G.C.E. (A.L.) Support Seminar - 2016
Physics - Paper I
Answer Guide

Question No	Answer	Question No	Answer
(1)	3	(26)	4
(2)	5	(27)	4
(3)	3	(28)	5
(4)	5	(29)	3
(5)	1	(30)	4
(6)	4	(31)	3
(7)	5	(32)	2
(8)	3	(33)	4
(9)	2	(34)	5
(10)	2	(35)	4
(11)	2	(36)	5
(12)	5	(37)	2
(13)	3	(38)	4
(14)	3	(39)	1
(15)	1	(40)	4
(16)	5	(41)	3
(17)	5	(42)	2
(18)	1	(43)	2
(19)	4	(44)	2
(20)	4	(45)	4
(21)	5	(46)	3
(22)	2	(47)	5
(23)	3	(48)	3
(24)	3	(49)	2
(25)	4	(50)	5

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Physics - Paper II
Answer Guide

Part A - Structured Essay

1. (a) Micrometer screw gauge **(01 Mark)**
(b) Checking for the zero error **(01 Mark)**

(c) (a) - External jaws/ outer jaws
(b) - External jaws/ outer jaws
(c) - Internal jaws/ inner jaws **(02 Marks for all/ one mark for two)**

(d) Electronic balance
Chemical balance **(01 Mark)**

(e) $$V = \left[a \times b - \pi\left(\frac{d}{2}\right)^2\right] t$$ **(01 Mark)**

$$d = \frac{m}{\left[a \times b - \pi\left(\frac{d}{2}\right)^2\right] t}$$

(01 Mark)

(f) (i) 0.01 mm **(01 Mark)**

(ii) 3.05 + 3.51 + 3.52 + 3.51 + 3.53 = 17.12

3.42 mm
$$\frac{\cancel{17.12}}{\cancel{5}} = 3.42 \text{ mm}$$ **(01 Mark)**

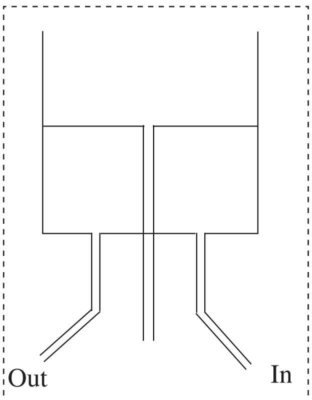
(iii) For two, because measurement can be obtained only for two decimal places. **(01 Mark)**

2. (a) In let - *A*

Out let - *B* **(01 Mark)**

(b) Cannot
A steady state can not be maintained in the rod due to the inability to maintain a temperature of 100 C° in the chamber. Ability to heat the rod within a considerable time because the steam has a low density. **(01 Mark)**

(c)



(01 Mark)

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(d) $\frac{Q}{t}$ heat flow rate

$\frac{(\theta_1 - \theta_2)}{x}$ Temperature gradient **(01 Mark)**

(e) Constant/ steady readings in the thermometer **(01 Mark)**

(f) diameter of the cross section of the rod. **(01 Mark)**
distance between T_1 and T_2 **(01 Mark)**
volume of liquid flow per during a known time or mass of liquid flow per during a known time.

(g) $k = \frac{Q}{t} \cdot \frac{x}{(\theta_1 - \theta_2)} \times \frac{1}{A}$ **(01 Mark)**

(h) Because the time is not enough to heat the water, the readings of the thermometer T_3 and T_4 will not have a significant difference. **(01 Mark)**

(i) Cannot

No considerable difference in thermometer readings. **(01 Mark)**

3. (a) $\frac{\lambda}{2} = l$ **(01 Mark)**

$\lambda = 2l$

$f = \sqrt{\frac{I}{m}} = \frac{1}{2L}\sqrt{\frac{T}{m}}$

$f = \frac{1}{2}l\sqrt{\frac{I}{m}}$

(01 Mark)

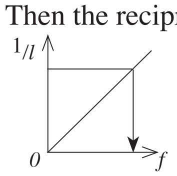
(b) $f^2 = \frac{1}{y} L^2 = mT$

$f^2 = \left(\frac{l}{4L^2 m}\right)^2 T$

$y = mx$ **(01 Mark)**

(c) (i) The length l is kept minimum and paper mounts are held on the wire. Vibrating the tuning fork and increasing the distance between the bridge until the paper mounts are thrown away. length between bridges is obtained at that time. **(01 Mark)**

(ii) Length L is vibrated in B and paper mounts are held on A, the distance between bridges is gradually increased until the paper mounts Thrown away or the instance where the tuning is occurred. At that instance the length of wire A is measured. Then the reciprocal of A is found and corresponding frequency is obtained from the graph



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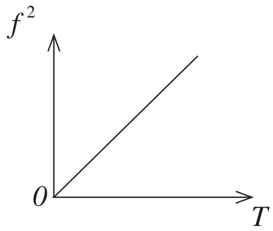
(01 Mark)

(d) 

Mark the axis & shape (01 Mark)

(e) (i) Gradient $= \frac{1}{4L^2}\, m$

$m = \frac{1}{4L^2} =$ gradient **(01 Mark)**

(ii) Because the minimum value is $f \propto \frac{1}{l}$, lengths for large values can be found when the length for minimum value is found. **(01 Mark)**

(f) $f_A = 480\, f \times \frac{1}{l}$ **(01 Mark)**

$f = k\,\frac{1}{l}$

$480 = k\,\frac{100}{23.7}$

$474 = k\,\frac{100}{l}$

$\frac{480}{474} = \frac{l}{23.7}$

$l = \frac{480}{474} \times 23.7$ cm

$l = 24$ cm **(01 Mark)**

4. (i) *A* - Driver cell

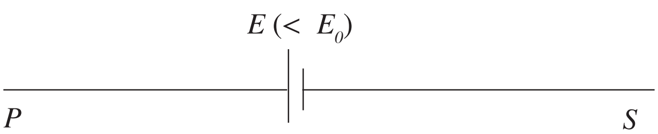
B - Switch (one way)

C - Protective measure of the galvanometer

D - Centre zero galvanometer **(01 Mark)**

(ii) *A* - Possibility Supplying the same current for a long period of time.

D - Having a high the sensitivity **(01 Mark)**

(iii) 

(01 Mark)

(iv) $\frac{2}{200}$ Vcm^{-1}

0.01 Vcm^{-1}

10 mVcm^{-1} **(01 Mark)**

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(v) $\frac{\cancel{200}^{100}}{\cancel{2}V} \times 4 \times 10^{-1}$ = 0.4 cm **(01 Mark)**

(vi) No. The fractional error of measuring the length is high **(01 Mark)**

(vii) Connecting the resistor to the driver cell in series **(01 Mark)**

(viii) 4 : 1996
10 : 399
3990 Ω **(01 Mark)**

(ix) $\frac{200}{10} \times 4 = 80$ cm **(01 Mark)**

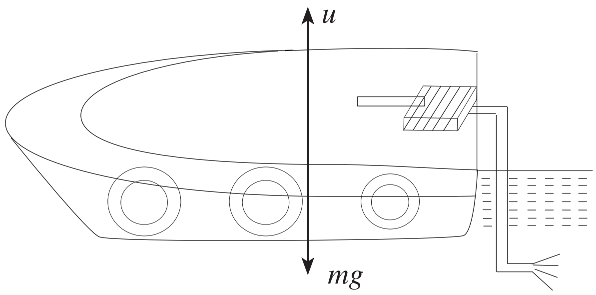
(x) $F_1 = \frac{1}{4}$ $F_2 = \frac{1}{800}$ **(01 Mark)**

$F_1 > F_2$ the fractional error is very small.

Part B - Essay

5. (a) Weight of the boat is equal to the upthrust. Line of action of weight and upthrust should be coincided. **(01 Mark)**

(b)



(01 Mark)

(c) 600 + 70 × 8 **(01 Mark)**
600 + 560
1160 kg
11600 N **(01 Mark)**

(d) (i) Resistive force = 1160 × 0.6 N
= 6960 N
= 696 N **(01 Mark)**

(ii) $F = mu$ **(01 Mark)**

$696 = (AVP)\ V$

$696 = AV^2P^2$

$= 0.05 \times 1000 \times V^2$

$= \frac{5}{\cancel{100}} \times 10\cancel{00} \times V^2$

$696 = 50 \times V^2$

$\frac{696}{50} = V^2$

$\sqrt{\frac{696}{50}} = V$ **(01 Mark)**

$3.73\ ms^{-1} = V$

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(e) (i) $P = FV$

$= 696 \times \sqrt{\frac{696}{50}}$ **(01 Mark)**

$= 2596$ W **(01 Mark)**

(ii) $P = FV \times \frac{100}{40}$ **(01 Mark)**

$= 696 \times \sqrt{\frac{696}{50}} \times 2.5$

$= 6490$ W **(01 Mark)**

(f) (i) Volume needed for the initial up thrust $= \frac{11600}{10000}$

Volume sinks in the area with air bubbles $= \frac{11600}{8000}$

Extra volume sunken V^1 $= 11600 \times \left(\frac{1}{8000} - \frac{1}{10000}\right)$

(01 Mark)

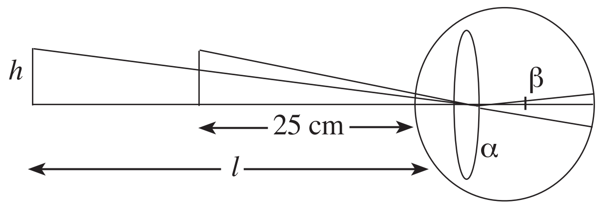
$= \overset{2900}{\cancel{11600}} \; \frac{\cancel{2000}}{\underset{4}{\cancel{8000}} \times 10000}$

$= 0.29 \text{ m}^3$ **(01 Mark)**

(ii) $= 0.29 \times \frac{\overset{10}{\cancel{100}}}{\cancel{60}} \times \frac{1}{\cancel{6}}$ **(01 Mark)**

$= 0.029 \text{ m}^3$ **(01 Mark)**

6. (a)



$\beta = \frac{h}{l}$

$\alpha = \frac{h}{D}$ **(01 Mark)**

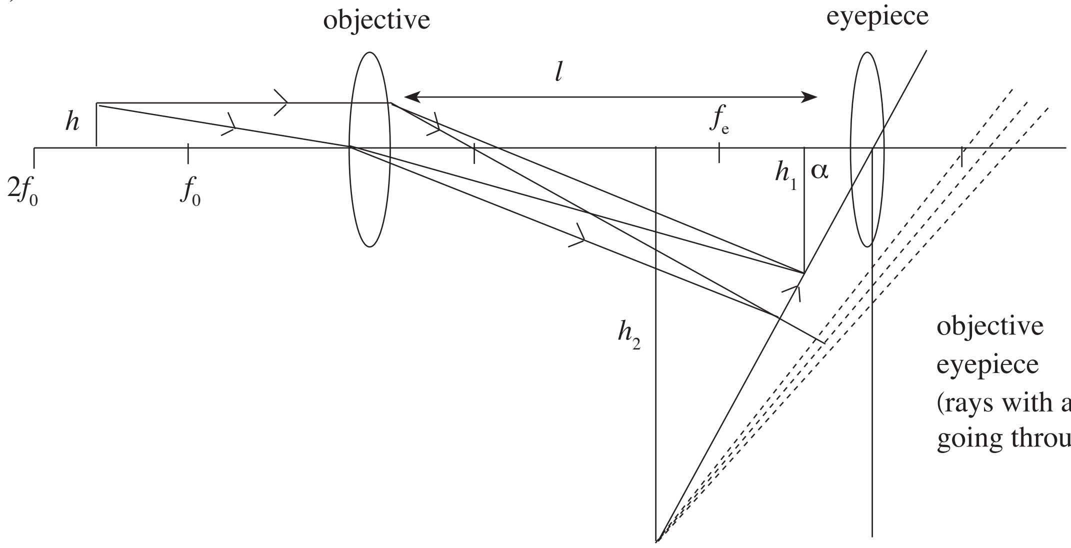
Angle subtended in the retina, when the object is at near point D α > objects away from D, subtend the angle in eye β.

α > β ∴ enlarged objects are received . **(01 Mark)**

(b) The angle subtended on the retina when look through the microscope is how many times larger as the angle subtensed on retina when the eye is non equipped/ naked.

(01 Mark)

(c)



objective **(01 Mark)**
eyepiece **(01 Mark)**
(rays with arrow head going through the pole)

$$M = \frac{\alpha^1}{\alpha}$$ **(01 Mark)**

$$M = \frac{h_2/D}{h/D} = \frac{h_2}{h} = \frac{h_2}{h_1} \times \frac{h_1}{h}$$

$$\frac{h_2/D}{h/D} = \frac{h_2}{h} = \frac{h_2}{h_1} \times \frac{h_1}{h}$$ **(01 Mark)**

$$= m_e \times m_o$$

$$= \left(\frac{D}{f_e} + 1\right)\left(\frac{l}{f_o} - 1\right)$$ **(01 Mark)**

(d) $\left(\frac{25}{2.5} + 1\right) \left(\frac{202}{2} - 1\right)$

$(10 + 1) \quad (101 - 1)$

11×100

1100 **(01 Mark)**

(e) (i) Long sight **(01 Mark)**

(ii) $\frac{1}{V} - \frac{1}{U} = \frac{1}{f}$

$+\frac{1}{25} - \frac{1}{U} = -\frac{1}{2.5}$ **(For correct sign conversion and the substitution 01 Mark)**

$+\frac{1}{25} + \frac{1}{2.5} = \frac{1}{U}$

$+\frac{11}{25} = \frac{1}{U}$

$U = \frac{25}{11}$ cm **(01 Mark)**

New $U^1 = \frac{25}{11} + \frac{175}{81 \times 11}$

$= \frac{81 \times 25 + 175}{81 \times 11}$

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$$= \frac{2025 + 175}{81 \times 11}$$

$$= \frac{\cancel{2200}}{81 \times \cancel{11}}$$

$$U^1 = \frac{200}{81} \text{ cm}$$

$$= 2.47 \text{ cm}$$ **(01 Mark)**

$$\frac{1}{V} - \frac{1}{U} = \frac{1}{f}$$

$$\frac{1}{V} - \frac{81}{200} = -\frac{1}{2.5}$$ **(For correct substitution) (01 Mark)**

$$\frac{1}{V} - \frac{81}{200} = -\frac{1}{2.5}$$

$$\frac{1}{V} = \frac{81 - 80}{200}$$

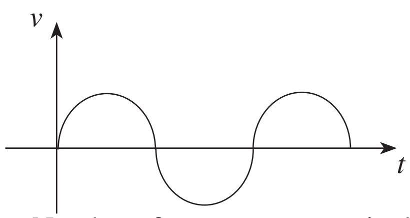
$$\frac{1}{V} = \frac{81 - 80}{200}$$

$$\frac{1}{V} = \frac{1}{200}$$

$$V = 200 \text{ cm}$$ **(01 Mark)**

(iii) 20.2 + 2.5 cm
22.7 cm **(01 Mark)**

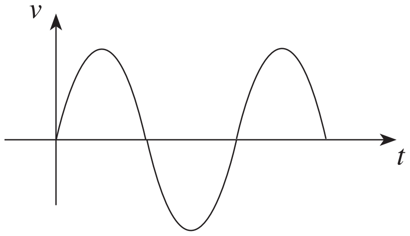
7. (a)



(01 Mark)

(b) Number of turns are greater in the secondary than in the primary
Thickness of the wires are less in the secondary than in the primary **(01 Mark)**

(c)



The height should be greater than 1 **(01 Mark)**

(d) (i) $$\frac{v_p}{N_p} = \frac{v_s}{N_s}$$ **(01 Mark)**

$$\frac{v_p}{v_s} = \frac{N_p}{N_s}$$

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$$\frac{11000}{250} = \frac{N_p}{N_s}$$

$$\frac{44}{1} = \frac{N_p}{N_s}$$

$44 : 1 = N_p : N_s$ **(01 Mark)**

(ii) $Vrms = \frac{V_p}{\sqrt{2}} = 250$ **(01 Mark)**

$$v_p = \sqrt{2}\ Vrms$$
$$= 250 \times 1.41$$
$$= 353.5\text{ V}$$ **(01 Mark)**

(iii) Joule energy loss
Eddy current loss
Hysteresis loss **(01 Mark)**

(iv) to increase the permeability to decrease the leakage of flux. **(01 Mark)**

(e) (i) $\text{I} = F \times l$

$\text{I} = BIab\text{ N}$ **(01 Mark)**

(ii) BI (ab) N Cos θ **(01 Mark)**

(iii) $V = IR$

$$\frac{20}{\sqrt{2}} = \text{I} \times 100$$

$$\text{I} = \frac{1}{5\sqrt{2}}$$ **(01 Mark)**

$$\text{I} = BI\text{ (ab) N}$$

$$= 0.2 \times \frac{1}{5\sqrt{2}} \times \left(\frac{2\cancel{0} \times 1\cancel{0}}{1\cancel{00} \times 1\cancel{00}}\right) \times 400$$

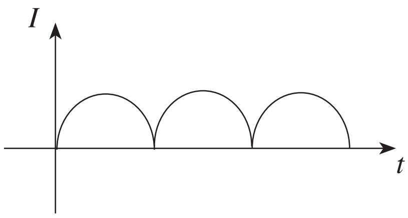
$$\frac{1.6}{5\sqrt{2}} = \frac{1.6 \times \sqrt{2}}{10}$$

$$= 0.16 \times \sqrt{2}\ \text{Nm}$$ **(01 Mark)**

$$= 0.225\ \text{Nm}$$

(iv) Using commutators **(01 Mark)**

(f)



(01 Mark)

8. (a) $F = 6\,\pi q r v$

$(F) = MLT^{-2}$

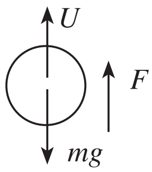
$6\,\pi q r v = [q]\,[r]\,[v]$

$= ML^{-2}$

$= ML^{-1}\,T^{-1}\,L\,LT^{-1}$ **(01 Mark)**

$= MLT^{-2}$

(b) $U + F = mg$ **(01 Mark)**

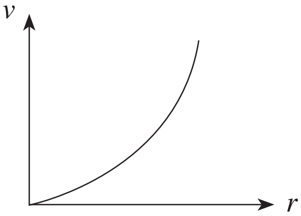


$\frac{4}{3}\pi r^3 p q + 6\pi q r v = \frac{4}{3}\pi d q$

$\overset{3}{\cancel{6}}\pi q \cancel{r} v + \frac{\cancel{4}}{3}\pi g\,(d-p)r^{\cancel{3}}$

$v = \frac{2}{9}q r^2 g(d-p)$ **(01 Mark)**

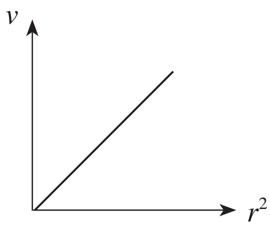
(c)



(01 Mark)

(d) (i) $v = \frac{2g}{9q}\,(d-p)\,r^2$

$y = m \quad x$



(ii) $m = \frac{2g}{9\eta}\,(d-p)$ **(01 Mark)**

$\eta = \frac{2g}{9m}\,(d-p)$

(01 Mark)

(iii) $\eta = \frac{2g}{9m}\,(d-p)$

$= \frac{2 \times 1\cancel{0}\,(1240-700)}{9 \times 80\cancel{0}}$ **(substitution 01 Mark)**

$= \frac{2 \times \overset{60}{\cancel{540}}}{\cancel{9} \times 8\cancel{0}}$

$\eta = \frac{12}{8} = 1.5\ \mathrm{Nm^{-2}}$ **(01 Mark)**

(iv) $v = m \times r^2$ **(01 Mark)**

$v = 800 \times \left(\frac{1\cancel{0}}{10\cancel{0}}\right)^2$

$= 800 \times \frac{10}{100}$

$= 8\ \mathrm{ms^{-1}}$ **(01 Mark)**

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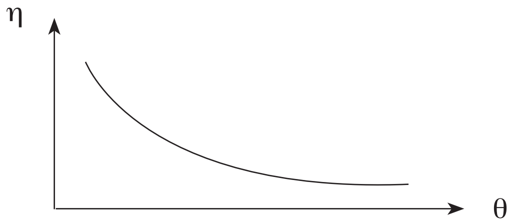
(e)



(01 Mark)

(f) (i) $\frac{F}{A} = \eta\frac{\Delta V}{d}$

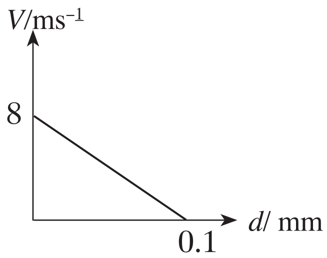
$$\frac{F}{40\cancel{0} \times 10^{\cancel{-4}-1}} = 1.5 \times \frac{8}{1 \times 10^{\cancel{-4}}}$$

(01 Mark)

$$F = 40 \times 1.5 \times 8$$
$$= 60 \times 8$$
$$= 480\ \text{N}$$

(01 Mark)

(ii)

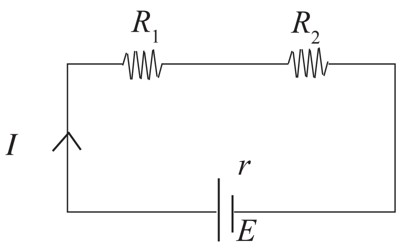


(Shape 01 Mark)
(Marking the axis with units 01 Mark)

9. (a) (i) Heat is generated due to the collision of electrons with electrons and electrons with the atoms **(01 Mark)**

(ii) Electric Iron/ Filament bulb **(01 Mark)**

(b) (A) In series



$$E = I(r + R_1 + R_2)$$

$$I = \left(\frac{E}{(r + R_1 + R_2)}\right)$$

(01 Mark)

(ii) Rate of heat dissipation $R_1 = I^2R_1$
Rate of heat across $R_2 = I^2R_2$ } **For both**

Since the same current passes through each resistor and heat dissipation R_1 is greater.

(01 Mark)

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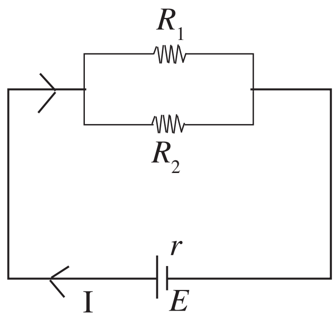
(B) In parallel



$R_f = \dfrac{R_1 R_2}{(R_1 + R_2)}$ **(For finding the effective resistance 01 Mark)**

$I = \dfrac{E}{\left(\dfrac{R_1 R_2}{R_1 + R_2}\right) + r}$ **(01 Mark)**

current across R_1 $I_1 = \dfrac{I}{(R_1 + R_2)} \times R_2$ **(01 Mark)**

(01 Mark)

current across R_2 $I_2 = \dfrac{I}{(R_1 + R_2)} \times R_1$

Rate of heat dissipation across R_1 $= \dfrac{I^2 R_2^2}{(R_1 + R_2)^2} \times R_1 = \dfrac{I^2 R_2 R_1}{(R_1 + R_2)^2} \times R_2$

Rate of heat dissipation across R_2 $= \dfrac{I^2 R_1^2}{(R_1 + R_2)^2} \times R_2 = \dfrac{I^2 R_2 R_1}{(R_1 + R_2)^2} \times R_1$

For both (01 Mark)

since $R_1 > R_2$, heat dissipation across R_2 is greater **(01 Mark)**

(Optional method = $P = V^2/R$ can be used to explain)

(c) (i) $P = I^2 R$

$= \left(\dfrac{E}{(R + r)}\right)^2 . \ R$ **(01 Mark)**

(ii) $R = r$. **(01 Mark)**

Then $P_{max} = \left(\dfrac{E}{(2r)}\right)^2 . \ R$

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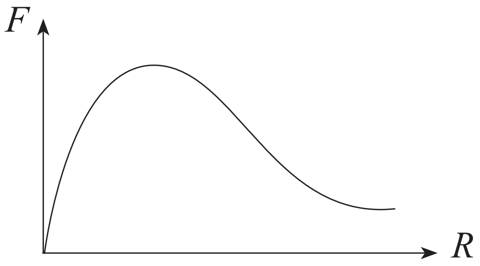
$$= \frac{1}{4}\left(\frac{E}{(r)}\right)^2 . \ r$$

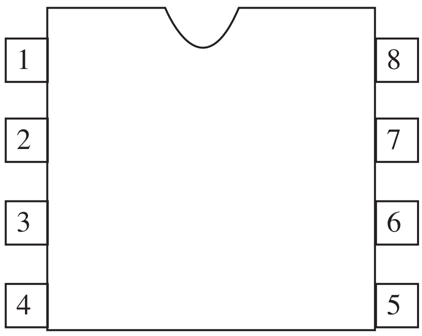
$$P_{max} = \frac{1}{4} r^2$$ **(01 Mark)**

(iii)

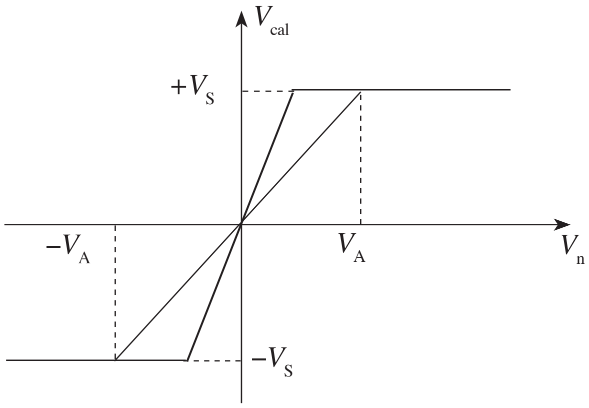


(01 Mark)

9. (B) (a)



(01 Mark)



(01 Mark)

(b) $V_o = \left(\frac{10}{R_1}\right) V_1$

(01 Mark)

$V_o = -\left(\frac{10}{R_2}\right) V_2$

(01 Mark)

$\therefore \ V_o = -\left(\frac{10}{R_1} V_1 + \frac{10}{R_2} V_1\right)$

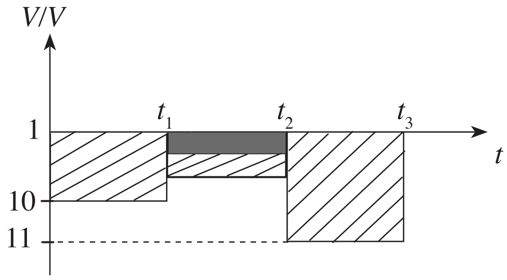
(01 Mark)

(c) $\frac{10}{R_1} = 5$ $\qquad$ $\frac{10}{R_2} = 0.2$

$R_1 = 2 \text{ k}\Omega$ $\qquad$ $R_2 = \frac{10}{0.2} = \frac{100}{2}$ **(02 Marks)**

$= 50 \text{ k}\Omega$

(d) $\left(\begin{array}{llll} V_1 = 2 & V_0 = -(10) & V_1 = 0 & V_0 = -1\text{V} \\ V_2 = 0 & & V_2 = 5 & \end{array} \right)$



(For time intervals with values) **(03 Marks)**

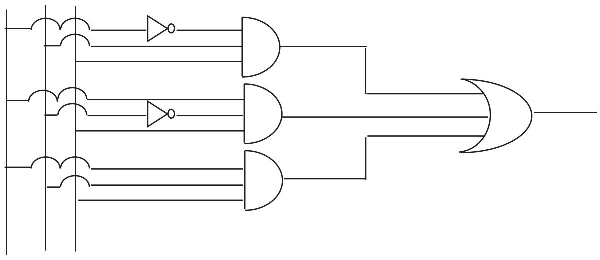
(e) (i)

A	**B**	**C**	**F**	
0	0	0		
0	0	1		
0	1	0		
0	1	1	**1**	$\bar{A}\,B\,C$
1	0	0		
1	0	1	**1**	$A\,\bar{B}\,C$
1	1	0		
1	1	1	**1**	$A\,B\,C$

(02 Marks)

(ii) $F_2 \quad \bar{A}BC + A\bar{B}C + ABC$ **(01 Mark)**

(iii)



(02 Marks)

10.(A) (a) Mass of water vapour present in a unit volume. **(01 Mark)**

(b) The ratio between mass of water vapour present and mass of saturated water vapour at a given temperature. **(01 Mark)**

(c) The quantity of water vapour present in thee space is reduced due to the condensation. Therefore absolute humidity is reduced. The relative humidity is increased when the temperature is reduced. Because when the temperature is reduced the quantity of water vapour needed to saturate the space is also reduced. **(01 Mark)**

$$\text{Relative humidity} = \frac{\text{Absolute humidity}}{\text{Saturated vapour pressure}}$$

$$\frac{80}{100} = \frac{\text{Absolute humidity}}{31.70}$$

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(01 Mark)

(d) (i) Absolute humidity $= \dfrac{8\cancel{0} \times 31.70}{10\cancel{0}}$

$= \dfrac{2536}{10}$

$= 25.36$ Hgmm **(01 Mark)**

(ii) Dew point is 26 °C because is there at 25.36 Hgmm **(01 Mark)**

(iii) Saturated vapour pressure at 24 °C is 22.3 Hgmm **(01 Mark)**

30 °C $\longrightarrow$ 24 °C when it comes, **(01 Mark)**

$$PV = nRT$$

$$PV = \frac{m}{M} RT$$

$$m = \frac{PVM}{RT}$$ **(01 Mark)**

30 °C $m_{30} = \dfrac{25.36 \times 13600 \times 10 \times 10^{-3} \times 60 \times 18}{8.3 \times 303}$ **Correct substitute (01 Mark)**

24 °C $m_{24} = \dfrac{22.3 \times 13600 \times 10 \times 10^{-3} \times 60 \times 18}{8.3 \times 297}$ **(01 Mark)**

[See page 16

mas of water vapour condensed (m) $= m_{30} - m_{24} + \dfrac{m_{24}}{2}$

$$= \frac{2m_{30} - m_{24}}{2} \qquad \textbf{(01 Mark)}$$

$$= \frac{13600 \times 10 \times 10^{-3} \times 60 \times 18}{8.3}\left[\frac{25 - 3 \times 2}{303} - \frac{22.3}{297}\right]$$

$$= \left[\frac{13600 \times 10 \times 10^{-3} \times 60 \times 18}{8.3}\right]\left[\frac{25.36}{303} - \frac{22.3}{297}\right]$$

$$= \frac{13600 \times 10 \times 10^{-3} \times 60 \times 18}{8.3}\left[\frac{25.36}{303} - \frac{22.3}{297}\right]$$

$$= \left[\frac{13600 \times 10 \times 10^{-3} \times 60 \times 18}{8.3}\right] \times (0.162392 - 0.075084)$$

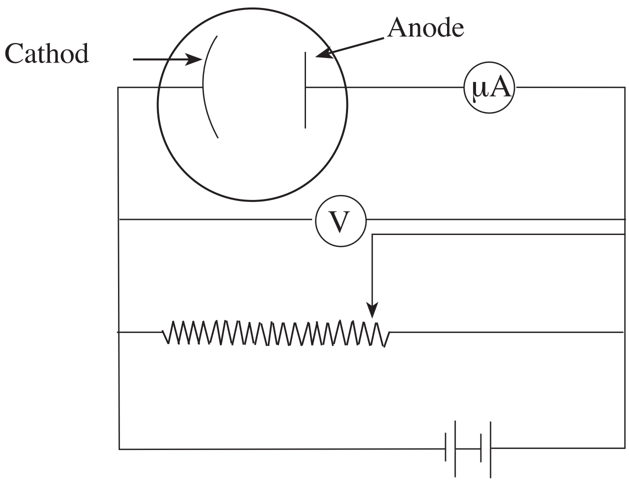
$$= \frac{1360\cancel{0} \times 1\cancel{0} \times \cancel{10}^{-3} \times 60 \times 18}{8.3} \times 0.092308$$

$$= 1633.52 \text{ g}$$

$$= 1.634 \text{ Kg} \qquad \textbf{(01 Mark)}$$

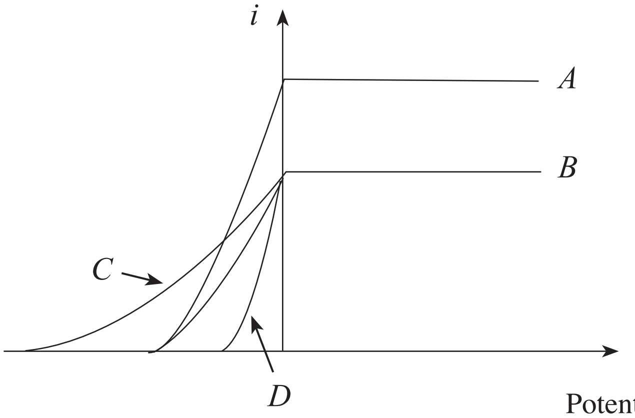
(e) Although exhaling removes water vapour from the body, inhaling does not supply it back. Because the quantity of water vapour is very low in the space. Therefore the water concentration in cell is reduced and metabolic activity is weakened. Therefore it id essential to drink more water. **(01 Mark)**

10.(B)(a) (i)



(01 Mark)

(a) Change the negative voltage **(01 Mark)**



(01 Mark)

(01 Mark)

(01 Mark)

(01 Mark)

(b) $E = hf$

$E = \frac{hC}{\lambda}$

$= \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{660 \times 10^{-9}}$

$= \frac{66 \times 3 \times 10^{-35} \times 10^{\cancel{17}\,16}}{\cancel{660}\,10}$

$E = 3 \times 10^{-19}$

$= \frac{3 \times \cancel{10^{-19}}}{1.6 \times \cancel{10^{-19}}} = \frac{3\cancel{0}}{\cancel{1}6} = \frac{15}{8} = 1.875$ ev

$KE = hf - Q$ **(01 Mark)**

$= 1.875 - 1 = 0.875$ ev

$= 0.875 \times 1.6 \times 10^{-19} = 1.4 \times 10^{-19}$ J **(01 Mark)**

$V_S e = KE_{max}$

$V_S e = 0.875$ ev

$V_S e = 0.875$ ev

(01 Mark)