FWC

GCE (A/L) Examination, June - 2018

Conducted by Field Work Centre, Thondaimanaru
In Collaboration with
Provincial Department of Education Northern Province

Grade:13(2018)	*Physics*	*Marking scheme*

Part- I

1)	**3**	11)	**3**	21)	**3**	31)	**2**	41)	**3**
2)	**5**	12)	**2**	22)	**4**	32)	**4**	42)	**5**
3)	**2**	13)	**3**	23)	**3**	33)	**4**	43)	**4**
4)	**3**	14)	**2**	24)	**1**	34)	**3**	44)	**2**
5)	**5**	15)	**5**	25)	**3**	35)	**4**	45)	**1**
6)	**3**	16)	**2**	26)	**2**	36)	**4**	46)	**3**
7)	**3**	17)	**3**	27)	**5**	37)	**3**	47)	**4**
8)	**5**	18)	**5**	28)	**3**	38)	**1**	48)	**4**
9)	**5**	19)	**5**	29)	**4**	39)	**2**	49)	**1**
10)	**2**	20)	**1**	30)	**3**	40)	**2**	50)	**5**

50 x 2 = 100

Part - II A (Structured Essay)

1. a) i) The board should be kept in a vertical plane
The masses should not touch the board or any other object
The strings should close to the drawing paper without touching it

At least 2 answers -1 mark

ii) To ensure the tension in AH and BH be equal to the weight of M -1 mark

iii) The tension in AH and BH are equal. When H is at rest, the horizontal components, of the tensions in AH and BH can only balance if and only if the inclination of AH and BH with vertical are equal. -1 mark

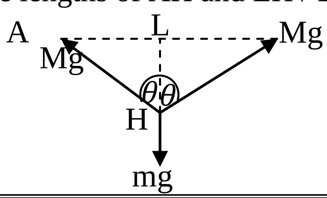
iv) Place the strip of plane mirror on the drawing paper, just behind the string. View the string and its image in the mirror with one eye and adjust the position of the eye such that the string coincides with the image. At this position mark the position of the string on the drawing paper with a pin. -1 mark

b) i) The inclination θ of the strings AH and BH.

ii) The lengths of AH and LH / BH and LH.

-1 mark

iii)



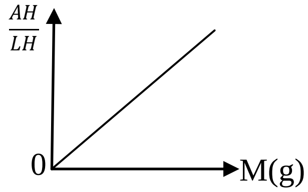
-1 mark

c) i) $2Mg\ Cos\theta = mg$ -1 mark

$2Mg \frac{LH}{AH} = mg$

$\frac{AH}{LH} = (\frac{2}{m})M$ OR $\frac{BH}{LH} = \frac{2}{m}M$ -1 mark

$\downarrow$ y $\quad \downarrow$ m $\quad \downarrow$ x

iii) 

-1 mark

iv) $0.04g^{-1} = \frac{2}{m}$

$\therefore \quad = \frac{2}{0.04}\ g$

$= 50g$ -1 mark

$\boxed{10}$

2. a) To provide the heat at constant rate -1 mark

Connect a variable resistor / Rheostat in series with the circuit -1 mark

b) i) Exp - 1 Heat gained from the surrounding in first half time of the practical is equal to heat lost to the surrounding in second half time of the practical. -1 mark

Exp - 2 Heat lost to the surrounding in first half time of the practical is equal to heat gained from the surrounding in second half time of the practical. -1 mark

ii) Break the ice cube into small pieces and mob them with blotting/filter paper, add and dissolve one piece at one time without splashing water. -1 mark

iii) To prevent the heat absorbed from the surrounding for ice melts. -1 mark

iv) e.m.f of the battery falls down and increase the resistance in the circuit by raising temperature. -1 mark

c) i) $VIt = (m_2 - m_1)S_w\ 25 + (m_2 - m_1) L$ -1 mark

ii) $4 \times 5 \times 220 = \frac{10}{1000} \times 4200 \times 25 + \frac{10}{1000} L$

$L = 335000\ Jkg^{-1}$ -1mark

iii) Heat capacity of the calorimeter is not involved in calculation. -1 mark

$\boxed{10}$

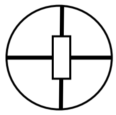
3, a) i) 25cm -1 mark

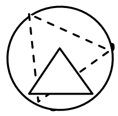
ii) D, move towards the eye of the observer. -1 mark

b) i) In component A, to receive the parallel rays -1 mark

ii) To observe the clear bright image. -1 mark

c) i) S is suitable for adjusting B, because only reflections occur at the surface of the prism. -1 mark

ii)  -1 mark

iii)  -1 mark

iv) 1) to observe clear bright image through, both side of the prism.
2) Quickly adjusting the prism table
} -1 mark

v) $A = \frac{17^o 26' + (360 - 257^o 24')}{2} = 60^o 1'$ -1 mark

vi) image appear as continuous spectrum -1 mark

$\boxed{10}$

4. a) i) PQ :- $\downarrow F = Bib\ Sin\theta$
SR :- $\uparrow F = Bib\ Sin\theta$
} directions and Magnitude -1 mark

ii) Both forces are equal, opposite and same line of action -1 mark

iii) In PS ⊗ F = BIa, In PQ ⊙ F = BIa -1 mark

$G = F \times bCos\theta$
$= BIabCos\theta$ -1 mark

iv) To established radial magnetic field in the Galvanometer -1 mark

v) $C\theta = NBIA$
$\theta = \frac{NABI}{C}$ OR any other suitable form -1 mark

b) i) To measure high current A
To measure high potential difference F
To measure resistance G
} -1 mark

ii) To ensure pointer shows, full scale deflection / zero resistance -1 mark

iii) $10 \times 10^{-6} R = 6$
$R = 600\Omega$ -1 mark

iv) it will show false reading,
the pointer will oscillate when measuring current
} -1 mark

$\boxed{10}$

Part II B (Essay)

5. a) i) rate of water flow of mass $\frac{m}{t} = AV\rho$

$= \pi \text{ x } (3 \text{ x } 10^{-2})^2 \text{ x } 0.8 \text{ x } 1000$

$= 2.16 \text{ kg s}^{-1}$ -1 mark

ii) rate of increasing P.E $= \frac{m}{t} \text{ x gh} = 2.16 \text{ x } 10 \text{ x } 3.5$

$= 75.6\text{W}$ -1 mark

iii) Providing power $= 1/2 \frac{(m)}{t} \text{V}^2 + \frac{m}{t} gh$ -1 mark

$= \frac{1}{2} \text{ x } 2.16 \text{ x } (0.8)^2 + 75.6$

$= 0.69 + 75.6$

$= 76.29\text{W}$ -1 mark

iv) The power required to move the handle $= \frac{100}{70} x\ 76.29$

$= 108.98\text{W}$

$\simeq 109\text{W}$ -1 mark

b) i) $h\rho g = 10^5$

$h \text{ x } 100 \text{ x } 10 = 10^5$

$h = 10 \text{ m}$

$\therefore$ 1atm = 10 m water column -1 mark

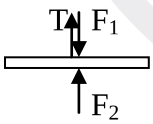
ii) Pressure at just below the piston is P (say)

$P + h\rho g = 10^5$

$P + 4 \text{ x } 1000 \text{ x } 10 = 10^5$

$P = 6 \text{ x } 10^4 \text{ Pa}$ -1 mark

iii) -1 mark



T - Tension in the piston rod
F_1 - Force act on piston due to atm pressure
F_2- Force act on just below the piston
} -1 mark

c) i) $F_2 + T = F_1$ -1 mark

$T = (F_1 - F_2)$

$= (\ \pi\ - P)\ A$ π—atm pressure

$= (10 - 6) \text{ x } 10^4 \text{ x } 50 \text{ x} 10^{-4}$

$= 200 \text{ N}$ -1 mark

ii) take a moment at O $200 \text{ x } 20 = 60 \text{ x F}$

$F = \frac{200}{3} = 66.66 \text{ N}$ perpendicular to handle of portion OA -1 mark

d) i) 10 m -1 mark

ii) To increase the length of the piston rod and extend the out let tube above the ground level. -2 marks

$\boxed{15}$

6. a) i) Maximum error = $\pm$ 4 x least count = $\pm$ 4 x 1mm = $\pm$ 4mm -1 mark

ii) To make it to vibrate with fundamental note / To avoid vibrating with overtones. -1 mark

iii) - The tuning fork must be held close to the open end of the pipe without touching it.
- The direction of the vibration of the prongs should be along the axis of the pipe.
- The above is done to transfer maximum energy from the fork to air column

At least two answers -1mark

iv) - Longitudinal stationary wave -1 mark
- Interference of incident and reflected waves are responsible for the formation of stationary wave. -1 mark

b) i) Antinode to eardrum = 25mm + 0.3 x 7mm = 27.1mm -1 mark

ii) $V_p = V_a\,(1 - \frac{k}{d})$

$\underset{y}{V_p} = \underset{m}{(-V_ak)}\,\underset{x}{\frac{1}{d}} + \underset{c}{V_a}$ -1 mark

$\therefore\ [V_a]_{20^\circ C}$ = intercept of the given graph
= $343\ ms^{-1}$ -1 mark

iii) $V_a\,k = \left|\text{slope of the given graph}\right|$

$= \left|\frac{-343\ ms^{-1}}{100\ m^{-1}}\right|$

$= 3.43\ m^2s^{-1}$ -1 mark

$V_p = (-V_ak)\,\frac{1}{d} + V_a$

$= -3.43\ \frac{1}{7\times 10^{-3}} + 343$ For substitution -1 mark

$= 343 - \frac{343}{70}$

$= 343 \times \frac{69}{70}$

$= 338\ ms^{-1}$ -1 mark

iv) The suitable frequency of the horn is one which can give resonance in the cannal with the fundamental note. This produces much more larger amplitude of vibration and larger amplitude of pressure variation at the eardrum. -1 mark

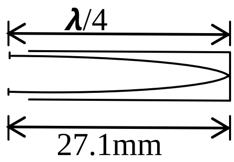
$\frac{\lambda}{4}$ = 27.1 x 10^{-3}

= 4 x 27,1 x 10^{-3} m

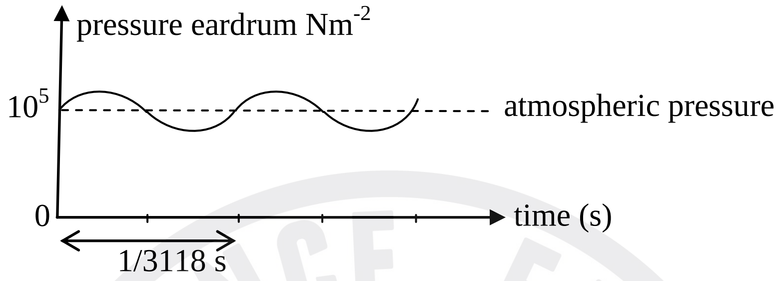
f = $\frac{V}{\lambda}$

= $\frac{338}{4x27.1x\ 10^{-3}}$

= 3118 Hz = frequency of the horn -1 mark



v) At the eardrum destructive interference takes place -1 mark



-1 mark

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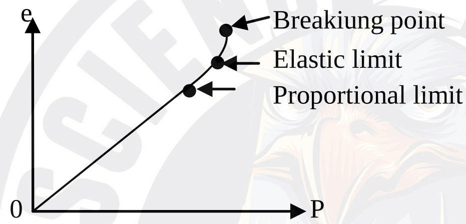
7. a) i)



For graph -1 mark

For marking proportional limit, elastic limit and breaking point -1 mark

ii) Work done / energy used in stretching the wire (No marks for energy stored because it is true if and only if the extension is within the elastic limit) -1 mark

b) i) Natural length of the spring = $\frac{5}{7}$ x35 - 1

= 24 cm

Length compressed = 24 cm - 4 cm

= 20 cm

Potential energy stored = $\frac{1}{2}$ ke^2

= $\frac{1}{2}$ x250 x (20x10^{-2})^2

= 5 J -1 mark

ii) Length of air column before firing = 35 - 5 = 30 cm

$P_2 V_2 = P_1 V_1$

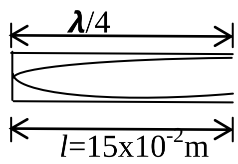
$2P_{atm} (lA) = P_{atm} (30 \times 10^{-2} A)$ -1 mark

$\therefore$ l = 15 x 10^{-2} m - This is the length of air column when firing

$\frac{\lambda}{4}$ = 15 x 10-2

λ = 0.6 m -1 mark

f = $\frac{V}{\lambda}$ = $\frac{330}{0.6}$ = 550 Hz -1mark



iii) $\frac{80}{100}$ x 5 = $\frac{1}{2}$ (5x10-3) V^2

$V^2 = \frac{2 \text{ x } 80 \text{ x } 5}{100 \text{ x } 5 \text{ x} 10^{-3}}$

= 1600

$\therefore$ V = $\sqrt{1600}$

= 40 ms^{-1} -1 mark

c) i) Compressive strength = $\frac{Compressive \;\; force}{area \;\; cross-section}$

$= \frac{2400 \; N}{200 \text{ x } 10^{-3} m \text{ x } 80 \text{ x } 10^{-3} m}$

= 1.5 x 10^5 Nm^{-2} -1 mark

ii) The number bricks that can be arranged inside the square in one layer

$= \frac{area \;\; of \;\; the \;\; square}{area \;\; of \;\; cross \;\; section \;\; of \;\; the \;\; brick \;\; paralled \;\; to \;\; the \;\; ground}$

$= \frac{2m \text{ x } 2m}{200 \text{ x } 10^{-3} m \text{ x } 80 \text{ x } 10^{-3} m}$

= 250 bricks -1 mark

Weight of one brick = volume x density x g

= 200 x 10^{-3} x 80 10^{-3} x 50 x 10^{-3} x 2000 x 10

= 16 N -1 mark

let the possible number of layers = n

The compressive stress at the bottom layer < 10% of compressive strength

$\frac{Total \;\; weight \;\; of \;\; the \;\; bricks \;\; above \;\; the \;\; bottom \;\; layer}{Area \;\; of \;\; the \;\; bottom \;\; layer} < 10\% \text{ x } 1.5 \text{ x } 10^5$

$\frac{250 \text{ x } 16 \text{ x } (n-1)}{2 \text{ x } 2} < 1.5 \text{ x } 10^4$ -1 mark

n - < $\frac{2 \text{ x } 2 \text{ x } 1.5 \text{ x } 10^4}{250 \; x \; 16}$

< 15

n < 16

$\therefore$ The maximum possible value for n = 15

$\therefore$ Maximum number bricks that can be piled up = 250 x 15

= 3750

If n is correct award full marks -1 mark

iii) Initial height of centre of gravity = 1/2 x 50mm = 25 x 10^{-3}m

Final height of centre of gravity = 1/2 x 15 x 50mm = 15 x 25 x 10^{-3}m

$\therefore$ height through which C.G is lifted = 15 x 25 x 10^{-3}m - 25 x 10^{-3}m

= 14 x 25 x 10^{-3}m -1 mark

Total weight of the piled up bricks = 3750 x 16 N

Work done = 3750 x 16 N x 14 x 25 x 10^{-3}m

= 21,000 J -1 mark

15

8. a) i) effective area of the parallel plate, distance between the parallel plate, dielectric medium between the parallel plate } -1 mark

ii) $C_o = \frac{Hl\epsilon_o}{d}$ -1 mark

iii) $W_o = 1/2\ CV^2$

$= 1/2\ C_o\ (E_o d)^2 = 1/2\ C_o E_o^2\ d^2$ -1 mark

b) i) Attraction due to electrostatics induction on ink -1 mark

ii) $C = \frac{A_1\epsilon_o}{d} + \frac{A_2\epsilon_o k}{d}$

$\frac{l(H-h)\epsilon_o}{d} + \frac{hlk\epsilon_o}{d} = \frac{l\epsilon_o}{d}[H - h + hk]$

$= \frac{l\epsilon_o}{d}[H + h(k - 1)]$ -1 mark

iii) $W_1 = \frac{mg\,h}{2} = \frac{1}{2}\rho gh^2 ld$ -1 mark

iv) $\frac{1}{2}\frac{Q^2}{C_o} = \frac{1}{2}\frac{Q^2}{C} + \frac{1}{2}\rho gh^2 ld$ -1 mark

$\frac{(Hl\epsilon_o E_o)^2}{Hl\epsilon_o} d = \frac{(Hl\epsilon_o E_o)^2}{\frac{l\epsilon_o}{d}[H+h\ (k-1)} + \rho gh^2 ld$ -1 mark

$Hl\epsilon_o\ E_o^2 d = \frac{H^2 l\epsilon_o E_o{}^2 d}{H+h\ (k-1)} + \rho gh^2 ld$

$(k - 1)\ h\ H\ l\epsilon_o\ E_o^2 d = \rho gh^2 ld\ [H + h(k-1)]$

$\frac{(k-1)\ H\ l\epsilon_o E_o^2}{\rho g} = Hh + (k - 1)\ h^2$ (for any suitable form) -1 mark

c) i) $C = \frac{Hlk\epsilon_o}{d} = \frac{2Hl\epsilon_o}{d} = 2C_o$ -1 mark

ii) $\frac{(2-1)5 \text{ x } 10^{-2} \text{ x } 8.85\ x\ 10^{-12} \text{ x } (\sqrt{12})^2 \text{ x } 10^{12}}{8.85 \text{ x } 10 \text{ x} 10^2} = 5 \text{ x } 10^{-4}h + (2 - 1) + h^2 \text{ x } 10^{-4}$

(correct substitution) -1 mark

$12 \text{ x } 5 \text{ x } 10^{-5} = (5h + h^2)\ 10^{-4}$

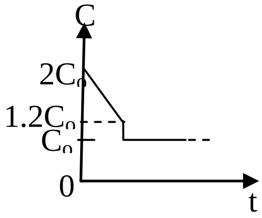
$h^2 + 5h - 6 = 0$

$(h + 6)\ (h - 1) = 0$

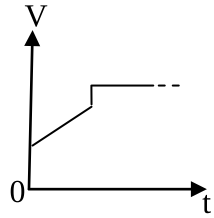
$h \neq -6 \quad \therefore\ h = 1$ cm -1 mark

$(\beta)\ C = \frac{l\epsilon_o}{d}[5 + 1] \text{ x } 10^{-2}, \quad C_o = \frac{l\epsilon_o}{d} 5 \text{ x } 10^{-2}$

$\frac{C}{C_o} = \frac{6}{5} \quad \therefore\ C = 1.2C_o$ -1 mark

iii) 

-1 mark



-1 mark

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9A)a) i) Current (I) : - the rate of flow of charge

$$I = Q / t$$

P. D (V) : - the energy dissipated when one Coulomb charge flows from one point to another — -1 mark

ii) $V = \frac{Energy}{Charge} = \frac{E}{Q}$

$V = E/Q$

$V = E/It \quad (E/t = P)$

$\therefore \quad P = VI$ — -1 mark

iii) $R = \frac{V}{I}$,

$R = \frac{V}{P} \times V$

$R = \frac{V^2}{P}$ — -1 mark

b) i) The resistance of the kettle element is $R = \frac{V^2}{P}$

$R = \frac{110^2}{2400} \simeq 5\ \Omega$

When plugged in Sri Lanka $I = \frac{240}{5} = 48\ A$ — -1 mark

the normal fuse does not provide for this current flow and as a result it will melt — -1 mark

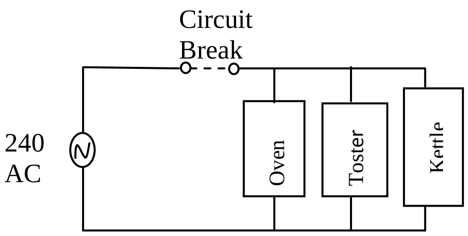
ii) The resistance of the kettle element is $R = \frac{240^2}{2400} = 24\Omega$

When plugged in USA $I = \frac{110}{24} \simeq 4.6\ A$ — -1 mark

The power out put in Sri Lanka is 2400W

The power out put in USA is 110 x 4.6 = 506W — -1 mark

In USA the out put power is only 20% that of in Sri Lanka as a result kettle take longer time to heat. — -1 mark

c) i) 

-1 mark

ii) $I = \frac{P}{V}$

toaster	$I_1 = \frac{1440}{240} = 6A$	
kettle	$I_2 = \frac{960}{240} = 4A$	-1 mark
microwave oven	$I_3 = \frac{480}{240} = 2A$	

iii) $R = \frac{V}{I}$

toaster	$R_1 = \frac{240}{640} = 40\Omega$	
kettle	$R_2 = \frac{240}{4} = 60\Omega$	-1 mark
microwave oven	$R_3 = \frac{240}{2} = 120\Omega$	

iv) $\frac{1}{R} = \frac{1}{40} + \frac{1}{60} + \frac{1}{120}$ OR $R = \frac{V}{I} = \frac{240}{6+4+2} = 20\Omega$

$R = 20\Omega$ -1 mark

v) Total current = 12A. This is more than the circuit breaker which will open. -1 mark

d) i) for A $I_1 = \frac{P}{V} = \frac{6}{6} = 14$

for B $I_2 = 0.5A$

for C $I_3 = \frac{27}{9} = 3A$

Total current $= 1 + 0.5 + 3 = 4.5A$ -1 mark

ii) Only using single cell, the P.D across the cell is V (say)

$V = E - Ir$

$= 10\text{-}4.5\text{x}0.5\text{=}7.75V$ -1 mark

$\therefore$ appliance C does not work properly

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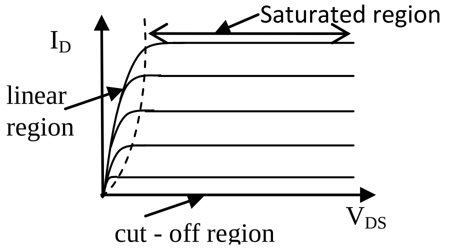
9B) a)

JFET	BJT
one p - n junction charge carrier	two p - n junction
electron or hole	charge carrier electron and hole
controlled by field	controlled by current

-2 marks

b) i)



-1 mark

ii) V_{GS} - Gate - Source Voltage -1 mark

iii) Marking linear, Saturated, Cut off regions -1 mark

c) i) $I_G = 0$

Voltage drop across R_G = O ie $I_G R_G = 0$ $V_G = 0$ -1 mark

ii) $I_D = I_S$ -1 mark

$V_S = I_D R_S$ -1 mark

$V_{GS} = V_G - V_S = 0 - I_D R_S$

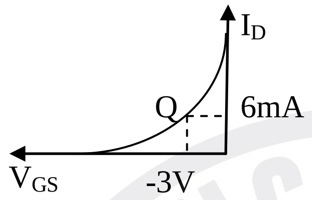
$I_D = - V_{GS}/R_S$ -1 mark

iii) Applying the Kirchchoff's law

$V_{GS} = V_{DD} - I_D(R_D – R_S)$ -1 mark

d) i) Cut - off voltage $\left.\begin{array}{l} V_{GS\,(off)} = -8V \\ I_{DS(sat)} = 16mA \end{array}\right\}$ -1 mark

ii)



Denoting Q -1 mark

iii) V_{GS} = -3V (accept value between - 2.5V to -35V) -1 mark

$I_D = \frac{-V_{GS}}{R_S}$

$R_S = \frac{-(-3)}{6x10^{-3}} = 500\Omega$ -1 mark

$V_{DS} = V_{DD} - I_D (R_D + R_S)$

$= 10 - 6x10^{-3} (500 + 500)$

$= 4V$ -1 mark

15

10Aa) rate of heat flow through water $P_w = \frac{4x0.57}{5} = 0.456Wm^{-2}/0.46Wm^{-2}$ -1 mark

rate of heat flow through ice $P_I = \frac{10x2.2}{0.01} = 2200Wm^{-2}$ -1 mark

$P_W << P_I$ Hence P_W is negligible

b) i) Heat lost from area of $1m^2$ water in 1sec = 2200J -1 mark

rate of mass change, when area of $1m^2$ water to ice = $\frac{2200}{330000} = 6.7x10^{-3} kgs^{-1}$ -1 mark

rate of volume change, when area of $1m^2$ water to ice = $\frac{6.7x10^{-3}}{920} = 7.2x10^{-6} m^3 s^{-1}$

-1 mark

rate of growth in ice thickness = $\frac{7.2x10^{-6}\ m^3 S^{-1}}{m^2} = 7.2 \text{ x } 10^{-6}ms^{-1}$ -1 mark

ii) decrease -1 mark

c) increasing level of water when 1cm ice melt

$\Delta h = \frac{A x 1 x 10^{-2} x 920}{A x 1000} = 0.92x10^{-2}m$ (A - average area of the lake) -1 mark

/ $h_o = (5+0.92 \text{ x } 10^{-2})m$

$= 5.0092$ m -1 mark

d) When rate of heat flow through water is equal to rate of heat flow through ice -1 mark

e) i) $h_{ice} \times \rho_{ice} = (h_o - h_w)\rho$ -1 mark

$h_w = \frac{h_o \rho_w - h_{cie}\ \rho_{ice}}{\rho_w}$

ii) $\frac{4}{h_w} \times k_w = \frac{10}{h_{ice}}\ k_{ice}$ -1 mark

f) $\frac{4\ k_w \rho_w}{h_o \rho_w - h_{ice}\ \rho_{ice}} = \frac{10\ k_{ice}}{h_{ice}}$ -1 mark

$h_{ice} = h_o\ \frac{10\ k_{ice}\ \rho_w}{4\ k_w\ \rho_w + 10 k_{ice}\ \rho_{ice}}$

h_{ice} = Correct substitution -1 mark

h_{ice} = 4.89 m -1 mark

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10Ba) i) E = nuclear energy or energy released

m = mass lost or defect

C = speed of light (in vacuum) -1 mark

ii) The disintegration of the nucleus / element is taking place on its own without any external influence -1 mark

iii) $\left.\begin{array}{l} a = 226 - 222 = 4 \\ b = 88 - 86 = 2 \end{array}\right\}$ -1 mark

The particle X is Helium nucleus -1 mark

iv) Mass of Ra = 226.0254 u

Mass of Rn and X = 226.0204 u

Mass lost or defect = 0.0050 u

In this reaction mass is lost. Therefore energy is released hence the reaction is spontaneous -1 mark

v) Energy released, $E = mC^2$

$= 0.0050 \times 1.66 \times 10^{-27} \times (3.0 \times 10^8)^2$

$= 7.47 \times 10^{-13}$ J -1 mark

vi) $K.E = \frac{1}{2} mV^2$

$= \frac{1}{2}\ \frac{(mV)^2}{m}$

$= \frac{P^2}{2m}$

If for two particles P is same,

then K.E of the particle $\alpha\ \frac{1}{mass\ of\ the\ particle}$ -1 mark

(vii) At the beginning Ra is at rest

$\therefore$ Rn and X will have equal momentum in the opposite direction

Both particle have equal momentum -1 mark

$\therefore \frac{K.E\ of\ Rn}{K.E\ of\ X} = \frac{mass\ of\ X}{Mass\ of\ Rn}$

$\frac{K.E\ of\ Rn}{K.E\ of\ X} + 1 = \frac{mass\ of\ X}{Mass\ of\ Rn} + 1$

$\frac{K.E\ of\ Rn + K.E\ of\ X}{K.E\ of\ X} = \frac{mass\ of\ X + mass\ of\ Rn}{mass\ of\ Rn}$

$K.E\ of\ X = \frac{mass\ of\ Rn}{(mass\ of\ X + Mmass\ Rn)} . (K.E\ of\ Rn + K.E\ of\ X)$

$= (\frac{222}{4+222})$. (Nuclear energy released)

$= (\frac{222}{226})$. 7.47×10^{-13} J

$= 7.34 \times 10^{-13}$ J -1 mark

$\frac{1}{2}\ 4 \times 1.66 \times 10^{-27} \times V^2 = 7.34 \times 10^{-13}$

$V2 = 2.2 \times 10^{14} \Rightarrow V = 1.5 \times 10^{7}\ ms^{-1}$

b) i) 5min + 25min = 30min -1 mark

ii) Fractional mass undecayed $= 2^{-t/T}$

$= 2^{-30/15x60}$

$= 2^{-1/30}$

$= 0.977$ -1 mark

iii) Fraction of Na - 24 $= \frac{0.977}{V}$ x10 -1 mark

iv) Amount of substance α activity

$1\ \alpha\ 5950$ —— ①

$\frac{0.977 \times 10}{V}\ \alpha\ 10$ —— ②

$\frac{eq\ 1}{eq\ 2} \Rightarrow \frac{1 \times V}{0.977 \times 10} = \frac{5950}{10}$ -1 mark

$\therefore\ V = \frac{5950}{10} \times 0.977 \times 10$

$= 5813$ ml

$= 5.8\ l$ -1 mark

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