

TOTAL 10

04.



(a).(i). A current flows through X when K is closed.
(It get charged)
This causes for the change in the magnetic field -- (01)
Therefore a current is induced at Y ------------ (01)

(ii). Given in the diagram ------------ (01)

(iii). Lenz law
When there is a change occured in the magnetic flux of the circuit, the direction of the induced current is towards the opposing direction of the change ------ (01)

(iv). To make a maximum magnetic flux across Y coil or to increase the magnetic flux across Y coil using an iron medium. or
to minimize the flux leak or
to control the magnetic flux across the Y coil -- (01)
(For any of the above)

(b). $V_2 = \frac{N_2}{N_1} V_1$ ------------------------ (01)

(c). (i). Using a medium for insulation ------------ (01)
(ii). A continous medium is necessary to get spiral currents. ------------------------ (01)
It can be prevented by inserting insulated plates in between.

(d). (i). Step-down transformer ------------ (01)
(ii). A large current is needed to generate the heat required to boil. ------------------ (01)

TOTAL 10

Part - B

01. **(a).** (i). Length of the inclined plane.
$= \frac{1.4}{\sin 30^0}$ or (2.8 m) ------------ (01)

Magnitude of the total work done
= 640 x d ------------------ (01)
= 640 x 2.8
= 1792 J ------------------ (01)

(ii). Increase of the formed potential energy
= 100 x 10 x 1.4
= 1400 J ------------------ (01)

(iii). Apart of the work done is used to minimize the friction between the object and the plane. ------------ (01)

(iv). Against the frictional force
= 1792 - 1400 (For the subtraction) —(01)
= 392 J

Frictional force = 392/2.8 (For the division) —(01)
= 140 N

Normal reaction
= 10 x 100 x cos 30^0 ------------ (01)

Co-efficient of friction
$= \frac{140}{1000 \cos 30^0}$ ------------ (01)
= 0.16 (0.15 - 0.2) ------------ (01)

(v). (a). Change of momentum
= 100 x (4 - 0)
= 400 kg ms^{-1} ------------ (01)

(b). Force acting on the object
= 400 / 2
= 200 N ------------------ (01)

This force is occured due to the friction between the box and the belt. ------------ (01)

(c). Required force = 200 N
(or equal to the above value) -------------- (01)
Using on external work -------------- (01)
ex :- Using an electric motor

TOTAL 15

(b). Using $\frac{F}{A} = E\left(\frac{e}{L}\right)$. -------------- (01)

If the force acting on A is F_A

$$\frac{F_A}{\pi \times 10^2 \times 10^{-4}} = 1.0 \times 10^{11}\left(\frac{e_A}{5}\right) \text{-------- (1)} \quad \text{--(01)}$$

(for the correct substitution)

If the force acting on B is F_B

$$\frac{F_B}{\pi\,(15^2 - 10^2)\,10^{-4}} = 1.2 \times 10^{11}\left(\frac{e_B}{5}\right) \text{-------- (2) -- (02)}$$

(1 mark for the correct area
1 mark for the correct substitution)

$e_A = e_B$ (consider = e) -------------- (01)

$$\frac{(1)}{(2)} \Rightarrow \frac{F_A}{F_B} = \frac{10^2}{(15^2 - 10^2)} \times \frac{1}{1.2}$$

$= 2/3$ -------------- (01)

(ii). $F_A + F_B = 2.2 \times 10^6$ N -------------- (01)

Therefore, (1) $F_A = 2/3\ F_B$

$2/3\ F_B = F_B - 2.2 \times 10^6$

$F_B = \frac{3 \times 2.2 \times 10^6}{5}$ N

by substituting in (2)

$$\frac{3 \times 2.2 \times 10^6}{5 \times \pi(15^2 - 10^2) \times 10^{-4}} = 1.2 \times 10^{11}\left(\frac{e}{5}\right)$$

For the correct substitution -------------- (01)

$e = 1.4 \times 10^{-3}$ m --(01)

(marks are not given if the unit is incorrect)

(iii). Using $\Delta l = l\,\alpha\,\theta$ -------------- (01)

increase of length in A

$\Delta l_A = l_A\,\alpha_A\,\theta$
$= 5 \times 2.0 \times 10^{-5} \times 20$
$= 2.0 \times 10^{-3}$ m -------------- (01)

increase of length in B

$\Delta l_B = l_B\,\alpha_B\,\theta$
$= 5 \times 1.0 \times 10^{-5} \times 20$
$= 1.0 \times 10^{-3}$ m -------------- (01)

(iv). If the required force to suppress the increase in length is F_A

Using $\frac{F}{A} = E\left(\frac{\Delta l_A}{L}\right)$

$$\frac{F_A}{\pi \times 10^2 \times 10^{-4}} = \frac{1 \times 10^{11}(2 \times 10^{-3})}{(5 + 2 \times 10^{-3})} \quad \text{or}$$

$$= \frac{1.0 \times 10^{11}\,(2 \times 10^{-3})}{5} \text{ -------- (01)}$$

(for the correct substitution)

Similarly, if the required force to suppress the increase in length is F_B.

$$\frac{F_B}{\pi \times (15^2 - 10^2) \times 10^{-4}} = \frac{1.2 \times 10^{11} \times 1.0 \times 10^{-3}}{5}$$

for the correct substitution ------ (01)

Therefore, $F_A + F_B = \frac{\pi \times 10^{-4} \times 10^{8}}{5}(2 \times 100 + 1.2 \times 125)$

$= 2.2 \times 10^6$ N -------------- (01)

Therefore if a weight of 2.2×10^6 N is kept on the load sheet, the length of the supporter again becomes 5m.)

TOTAL 15

02. If F is the viscos force acting on a sphere with radius r which moves in a fluid with the co-efficient of viscosity η in V velocity.

$F = K\,a^X\,\eta^Y\,V^Z$ -------------- (01)
$[a] = L$
$[\eta] = [M][L]^{-1}[T]^{-1}$
$[V] = [L][T]^{-1}$
$[F] = [M][L][T]^{-2}$

If all 4 are correct -------------- (02)
If any 3 are correct -------------- (01)

Therefore, $MLT^{-2} = L^X\,(ML^{-1}T^{-1})^Y\,(LT^{-1})^Z$

Using that by equating the indices of M , L , T

$y = 1$; $x - y + z = 1$; $-y - z = -2$

Therefore,

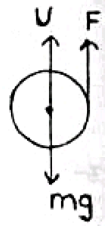
$x = 1$; $y = 1$ and $z = 1$ -------------- (01)

Therefore,

$F = k\,a\,\eta\,v$

(i). Expression for the terminal velocity V by equating the forces.

$$\frac{4}{3}\pi a^3 \rho g - \frac{4}{3}\pi a^3 \sigma g - 6\pi a \eta v = 0 \text{ ---------- (03)}$$



(for the correct 1st or the 3rd term ------- (01))
(for $6\pi a\eta v$ term --------- (01)
Marks are not given for $\pi a \eta v$
(For equating the forces correctly ------ 01)

$$v = \frac{2a^2 g\,(\rho - \sigma)}{9\,\eta} \text{ -------------- (01)}$$

Terminal velocity of the particle with

$a = 8 \times 10^{-6}$ m

$$v = 2 \times \frac{(8 \times 10^{-6})^2 \times 10}{9 \times 8 \times 10^{-4}} \times (2500 - 1000) \quad \text{--(01)}$$

(for the correct substitution)

$= {}^8/_3 \times 10^{-4}$ ms^{-1}

Time taken for the particle with

$a = 8 \times 10^{-6}$
$= 1/v$ -------------- (01)
$= {}^3/_8 \times 10^{4}$
$= 3750$ s (take as t_1) -------------- (01)
(between 3700 s and 3750 s)

(iii). $a = 3 \times 10^{-6}$ m time taken to deposit the particle

$$v = 2 \times \frac{(3 \times 10^{-6})^2 \times 10\,(2500 - 1000)}{9 \times 8 \times 10^{-4}} \quad \text{--(01)}$$

(for the correct substitution)

Therefore time taken to settle down

$= \frac{4}{15} \times 10^5$

(let's take it as t_2) = 26667 s

(Values between 26100 s and 27100 s are accepted) -------- (01)

(iv). When settling down $a = 8 \times 10^{-6}$ m particles settled down fraction settled down

$a = 3 \times 10^{-6}$ m

$= t_1 / t_2$ -------- (01)

$= \frac{3 \times 10^{-4} \times 15}{8 \times 4} \times 10^{-5}$ -------- (01)

$= 9/64$

TOTAL 15

03. (a). Newton's cooling law.

The rate of heat wastage from an object is directly propotional to the excess temperature between that object and the surrounding. (2 marks or 0) -------- (02)

(i). (a). The rate of heat wastage from the water container at 90 °C is equal to the rate of heat supply from the thermistor. or (420 W) -------- (02)

(2 marks or 0)

(b). If the wattage that is required to make water just 100 °C is W.

by applying Newton's cooling law for this situation.

$420 \alpha (90 - 30)$ -------- (01)

and $W \alpha (100 - 30)$ -------- (01)

Therefore, $\left(\frac{420}{W}\right) = \frac{60}{70}$ -------- (01)

$W = 490$ W -------- (01)

(ii). (a). No. -------- (01)

(b). No. Since part of the given energy for water is used for the vapourization. It's not used in the calculation. -------- (01)

(c). Newton's laws cannot be applied for vapourization since the heat is not lost by convection or since the vapourization is a different process, the rate of heat loss due to vapourization is not propotional to the excess temperature. -------- (01)

(Give marks for the below answer even)

Rate of vapourization depends on the water volume, mass and the surface area.

(d). $mL = 420$ -------- (02)

(1 mark for the mL term)

(1 mark for the correct expression)

$m = \frac{420}{(2.27 \times 10^6)} = 1.85 \times 10^{-4}$ kg s^{-1} -- (01)

$(1.8 \times 10^{-4} - 1.9 \times 10^{-4})$

(e). No. At 100°C vapourization becomes vapourization and 420 W power is given to that process. All the other wastages are held by the other heater. -- (01)

TOTAL 15

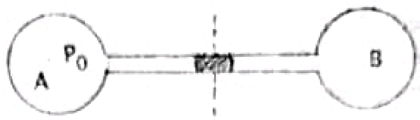
04. $PV = nRT$

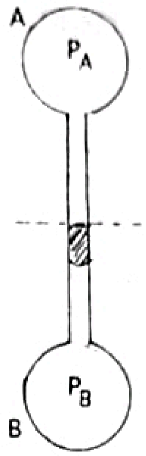
(Deduct 1 mark if the symbols are introduced improperly)

P - Pressure V - Volume

n - no.of moles R - Universal gas constant

T - absolute temperature -------- (02)





by applying Boyle's law for the bulb A.

$P_0(50 + 40) = P_A(50 + 50)$ -------- (01)

$P_A = \left(\frac{90}{100}\right) P_0$ -------- (1)

For the bulb B,

$P_0(50 + 40) = P_B(50 + 30)$ -------- (01)

$P_B = \left(\frac{90}{80}\right) P_0$ -------- (2)

But $P_B = P_A + 20$ -------- (3) -- (01)

(1) and (2) substitute in (3)

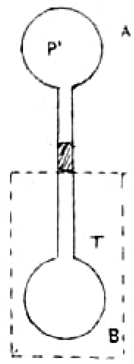
$\left(\frac{90}{80}\right) P_0 = \left(\frac{90}{100}\right) P_0 + 20$

Therefore, $P_0 = 800/9$

$= 88.9$ Hg cm **or**

89 Hg cm -------- (01)

(ii).



By applying Boyle's law for bulb A.

$P_0 \times 90 = P' \times 80$ -- (01)

$P' = \frac{800}{9} \times \frac{90}{80}$

Therefore,

$P' = 100$ Hg cm

Using,

$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ -------- (01)

for B,

$\frac{P_0 \times 90}{300} = \frac{(P' + 20)}{T} \times 100$ -------- (01)

(For the correct substitution)

$\frac{800 \times 90}{9 \times 300} = \frac{120 \times 100}{T}$

$T = 450$ K -------- (01)

(iii). If the no. of moles is n, by substituting it to the gas law.

no. of moles of water vapour at 12 °C

$= \frac{90 \times 10^6 \times 4 \times 10^3}{300 R}$ -------- (01)

no. of moles of water vapour at 12 °C

$= \frac{(90 - 1.5) \times 10^6 \times 1.5 \times 10^3}{285 R}$ -------- (01)

Force on JK $= \frac{8 \times 10^{-5}}{3}$ N $\rightarrow$ ——— (01)

Force on MN

$= \frac{8 \times 10^{-5}}{4}$ N $\leftarrow$ ——— (01)

$= 2 \times 10^{-5}$ N

Therefore,

Resultant force on XY

$= \left(8 - 4 + \frac{8}{3} - 2\right) 10^{-5}$

$= (14/3) \times 10^{-5}$

$= 4.67 \times 10^{-5}$ N to right ——— (02)

or 4.7×10^{-5} N to right

(1 mark for the correct direction, 1 mark for the current value)

(ii). Yes ——— (01)

due to the current flowing from XY wire and since the forces acting on different parts balance, there's no external force acting on XY ——— (01)

(iii). 0 (zero) ——— (01)

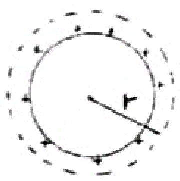
(For the correct calculation or for writing the below reasons.)

The resultant force occured on CD due to the current is equal in magnitude and the direction to AB. ——— (01)

(iv). The magnetic field at an outside from the wire pair is zero since the directions of the currents flowing in wire pairs are opposite to each other. ——— (01)

TOTAL 15

08.

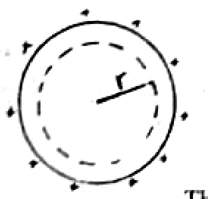


Select a Gaussion surface outside the shell with radius ——— (01)

If the electric field intencity at r distance is E_1

$E_1 \, 4\pi r^2 = \frac{Q}{\varepsilon_0}$ ——— (01)

Therefore, $E_1 = \frac{1}{4\pi\varepsilon_0} \times \frac{Q}{r^2}$ ——— (01)



If the electric field intencity inside the shell is E_2,

$E_2 \, 4\pi r^2 = 0$ ——— (01)

Or

(Charge inside the shell is zero)

Therefore, $E_2 = 0$ ——— (01)

(i).(a). Electro potential energy at A

$= -\frac{1}{4\pi\varepsilon_0} \times \frac{qQ}{d}$ ——— (01)

(b). Electro potential energy at the centre

$= -\frac{1}{4\pi\varepsilon_0} \times \frac{qQ}{R}$ ——— (01)

(If the expressions are without +/- give only 1 mark for the both of the instances)

(ii). From the law of conservation of energy

$-\frac{1}{4\pi\varepsilon_0} \times \frac{qQ}{d} = -\frac{1}{4\pi\varepsilon_0} \frac{qQ}{R} + k$ ——— (02)

The kinetic energy of the particle is k.

(If the sign of the expression is incorrect, 1 mark is given for the conservation of energy)

Therefore, $k = \frac{1}{4\pi\varepsilon_0} qQ \left[\frac{1}{R} - \frac{1}{d}\right]$ ——— (01)

(iii). The particle comes distance to a towards right from the centre and stops ——— (02)

or

if a candidate has used the below method offer marks for that method.

by applying law of conservation of energy if the distance to the particle is y

$-\frac{1}{4\pi\varepsilon_0} \times \frac{qQ}{d} = -\frac{1}{4\pi\varepsilon_0} \times \frac{qQ}{y}$ ——— (01)

Therefore, $y = d$ ——— (01)

(iv). From A to B the velocity of the particle increases -- (01)

From B to C the velocity of the particle is constant -- (01)

Ahead of C, the velocity of the particle decreases -- (01)

TOTAL 15