தரம் :- 13 (2022)	பௌதிகவியல்	புள்ளித்திட்டம்

பகுதி - I

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

(50 x 1 = 50 புள்ளிகள்)

Part - II A

(1) (a) When floating freely, the weight of the boiling tube is equal to the upthrust. (1)

$U_1 = U_2$ (1)

(b) $(M+m)g = (V + A\ell)\rho g$ (1)

(c) Law of principal of flotation. (2)

(d) $(V + A\ell)\rho = M + m$

$V + A\cdot\ell = \frac{M}{\rho} + \frac{m}{\rho}$

$A\ell = \frac{m}{\rho} + \frac{M}{\rho} - V$

$\ell = \frac{1}{A\rho} m + \left(\frac{M}{\rho} - V\right)\frac{1}{A}$ (1)

$y \quad\quad m \quad x \quad + \quad c$

Independent variable - m
Dependant variable - ℓ (1)

(e) Adjust the weights, until the liquid column is close to the open end of the tube, and find the high mass, divide it into equal part and measure their respective legths. (2)

(f) Outer diameter of tube (1)
Vernier Caliper (1)
External jaws (1)

(g)(i) -0.4mm (1)

(ii) $19 + 0.1 \times 6 = 19.6$mm (1)

(iii) $19.6 + 0.4 = 20$mm (1)

(h) $A = \pi r^2$

$= 3 \times 1 \times 10^{-2} \times 1 \times 10^{-2}$

$= 3 \times 10^{-4}\ m^2$ —— 1

$m = \frac{1}{A\rho} \Rightarrow \rho = \frac{1}{mA}$

$\rho = \frac{1}{3 \times 10^{-4} \times 1000 \times 10^{-2}}$ —— 1

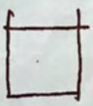
$= \frac{1000}{3}$

$= 333.33\ kgm^{-3}$ —— 1

(j) (i) Will increase —— 1

(ii) Will not change —— 1

$\frac{\quad}{20}$

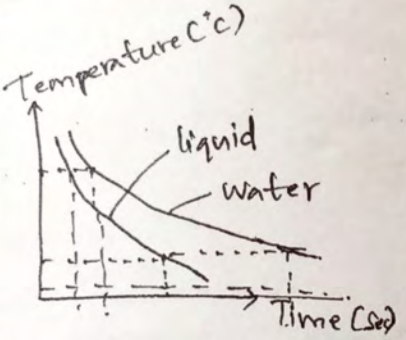
2 (i)  —— 1

(a) (ii) To maintain the temperature of the liquid throughout the exterior of the vesel. —— 2

(iii) Yes, —— 1
To maintain the same heat loss for water and liquid —— 1

(iv) Yes —— 1
To maintain the temperature of the liquid and the temperature of the outer surface of the calorimeter equal —— 1

(b) Mix well with a stirrer —— 1

(c) 

(i) unit, x, y — ②
(ii) Nameing — ②

(d) (i) $\frac{dQ}{dt} = ms\frac{d\theta}{dt}$ $= 0.2 \times 4000 \times \frac{(55-45)}{4 \times 60}$ $= 33.33\ W$ —— ①

①

(ii) $(C+ms)\frac{d\theta}{dt} = KA(\theta - \theta_R)$ —— ①

$(112 + 0.2 \times 4000)\frac{10}{4 \times 60} = KA(50 - \theta_R)$ —— ①

$(112 + 0.172 \times 5)\frac{10}{2 \times 60} = KA(50 - \theta_R)$ —— ①

$s = 2000\ J\,kg^{-1}K^{-1}$ ①

(iii) Same calorimeter
Same environmental condition
Same volume of water and liquid —— ②

$\boxed{20}$

③ (a) To obtain one end closed ~~tube~~ ~~length~~ tube with uniform variable length. —— ①

(b) 512 Hz —— ①

A short length of tube is sufficient to complete the experiment —— ①

Resonance can be heard correctly / Resonance length can be measured correctly —— ①

(c) ①

(d) (i) ① , ①

(ii) $\lambda/4 = l_1 + e$ —— ①

(iii) $v = 4f(l_1 + e)$ —— 1

(e) (i) 1 , 1

(ii) $3\lambda/4 = l_2 + e$ —— 1

(iii) $v = \frac{4}{3} f (l_2 + e)$ —— 1

(f) (i) $4f(l_1 + e) = \frac{4f}{3}(l_2 + e)$ —— 1

$$e = \frac{l_2 - 3l_1}{2}$$ —— 1

(ii) $e = \frac{49.8 - 3\times16}{2}$ —— 1

$= 0.9\,cm$ —— 1

(iii) $v = 4f(l_1 + e)$

$= 4 \times 512 \times 16.9 \times 10^{-2}$ —— 1

$= 346.1\,ms^{-1}$ —— 1

$\boxed{20}$

(g) The amount of water vapour inside the tube is higher so the molecular mass less inside the tube so the speed is slightly higher. —— 1

4 (a) (i) Yes —— 1

Resistance of connecting wires and copper strips can be neglected only if the resistances are smaller than the values of resistances compared. —— 1

(ii) As the resistances of wide copper strips are small compared to and can be ignored when comparable resistance —— 1

(iii) center zero galvanometer —— 1

(b) (i) No

The balance length does not depend on the current through the circuit. —— 1

(iii) 1. To prevent high currents from passing through the galvano meter when the equilibrium point is reached. —— 1

2. For high resistance short to find the accurate balance point —— 1

(c) (i) deflect in the same direction —— 1

Resistance of the Resistance box. is zero, the balance point is at zero —— 1

(ii) No —— 1

Touching the Jockey at the end of the meter bridge wire will shows deflection in the same direction —— 1

(iii) Infinity plug —— 1

(iv) the balance length should be close to the mid point of the wire —— 1

1. to reduce the error when measure the balance length —— 1

2. to increase the sensitivity —— 1

(d) i) $\frac{R_1}{R_2} = \frac{l}{100-l}$ —— 1

ii) $\frac{100-l}{l} = \frac{R_2}{R_1}$

$\frac{100}{l} - 1 = \frac{R_2}{R_1}$

$\frac{100}{l} = \frac{R_2}{R_1} + 1$

$\frac{1}{l} = \frac{R_2}{100}\frac{1}{R_1} + \frac{1}{100}$ —— 1

$\underset{y}{|}\quad \underset{m}{|}\quad \underset{x}{|}\quad \underset{c}{|}$

iii) $\frac{m}{c}$ —— 1

(iv) yes —— 1

switch

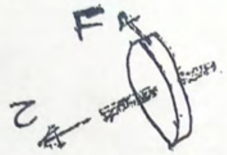
switch should be connect as series with electric cell } —— 1

20

05) a)

i. Torque = Force × Perpendicular distance from the rotation axis —— 1

ii.



—— 1

iii. $\tau = F \times R$ —— 1

b)

i. To take the moment about the axis of rotation when not rotating,

$T \times 0.1 = 250 \times 0.8$

$T = 2000N$ —— 1

ii. From Hooke's law, $F = k\,e$ —— 1

$2000 = 4 \times 10^4 \times e$

$e = 5cm$ —— 1

iii. Hooke's law —— 2

iv. Potential energy stored in the string $= \frac{1}{2} k e^2$ —— 1

$= \frac{1}{2} \times 4 \times 10^4 \times (5 \times 10^{-2})^2 \ J$

$= 50 J$ —— 1

c) To take the moment about the axis of rotation when trailer is stationary,

$5000 \times 0.8 = T \times 0.1 + 5$

$T = 3950 N$ —— 1

d)

i. By moving at constant speed,
Frictional force = Tension —— 1

$F = 3950N$ —— 1

ii. Rate of frictional energy loss = Force × Velocity —— 1

$= 3950N \times 0.25 \ ms^{-1}$

$= 987.5 W$ —— 1

iii. Frictional force acting on the boat $F = \mu R$

$= \mu mg \quad (R = mg)$ —— 1

$M = F/\mu g$

$= \frac{3950}{0.2 \times 10} \ kg$

e)

i. Applying $\tau = I\,\alpha$, at the moment of cutting the string,

$$-5 = 2\alpha \quad \text{—— (1)}$$

$$\alpha = -2.5 \ rad\,s^{-2}$$

Angular acceleration is 2.5 $rad\,s^{-1}$ —— (1)

ii. Until rest, $\omega = \omega_0 + \alpha t$ —— (1)

$$0 = 2.5 + (-2.5)t$$

$$t = 1s \quad \text{—— (1)}$$

$$\theta = \tfrac{1}{2}(\omega_0 + \omega)t \quad \text{—— (1)} \quad = \tfrac{1}{2}(2.5 + 0) \times 1 = 5/4$$

$$= 1.25 \ rad \quad \text{—— (1)}$$

Number of rotations $= \theta/2\pi$ —— (1)

$$= \frac{5/4}{2 \times 3} = 5/24 \quad \text{—— (1)}$$

f)

i. For the equilibrium of the boat,

$$Mg = 3T \quad \text{—— (1)}$$

$$T = \frac{1975 \times 10}{3} \qquad T = 6583.33\,N \quad \text{—— (1)}$$

ii. To take the moment about the axis of rotation

$$F \times 0.8 = 6583.33 \times 0.1$$

The force to apply, $F = 822.92\,N$ —— (1)

iii. Minimum work done on handle = increase in potential energy

$$= mgh \quad \text{—— (1)}$$

$$= 1975 \times 10 \times 0.5$$

$$= 9875\,J \quad \text{—— (1)}$$

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6.

a)

i. LASER light is monochromatic light, coherent light. —— (2)

ii. Level 2 —— (1)

iii. P - Optical pumping, Q – Spontaneous emission, R – Simulated emission/ LASER production. —— (3)

iv. Simulated emission. —— (1)

v. For optical pumping. —— (1)

vi. Energy of Pumping photon $= E_3 - E_1$ —— (1)

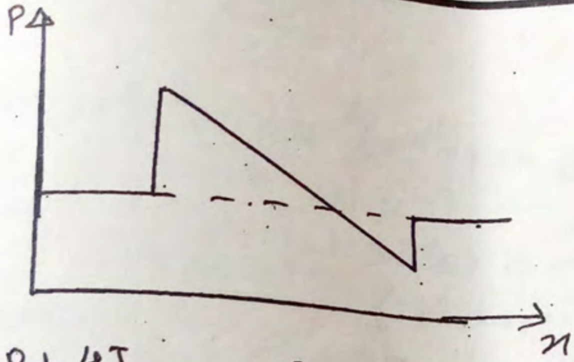
Frequency of pumping photon $= \frac{E_3 - E_1}{h}$ —— (1)

vii. Energy of LASER photon $= E_2 - E_1$ —— (1)

Frequency of LASER photon $= \frac{E_2 - E_1}{h}$ —— (2)

viii. No, the frequencies are the same for all similarly colored lights. —— (2)

iii.



—— (2)

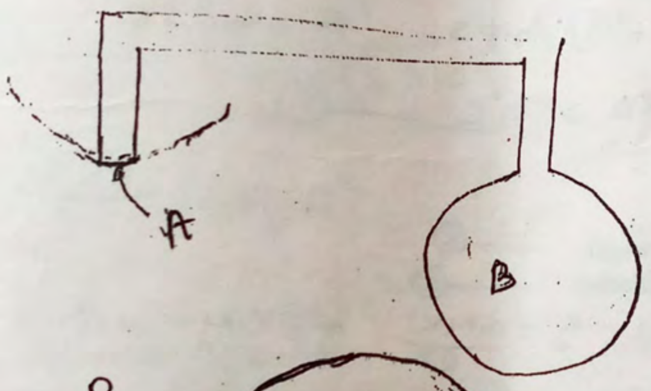
b)

i. $P_1 = P + \frac{4T}{r}$ —— (1)

$P_2 = P + 4T/R$ —— (1)

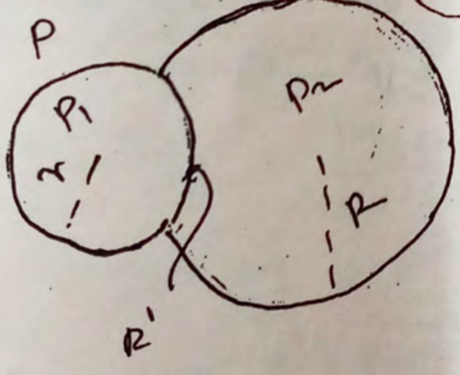
ii. Since $P_2 < P_1$ air moves from bubble A to B. so the smaller bubble (A) becomes too small, larger bubble (B) becomes too larger. —— (2)

Since both radii are equal in equilibrium, bubble A is meniscus shaped. —— (1)



—— (1)

iii.



$P_1 - P = 4T/r \ (1)$ —— (1)

$P_2 - P = 4T/R \ (2)$ —— (1)

$P_1 - P_2 = 4T/R' \ (3)$ —— (1)

$(1) - (2) \Rightarrow P_1 - P_2 = \frac{4T}{r} - \frac{4T}{R}$ —— (1)

$\frac{4T}{R'} = \frac{4T}{r} - \frac{4T}{R}$

$R' = \frac{Rr}{R-r}$ —— (1)

c)

i. Initial surface energy $= T \times A$ —— (1)

$= T \times 4\pi r^2$ —— (1)

$= 4\pi r^2 T$

ii. Volume after unity = Initial volume —— (1)

$\frac{4}{3}\pi R^3 = n \frac{4}{3}\pi r^3$

$R^3 = n r^3$ —— (1)

$R = n^{1/3} r$

b)

i. From Snell's law at point Y, 1

$n \sin C = 1 \sin 90$

$Sin\ C = {}^1/_n$ 1

$C = \sin^{-1}({}^1/_n)$

ii. 1) $r + C = 90$ 1

$r = 90 - C$

2) From Snell's law at point X, 1

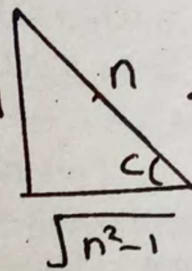
$1 \sin\theta = n \sin r$

$\sin\theta = n \sin(90 - C)$ 1

$\sin\theta = n \cos C$

$= n \times \frac{\sqrt{n^2-1}}{n}$

$\theta = \sin^{-1}(\sqrt{n^2-1})$ 1



1

c) i. Now, From Snell's law at point X,

$n_1 \sin C = n_2 \sin 90$

$1.5 \sin C = 1.44 \times 1$ 1

$\sin C = \frac{1.44}{1.5} = 0.96$

$C = 74^\circ$ 1

ii. $1.4 \sin C = n_2 \sin 90$ 1

$n_2 = 1.4 \times 0.97$

$= 1.358$ 1

$r = 90 - 76 = 14^\circ$ 1

$1 \sin\theta = 1.4 \times 0.24$ 1

$\sin\theta = 0.336$

$\theta = 19^\circ 38'$ 1

Range of θ : $0 < \theta \leq 19^\circ 38'$ 1

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7)

a) The Area in contact with air. 1

i. Pressure at point L,

$P_L = P - {}^{2T}/_r$ 1

Pressure at point M,

$P_M = P_L + hpg$ 1

$= P - {}^{2T}/_r + hpg$ 1

ii. Take the radius of the lower meniscus as r_1,

$P_M = P - \frac{2T}{r} + hpg$

$P_M - P = \frac{2T}{r'}$ 1

$\frac{2T}{r'} = \cancel{P} - \frac{2T}{r} + hpg - \cancel{P}$ 1

$\frac{2T}{r'} = hpg - {}^{2T}/_r$

$r' = \frac{2T}{hpg - {}^{2T}/_r} = \frac{2Tr}{rhpg - 2T}$ 1

iii. Final surface energy = $4\pi R^2 T = 4\pi (n^{1/3} r)^2 = 4\pi r^2 n^{2/3}$ — 1

∴ Released energy = $4\pi r^2 n T - 4\pi R^2 T$

$4\pi r^2 T (n - n^{2/3})$ — 1

iv. $4\pi r^2 T (n - n^{2/3}) = ms\theta$ — 1

$$\theta = \frac{4\pi r^2 T (n - n^{2/3})}{ms} \qquad = \frac{476 \times 10^{-3} \times (64-16)}{0.2 \times 10^{-3} \times 13600 \times 144}$$ — 1

$$= \frac{4\pi r^2 T (n - n^{2/3})}{\frac{4}{3}\pi r^3 \rho s} \qquad = \frac{3.5}{2 \times 3 \times 10} = \frac{3.5}{60}$$

$$= T(n - n^{2/3}) / r\rho s \qquad \theta = 0.058\,^{\circ}C$$ — 1

Temperature of single drop = $30.058\,^{\circ}C$ — 1

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8)

a)

i. Definition: Gravitational field strength. — 2

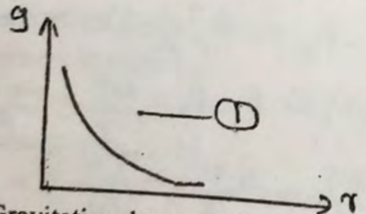
ii. Definition: Newton's law of gravitation. — 2

$F = \frac{GMm}{R^2}$ — 1, If $m = 1kg$ $g = \frac{GM \times 1}{R^2}$ $g = \frac{GM}{R^2}$ — 1

iii. $g^1 = \frac{GM \times 1}{r^2}$ — 1 $GM = gR^2$ — 1

$g^1 = gR^2 / r^2$ — 1

iv.



— 1

v. Gravitational potential energy $U = -\frac{GMm}{r}$ — 1

Where G – Universal gravitational constant, M - Mass of earth, r – Distance of mass m from center of earth.

b)

i. 64×10^9 J — 1

ii. In a state of escape, $TE = 0$ — 1

$\frac{1}{2}mv^2 + -64 \times 10^9 = 0$ — 1

$\frac{1}{2} \times 1000\, v^2 = 64 \times 10^9$

$v = 8\sqrt{2} \times 10^3$ $\sqrt{2} = 1.414$

$V = 11.3 \times 10^3\ ms^{-1}$ — 1

iii. $\Delta E = U_f - U_i$

$= -30.12 \times 10^{9} - (-32 \times 10^{9})$ —— (1)

$= (32 - 30.12) \times 10^{9}$ J

$= 1.88 \times 10^{9}$ J —— (1)

iv. $-\frac{GMm}{R} = -64 \times 10^{9}$ —— (1)

$GM = \frac{64 \times 10^{9} R}{m}$, $g = \frac{GM}{R^2}$ —— (1)

$gR^2 = \frac{64 \times 10^{9} R}{m R^2}$

$= \frac{64 \times 10^{9}}{1000 \times 6.4 \times 10^{6}}$

$g = 10 \, ms^{-2}$ —— (1)

v. $\frac{GMm}{R_0^2} = m R_0 \omega^2$

$\frac{mgR^2}{R_0^2} = m R_0 \omega^2$

$\omega = \sqrt{\frac{gR^2}{R_0^3}}$ —— (2)

vi. $\omega = \sqrt{gR^3/R_0^3} = \sqrt{\frac{9(6400 \times 10^3)^2}{(8150 \times 10^3)^3}}$

$\omega = \frac{64}{81} \times 10^{-2}$

$= 7.9 \times 10^{-3}$ rad s^{-1} —— (2)

vii. Total energy of the satellite = $\frac{1}{2} m v^2 + -\frac{GMm}{r}$ —— (1)

$= \frac{1}{2} \frac{GMm}{r} - \frac{GMm}{r}$

$= -\frac{1}{2} \frac{GMm}{r}$

$= -\frac{1}{2} \frac{gR^2 m}{r}$ —— (1)

$= -\frac{1}{2} \times 10 \times (6.4 \times 10^{6})^2 \frac{\times 1000}{8100 \times 10^3}$ —— (1)

$= -5.06 \times 10^{10}$ J —— (1)

viii. Total energy = $-\frac{1}{2} gR^2 m/r$

The total energy will decrease, and hence the radius will decrease. —— 1

$V = \sqrt{\frac{GM}{r}} = \sqrt{\frac{gR^2}{r}}$ $[g, R]$ $r\downarrow, V\uparrow$

So, V will increase. —— 1

09) (A) $\boxed{30}$

a)

i. $A_1 = 0.2\,A$ —— 1

$A_2 = 0.6\,A$ —— 1

ii. $0.4 \times 1.2 = 0.2\,S$ —— 1

$S = 24\,\Omega$ —— 1

iii. $V = E - Ir$ —— 1

$4.8 = 1.5\times4 - 0.6\times4r$

$r = 0.5\,\Omega$ —— 1

iv. a) Let n be the minimum number of cells required.

$V = E - Ir$

$4.8 = 6 - (3/n)\times0.6$ —— 1

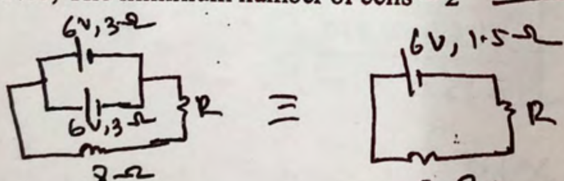
$1.2n = 1.8$

$n = 3/2$ —— 1

But n must be an integer.

Therefore, The minimum number of cells = 2 —— 1

b)



$V = IR$

$6 = 0.6(8 + R + 1.5)$ —— 1

$R = 0.5\,\Omega$ —— 1

5 ohms resistance should be connected in series in the circuit. —— 1

b)

i. Yes, the circuit is completed by the earth connection. —— 1

ii. P =VI

$66 = 12\,I$ —— 1 $I = 5\,A$ —— 1

iii. For circuit protection. —— 1

iv. (0 – 10 A) —— 1

Head light will burn when the current through the head light is more than 10 A. —— 1

v. $P = V^2/R \Rightarrow R = V^2/P$

$= \frac{12\times12}{60} = 2.4\,\Omega$ —— 1

—— 1

vi. Bulb will light up — 1

10 A current is enough. — 1

vii. No — 1

Voltage across a signal light is 6 V. — 1

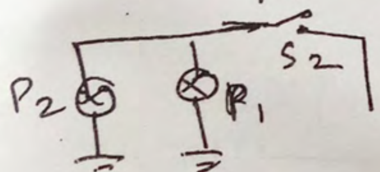
viii. $P = V^2/R$

$36 = \frac{12 \times 12}{R}$ — 1

$R = 4\,\Omega$ — 1

$I = 12/8 = 1.5\,A$ — 1

ix.



— 2

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(B)

a)

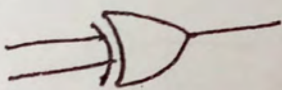
i.

A	B	F
ON	ON	0
ON	OFF	1
OFF	ON	1
OFF	OFF	0

— 2

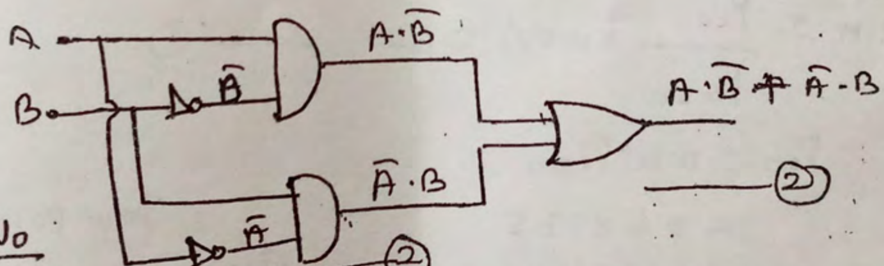
ii. $F = A \cdot \overline{B} + \overline{A} \cdot B$ — 2

iii.



— 1 XOR — 1

iv.



— 2

b)

i. $A_0 = \frac{V_0}{V_B - V_A}$ — 2

ii. (i). To prevent the current from the electric cell flowing into the solar cell. — 1

(ii). To monitor the current generated by the solar panel. — 1

iii. a)

1. $V_B = \frac{12}{R+R} \times R = 6\,V$ — 2

2. $V_A = \frac{12}{91+9} \times 9$

$= 1.08\,V$ — 2

3. $V_0 = A(V_B - V_A)$
$= A[6 - 1.08] > 12\,V \quad \therefore V_0 = 12\,V$ —— 2

4. Bulb will light up. —— 1

b)

1. $\frac{12}{R+R} \times R = 6V$ —— 2

2. $\frac{12}{9+1} \times 9 = 10.8V$ —— 2

3. $V_0 = A[V_B - V_A] = A[6 - 10.8] < 0$
$\therefore V_0 = 0\,V$ —— 2

4. The bulb will not light up. —— 1

iv. The cell will quickly discharge. —— 2

10) A)

a) i. Reducing the volume, Reducing the temperature, Injecting excess vapor. —— 2

ii. The dew point is the temperature at which vapor in the air becomes saturated vapor. —— 1

iii. $R.H = \frac{\textit{Saturated vapor pressure at dew point}}{\textit{Saturated vapor pressure at room temperature}} \times 100\%$ —— 1

b) 1) i. $R.H = \frac{P_{20}}{P_{s\,20}} \times 100\% = 60\%$ —— 1

$P_{20} = 0.6\, P_{s\,20}$

$= 0.6 \times 17.5$

$= 10.5$ Hg mm. —— 1

Dew point $15^\circ C$ —— 1

ii.

$PV = nRT$ —— 1

$P = (m/V)\frac{RT}{M}$ —— 1 $\quad \rho = m/V$

$\rho = \frac{PM}{RT}$ —— 1

$= \frac{10.5 \times 10^{-3} \times 13000 \times 10 \times 18 \times 10^{-3}}{8.3 \times 273}$ —— 1

$= 10.1\,9m^{-3}$ —— 1

2) $A \cdot H = \frac{\rho \times 1}{0.6}$ —— (1)

$= 16.84\, g\, m^{-3}$ —— (1)

$R \cdot H = 100\%$ —— (2)

Dew point $= 20^{\circ} C$ —— (1)

3) $\delta m = \rho_s \times (0.6 - 0.25)$ —— (2)

$= \rho_s \times 0.35\ kg$

$= 5.39 \times 10^{-3} kg$ —— (1)

4) $A \cdot H = \frac{\rho_s \times 0.25}{1}$ —— (2)

$R \cdot H = \rho_s \times 0.25 / \rho_s \times 1 \times 100\% = 25\%$ —— (1)

c) As the piston compresses, the speed of the air molecules relative to the piston increases. Collisions are elastic therefore, the molecules will back on behalf of the piston with the same speed, or the speed of molecules increases so, the temperature increases. —— (2)
The number of molecules colliding with the vessel and the change in momentum will increase, so the pressure will increase. —— (2)

d)

i. The temperature does not change due to heat loss to the environment even if the heat is increased while pushing slowly. —— (2)

ii. Due to the short time during rapid pushing heat is not lost to the environment so the temperature of the system increases, —— (1)

$\boxed{30}$

தரம் :- 13 (2022)	பௌதிகவியல்	புள்ளித்திட்டம்

பகுதி - I

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

(50 x 1 = 50 புள்ளிகள்)

B)

a) Since there is no charge, no force is required to resist the electrostatic force. —— 3

i. $x = 2$ —— 2

ii. $1u = 1.66\times10^{-27}\times(3\times10^{8})^{2}\ J$ —— 2

$= \dfrac{1.66\times10^{-27}\times(3\times10^{8})^{2}}{1.61\times10^{-19}}\ eV$ —— 1

$= 933.75\ MeV$ —— 1

iii. Mass of the reactors = $235.04393u + 1.00866u$

$= 236.05259u$ —— 1

Mass of the reactants = $95.93431u + 137.91101u + 2\times1.00866u$

$235.86264u$ —— 1

Mass defect = $236.05259u - 235.86264u$

$= 0.18995u$ —— 1

The energy to release = $0.18995\times933.75\ MeV$ —— 1

$= 177.36\ MeV$ —— 1

iv. Rate of fissions number = $\dfrac{200\ MJ}{177.36\ MeV}$ —— 2

$= \dfrac{200}{177.3\times1.6\times10^{-19}}$ —— 1 $= 705\times10^{8}\ s^{-1}$ —— 1

v. Chances are high, the reactants are more stable as the energy released increases. —— 2

b)

i. To unite nuclei against electrostatic force. —— 2

ii. $\Delta m = 4\times1.67\times10^{-27} - 6.65\times10^{-27} = 3\times10^{-29}\ kg$ —— 2

Energy to be release = $3\times10^{-29}\times(3\times10^{8})^{2} = 2.7\times10^{-12}\ J$ —— 1

iii. The number of nuclei that turn into helium per second= $\dfrac{4.8\times10^{26}\times4}{2.7\times10^{-12}}$ —— 2

$= 7.1\times10^{38}\ s^{-1}$ —— 1

iv. Helium nuclei change into other heavier nuclei. —— 2