MARKING SCHEME

PHYSICS

GRADE 13

3rd TERM TEST - JULY 2026

ROYAL COLLEGE

COLOMBO 07

M C Q ↓↓

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Royal College - Colombo 07

Grade 13

Final Term test - July 2026

Physics II

01 E II

Time : 3 hours

Reading time : 10 minutes

Important :

- *The question paper consists of 21 pages*
- *The question paper comprises Part A and Part B. The time allotted for both part is 3 hours*
- *Use of calculators is not allowed*

Part A - Structured Essay
(10 pages)

Answer all the questions on this paper itself. Write your answers in this spaces provided is sufficient for your answers and that extensive are not expected.

Part B - Essay
(11 pages)

This part contains five questions. Answer only four questions. Use the papers supplied for this purpose. At the end of the time allotted for this paper, tie the two papers so that Part A is on top of Part B before handing them over to the Supervisor.

You are permitted to remove only Part B of the question paper from Examination hall.

$g = 10\ Nkg^{-1}$

For Examiner's use only

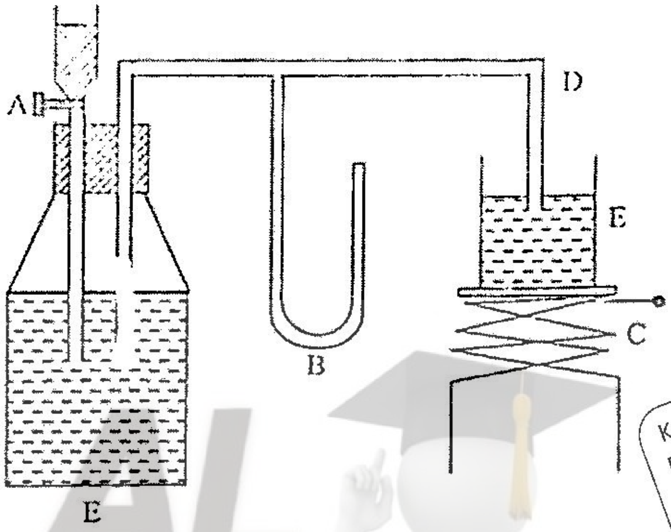
For the second paper		
Part	Question nos.	Marks
A	1	
	2	
	3	
	4	
B	5	
	6	
	7	
	8	
	9 (A)	
	9 (B)	
	10 (A)	
	10 (B)	
Total		

Final Marks

In numbers	
In words	

Answer All question

(1) Jegger's method can be used to determine the co-efficient of surface tension of a liquid using the concept of the additional pressure. The experimental setup is bown in the following figure.



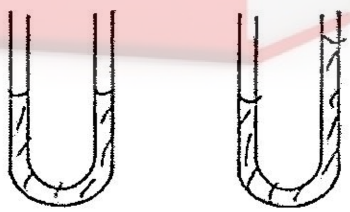
a) i) I) Define the co-efficient of surface tension.

Force acting on the surface of the liquid at right angles to one side of an imaginary straight line of unit length in the surface of the liquid. —(01)

II) Write down the dimensions of surface tension.

MT^{-2} —(01)

ii) I) Draw the liquid levels in the manaometer B before and after the tap A is opened in below given figures.



Before After

—(01)

II) Write down the reasons for liquid levels are setting up as the above figures in part (a) ii I) at relevant instances.

Before open the tap A: Pressures are equal inside tube D and inside and outside of tube E —(01)

After open the tap: E is filled with water and the pressure inside it is increased due to decrease of air —(01)

iii) Consider the instance of releasing an air buble at the end of the tube D. The pressure inside the air bubble is P_1 and the pressure outside the air bubble is P_2, the radius the tube D is r and the diameter of the air bubble is d. Write down the requrements to fullfil to release the air buble from the tube D.

I) a) Using the pressure difference

$P_1 > P_2$ OR $P_1 - P_2$ is maximum - (01)

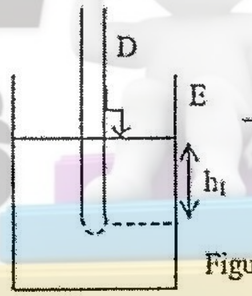
b) Using the radius of the tube.

$r = d/2$ —— (01)

II) What can you say about the difference of the liquid levels of the manometer when releasing the air bubble from the tube D.

Maximum —— (01)

b) Consider the surface tension of the liquid is T and the density of the liquid is ρ_1. The density of the liquid in the manometer is ρ_2, the difference of the liquid levels between the manometer when the air bubble is released is h_2, the distance between water level of the vessel E and the bottom end of the tube D is h_1 and the atmospheric pressure is P_0.



—— (01)

Figure (3)

i) Write down an equation for the internal pressure (P_1) of the air bubble created at the end of tube D.

$P_0 + h_2\rho_2 g$

(01)

ii) Write down an equation for the external pressure (P_2) at the instance of releasing the air bubble at the end of tube D.

$P_0 + h_1\rho_1 g$

iii) Obtain an expression for the additional pressure ($P_1 - P_2$) using theresults obtained in above part (b)(i) and (ii).

$P_0 + h_2\rho_2 g - P_0 - h_1\rho_1 g$

$(h_2\rho_2 - h_1\rho_1)g$ —— (01)

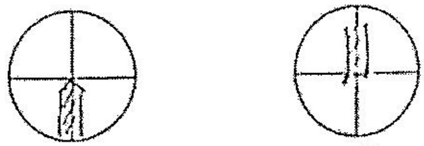
iv) Hens write down an expression for the surface tension (T) interms of above given symbols.

$(h_2\rho_2 - h_1\rho_1)g = \frac{4T}{d}$ —— (01)

$T = \frac{d}{4}(h_2\rho_2 - h_1\rho_1)$

v) Draw the index I_2 which is used to read the water level of the vessel E of tube D is inserted at the appropriate position.

vi) When the travelling microscope is focused at of the liquid surface and the end of the tube D to obtain the height h_1, draw the appearance of them on the cross wires given below.



index   end of the capillary tube   —(01)

vii) Explain the steps of measuring h_1.

First remove laboratory bench. Obtain readings using travelling microscope at the lower end of the index and the position of the lower end of capillary tube. —(01)

c) i) Write down the special characteristic which should be in the manometer liquid.

Density ~~is~~ should be less than the density of the liquid in vessel E / The liquid should not be thick. —(01)

ii) What is effect of the special characteristic of the liquid in part (c)(i) on the experiment?

Density less – Percentage error less

Less thick – Liquid levels will be balanced very quickly —(01)

iii) A student says that coconut oil can be used as the manometer liquid. Explain whether it is true or false.

False. —(01)

Liquid levels are not balanced very quickly and therefore cannot be measured h_1 accurately.

iv) Another student plans an experiment to find the surface tension (T) of the liquid using the capillary rise method. Write down two advantages using the Jeggars method than the capillary rise method.

(I) No need of contact angle —(01)

(II) Can be found various densities and surface tension at different temperatures.

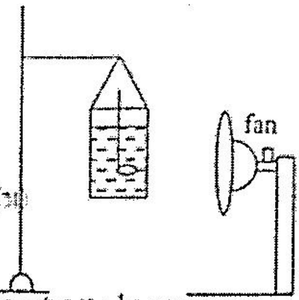
v) What effect can be expected, if the rate of collecting water in to the Jeggers vessel is increased?

Then rate of change of h_1 is high and due to that measuring of h_1 is errornous. —(01)

vi) What is the special observation can be seen in above c (v).

Liquid levels of manometer is rapidly moving upwards and downwards. —(01)

(2) The figure shows an experimental setup to determine the specific heat capacity of cocnut oil using the Newton's Cooling Law. A polished copper calorimeter with a lid, stirrer, heated coconut oil, heated water and a stand are provided.



a) Name three mesuring instruments which are using in this experiment.

Thermometer ——— (01)
Laboratory electronic balance / triple beam balance — (01)
Stop watch ——— (01)

b) Write down the equation of Newton's Cooling Law using the usual symbols and name them.

$\frac{dQ}{dt} = eA(\theta - \theta_R)$ ——— (01)

θ_R – Room temperature
dQ/dt – Rate of heat loss
e – Surface emissivity
A – Surface area of heat loss
θ – Temperature of object
— (01)

c) Write down the reason for using the same calorimeter for both water and cocnut oil.

To equate the surface emissivity in both instances — (01)

d) What is the reason for using a polished calorimeter in this experiment.

To minimize the heat loss from radiation ——— (01)

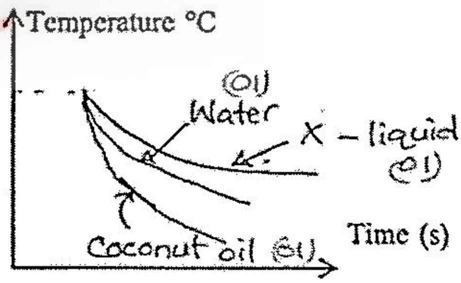
e) Write down the experimental step which is used to equalise the internal and the external temperetautre of the calorimeter.

Stir well continouously ——— (01)

f) Which physical quantity can be maintained constant by using the equal volumes of water and coconut oil.

To equate the surface area ——— (01)

g) Draw the rough sketch of two cooling curves for cocnut oil and water in the given axes and name them.



h) The readings and data for calculating specific heat capacity of coconut are given below.

Mass of the calorimeter(m_c) = 0.15 kg

Specific heat capacity of the material of the calaorimeter(S_c) = 400 $Jkg^{-1}k^{-1}$

Mass of the water (m_1) = 0.25 kg

Specific heat capacity of water(s_1) = 4200 $J\,kg^{-1}k^{-1}$

Mass of the coconut oil (m_2) = 0.20 kg

The time taken to cooling the water and the coconut oil from from θ_1 to θ_2 are t_w and t_l respectively. Write down an expression for the specific heat capacity of coconut oil (s_2).

$$(m_cS_c + m_1S_1)\frac{(\theta_1-\theta_2)}{t_w} = (m_cS_c + m_2S_2)\frac{(\theta_1-\theta_2)}{t_l}$$

(01) (01)

i) If t_w = 15 minutes and t_l = 6 minutes, determine the specific heat capacitiy (s_2) of coconut oil.

$$\frac{(0.15\times 400 + 0.25\times 4200)}{15} = \frac{(0.15\times 400 + 0.20\times S_2)}{6}$$

(01) (01)

$S_2 = 1920\ J\,kg^{-1}K^{-1}$ (01)

(01)

K) If the same practical is done for another liquid (X) of having higher heat capacity than water, draw the cooling curve the liquid X for above given axes in part (h) and name it.

(3) You are asked to determine the frequency of a tuninig fork of unkown frequency using the sonometer. A set of weights each 0.5kg, a tuninig fork of unkown frequency and a meter ruler are provided. The practical setup is arranged below.

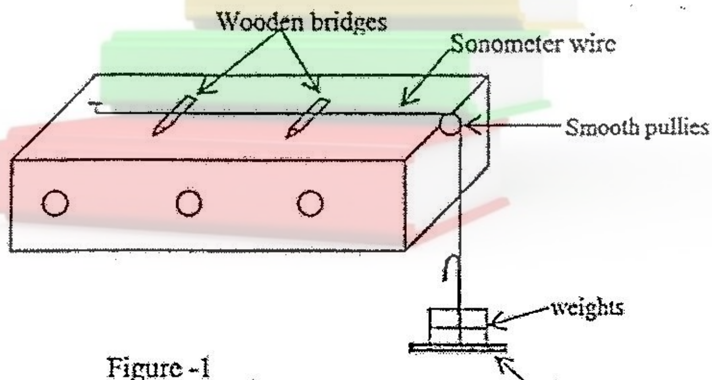
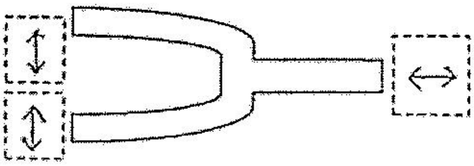


Figure -1

a) When the tuning fork is held by hand, draw the vibrating dirrections (both side) of the stem and the prongs in the given dashed squares using arrows.



(01)

b) When the vibrating tuning fork is kept on the sonometer box, state the the type of the wave formed in the sonometer wire.

I) Longitudinal/Transvers.

II) Stationary/ Progressive.

Transverse stationary wave —— (01)

c) The teacher says that, the stem of the vibrated tuninig fork should be kept on the sonometer box perpendularly between the two bridges closer to the sonometer wire. Are you agreed with the teacher's statement? State Yes/No and give the reason for your answer.

Yes. —— (01)

To transfer the energy efficiently from the tuning fork to the sonometer wire. —— (01)

d) When the tension of the wire is T, mass per unit length is m, write down an expression for the velocity of transverse wave V.

$V = \sqrt{\frac{T}{m}}$ —— (01)

e) Write down the four experimental steps up to the obtaining the first reading. All 4 correct —(03)
3 correct —(02)
1 correct —(01)

1. Minimize the distance between two knife edges.
2. The vibrated tunning fork should be placed on the sonometer box close to the sonometer wire and at the middle of knife edges
3. Then the distance between two knife edges should be increased gradually
4. When the paper rider jumps off instantly/maximum height/high vibrat. measure the distance between two knife edges using the metre ruler

f) i) What is other item which is required in this practical.

Paper rider —— (01)

ii) Draw the vibrating pattern of the wire between P and Q when you are taking the first reading.

Give marks only if drawing with maximum amplitude. —— (01)

iii) Explain the reason for using the above instance to obtain the readings.

That instance is the resonance stage of tunning fork with maximum amplitude. —— (01)

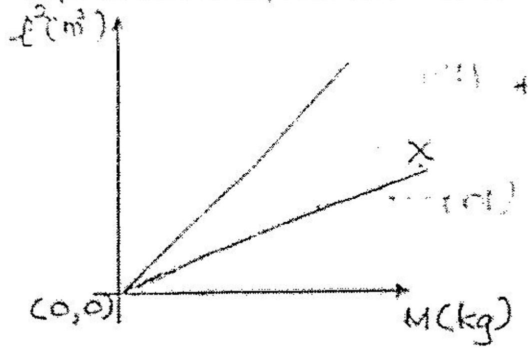
g) The total mass with the weight holder is M, the frequency of unknown tuning fork is f, the mass per unit length m, the gap between the two bridges is l. Arrange variables to determine f.

$\frac{d}{2} = l$ $\quad V = \sqrt{\frac{T}{m}}$ $\quad f \times 2l = \sqrt{\frac{Mg}{m}}$

$d = 2l$ —(01) $\quad fd = \sqrt{\frac{T}{m}}$ $\quad l^2 = \left(\frac{g}{4f^2 m}\right) M$ —— (01)

$y = m\,x$

h) Draw the rough sketh of the expected graph in the below axes. Name the axes.



Give marks only the gradient of graph X by half.

For both axes naming with correct units } (01)

i) The gradient of the graph in SI units is 4.0 and the mass per unit length is 1.25×10^{-3} kg m^{-1}
Determine the ~~gradient of the graph.~~ frequency of the tunning fork.

Gradient $= \frac{g}{4f^2 m}$ (01) $\Rightarrow f^2 = \frac{g}{4m \times \text{gradient}} \Rightarrow f = \sqrt{\frac{10}{4 \times 1.25 \times 10^{-3} \times 4}}$ (01)

$f = 500$ Hz (01)

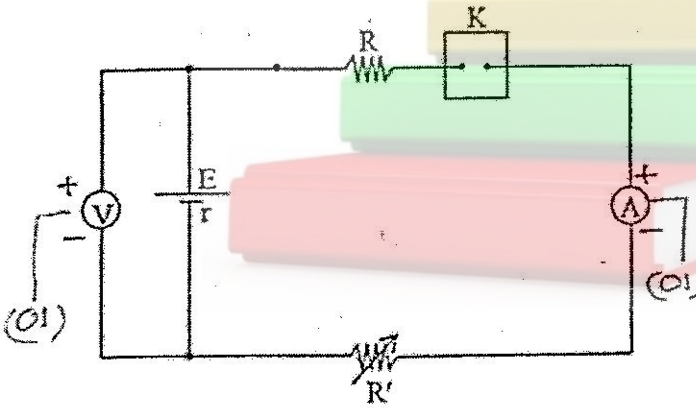
j) State two methods other than the method used in this practical to identify the resonance of the tuning fork and the sonometer wire.

1. Tune using beats
2. Tune using hearing

} Only both correct (01)

k) Draw the graph in above axes in part (h) for a sonometer wire which is having the two times linear density than the wire used in part(g). Name it as x.

(04) An experiment is planned by a student to determine an internal resistance and the electromotive force of a dry cell. The circuit is shown in the following figure.



Ⓥ - Digital Voltmeter
Ⓐ - milli ammeter
E - Electromotive force of dry cell
r - internal resistance of dry cell
R - 10Ω resistor
R' - variable resistor

a) Mark the polarities of the voltmeter and the ammeter as + and - which are shown in the figure -01.

b) Write an advantage of using a digital voltmeter in this practical.

Internal resistance of a digital voltmeter is a very high value. (As an ideal voltmeter) (01)

c) What would be used as the variable resistor R^1? (Resistance box or Rheostat)
Write down the reason for your selection.

Rheostat ...... (01)

Reason:- : Resistor / Current can be varied continuously OR
Current can be varied by known values - (01)

d) The electromotive force and the internal resistance of the dry cell is E and r respectively. The current drawn by the cell is I, the reading of the voltmeter is V. Write down an expression for V, interms of the given symbols.

$V = E - Ir$ —— (01)

e) Re-arrange the variables in the expresson of above part (c) to determine E and r by plotting a graph. Write down the independent and the dependent variable separately.

$V = (-r) I + E$ —— (01)
$y = -mx + c$

Independent Variable :– I
Dependent Variable.:– V —— (01)

f) Mension whether a tap key or a plug key should be used as the key K in the above circuit. Write down the reason for your selection.

Tap key —— (01)

To close the circuits only when obtaining readings OR
To avoid the discharging of the cell quickly. —— (01)

g) The co-ordinates of the plotted graph are given below.
(0.00, 1.45), (0.14, 1.05) (1.05, 0.40), (2.00. 0.00)
The range of readings taken for the x- coordinate is from 0.10 to 1.50. By using the given informations,

i) Determine the internal resistance of the dry cell (r).

Gradient $= \left(\frac{0.40 - 1.05}{1.05 - 0.14}\right) = \frac{-0.65}{0.91} = -0.71$

$-$ Gradient $= -r$ ← Give this mark only - choose these coordinates. (01)

$r = 0.71\,\Omega$ —— (01)

ii) Determine the electromotive force (E) of the dry cell.

$E = 1.45V$ —— (01)

h) Write down the reason for using a 10Ω resistor as R in the circuit shown in the figure-(01).

If the resistance of the rheostat equals to zero, there should be a permanent resistance of the circuit OR

To avoid the discharging of the cell quickly. —— (01)

i) Another student said that if the (A) R and R' are exchange each other, no effect for the experiment. Are you agree with that that student? State yes or No. Mension the reason for your selection.

Yes —— (01)

The current is not changed if it is interchanged

(A), R and R' are seriesly connected —— (01)

j) In this practical, R' is varied from the highest value to lowest value. State the reason.

To minimize the discharging of the cell —— (01)

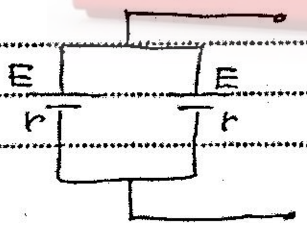
k) Another student is taking the reading of the voltmeter while the switch K is opened. What is meant by that reading taken by him.

Electro motive force of the dry cell (E) —— (01)

l) A student says that the readings were not correct due to the cell was discharged. How can you assure that the cell was discharged?

Rheostat is changed according to the initially applied current and check whether the voltmeter reading is the value previously obtained. —— (01)

m) If you are asked to design a cell of less discharging and you are allowed to use another cell with the given cell, draw the newly designd cell combination.



—— (01)

Part B - Essay

(5)

$\uparrow$ $s = ut + \frac{1}{2}at^2$ — (1)

$0 = u\sin\theta\, t - \frac{1}{2}gt^2$

$t = \frac{2u\sin\theta}{g}$ — (1)

$\rightarrow$ $S = ut + \frac{1}{2}at^2$

$R = \frac{u\cos\theta \cdot 2u\sin\theta}{g}$

$= \frac{2u^2\cos\theta \cdot \sin\theta}{g}$ — (2)

a.

(i) $E = \frac{1}{2}mv^2$ — (1)

$= \frac{1}{2} \times 0.2 \times 25^2$

$= 62.5\ J$ — (1)

(ii) $\rightarrow$ $s = ut$

$S = 25t$

$t = 0.2\ s$ — (1)

$\downarrow$ $v = u + at$

$v = 0 + 10 \times 0.2 = 2\ ms^{-1}$ — (1)

$= \sqrt{25^2 + 2^2} = \sqrt{629}$

$E = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 0.2 \times 629$

$= 62.9\ J$ — (2)

(iii) $\frac{1}{2}mv^2 = \frac{1}{2}kx^2 \times \frac{50}{100}$ — (1)

$0.2 \times 25^2 = K \times \frac{5}{100} \times \frac{5}{100} \times \frac{50}{100}$

$\frac{0.2 \times 25^2 \times 100 \times 100 \times 2}{25} = K$

$K = 100\,000\ Nm^{-1}$ — (2)

b.

(i) $F = \frac{mv - mu}{t}$ — (1)

$= \frac{0.2\,(30 - 20)}{0.2}$

$= 50\ N$ — (1)

(iii) $\overrightarrow{20\ ms^{-1}}$ $10\sqrt{17}$ $\sqrt{17}$ 1 4

Horizontal Velocity Change $= (20 - - 10\sqrt{17}\cos\theta)$ — (1)

$= 20 + 10\sqrt{17} \times \frac{4}{\sqrt{17}}$

$= (20 + 40)$

$= \overrightarrow{60}\ ms^{-1}$ — (1)

Vertical Velocity Change $\uparrow$ $10\sqrt{17}\sin\theta$

$10\sqrt{17} \times \frac{1}{\sqrt{17}} = 10\uparrow s^{-1}$ — (1)

$\Delta P = (0.2)\sqrt{60^2 + 10^2}$

$= (0.2)\sqrt{3600 + 100}$

$= (0.2)\sqrt{3700}$

$= (0.2)\,10\sqrt{37}\ kgms^{-2}$

$= 2\sqrt{37}\ kgms^{-2}$

$= 12.2\ kgms^{-2}$ — (1)

C.

(1). (i) According to First equation.

$R = \frac{2u^2\cos\theta \cdot \sin\theta}{g}$

$= 2 \times \frac{40^2}{10} \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$

$= 160\ m$ — (2)

(5) – (1)

(2) $\uparrow v^2 = u^2 + 2aS$

$$0 = \frac{40^2}{\sqrt{2}^2} - 2 \times 10 S$$

$$S = \frac{40 \times 40}{20 \times 2} = \frac{80}{2} \text{ m}$$

$$= 40 \text{ m} \text{ —— } (1)$$

(ii) $\overrightarrow{S} = ut$

$$60\sqrt{3} = 40 \cos\theta \times 3$$

$$\cos\theta = \frac{\sqrt{3}}{2}$$

$$\theta = 30^\circ \text{ —— } (1)$$

$$\uparrow S = ut + \tfrac{1}{2}at^2$$

$$S = 40 \sin 30 \times 3 - \tfrac{1}{2} \times 10 \times 3^2$$

$$= 60 - 45$$

$$= 15 \text{ m} \text{ —— } (1)$$

(d)

$$\downarrow S = ut + \tfrac{1}{2}at^2$$

$$9 = 0 + \tfrac{1}{2} a \times 3^2$$

$$a = 2 \text{ m}s^{-2} \text{ —— } (1)$$

$$\downarrow F = ma$$

$$mg - u = ma$$

$$0.2 \times 10 - u = 0.2 \times 2$$

$$2 - 0.4 = u$$

$$u = 1.6 \text{ N} \text{ —— } (1)$$

$$m\cancel{g} = vd\cancel{g} - \cancel{0}$$

$$0.2 \times 10 = vdg \text{ — } (1)$$

$$u = v\rho g$$

$$1.6 = v \times 1000 \times 10 \text{ — } (2)$$

$$\frac{(1)}{(2)} \quad \frac{2.0}{1.6} = \frac{vdg}{v \times 1000 \times g}$$

$$\frac{2000}{1.6} = d$$

$$d = 1250 \text{ kg m}^{-3} \text{ — } (1)$$

30

(6)

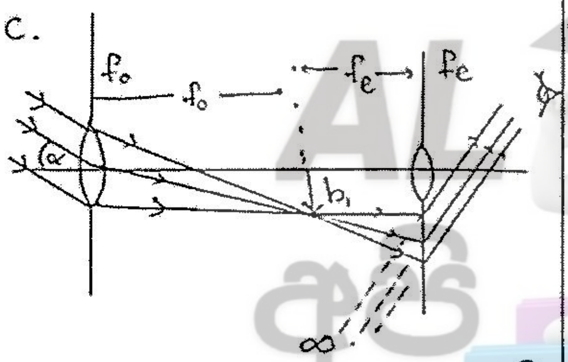
a. Angular Magnification

= The angle subtended at the eye by the image at infinity

The angle subtended at the eye by the object at infinity. — (2)

b. Normal Adjustment — (1)

c.



obtaining b_1 — (1)

Marking the focal length — (1)

Ray diagram — (1)

Parrellel lines — (1)

Marking eye — (1)

d. (i)

The distance between the two lenses is equals to the sum of the focal lengths of the objective and the eyepiece.

$f_o + f_e = 84$ - (1) — (1)

$\frac{f_o}{f_e} = 20$ - (2) — (1)

$f_o = 20 f_e$ — (1)

From (1)

$f_o + f_e = 84$ — (1)

$20 f_e + f_e = 84$

$21 f_e = 84$

$f_e = 4\,cm$ — (1)

$f_o = 80\,cm$ — (1)

(ii) The distance the eyepiece is pulled backward $\}$ = 4 cm — (1)

Focal length of the objective lens. = 80 cm — (1)

— (1)

$v = -84$

According to the sign convention.

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f_o}$ — (1)

$\frac{1}{-84} - \frac{1}{u} = \frac{-1}{80}$

$\frac{80 \times 84}{4} = 1680$ — (1)

The object is located at 16.8 cm from the objective lens. — (1)

e) (ii) $M = \frac{\beta}{\alpha} = \frac{h'/f_e}{h'/84(v)}$ — (1)

$\frac{v}{f_e} = \frac{84}{4} = 21$ — (1)

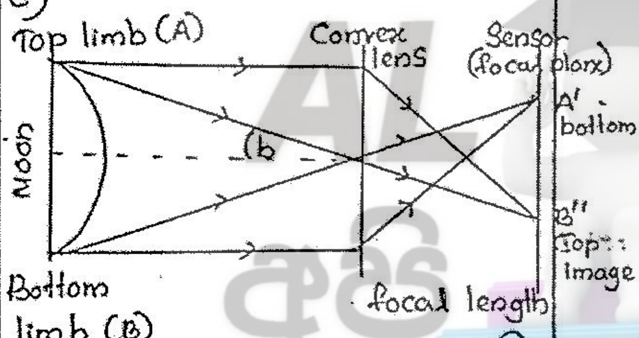
iii) $m = \frac{f_o}{f_e}\left(1 + \frac{f_e}{D}\right)$

$= \frac{80}{4}\left(1 + \frac{4}{25}\right)$ — (1)

$= 20 \times 1.16$

$= 23.2$ — (1)

e)



— (3)

ii) inverted image — (1)

iii) light - lens ⟶ Sensor, Electrica Shield.

⟶ digital image. — (2)

30

(7)

(i) $Q = \frac{\pi r^4 (\Delta p)}{8 \eta l}$ — (2)

Q - Volume flow Rate

r - Inner diameter of tube.

Δp - Pressure Difference accross the tube

η - Coefficient of Viscosity

l - length of tube

(If All correct — (02))

(iii) $P = \frac{F}{A}$, — (1)

$F = \frac{Q\, 8\eta l}{\pi r^4} \times \pi r^2$

$= \frac{Q\, 8 \eta l}{r^2}$

or

$= (\Delta p) \pi r^2$ — (1)

(iv) rate of Work done (p) $= F \times v$ — (1)

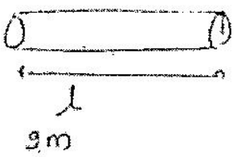
$Q = v \times \pi r^2$

$= (\Delta p) \pi r^2 \times \frac{Q}{\pi r^2}$ — (1)

$= (\Delta P) . Q$ — (01)

b)

(i)



$r = 1.5\ cm$

$\Delta p = 25\ kPa$

$\eta = 6\times10^{-4}\ P$

$$Q = \frac{\pi r^4(\Delta p)}{8\eta l}$$

$$= \frac{3\times(1.5\times10^{-2})^4\times25\times10^3}{8\times6\times10^{-4}\times2} \quad \text{— ①}$$

$$= \frac{5.0625\times10^{-8}\times25\times10^3}{8\times4\times10^{-4}}$$

$$= 3.955\times10^{-1}$$

$$= 0.3955$$

$$= 0.40\ m^3s^{-1} \quad \text{— ①}$$

(ii) $\frac{\text{Output power}}{\text{Input power}}\times100 = 80$ — ①

Input power $= \frac{\text{output power}}{80}\times100$

output power $= \Delta p\times Q$

$= 25\times10^3\times0.4$

$= 10^4\ Pa$ — ①

Input power $= \frac{10^4}{80}\times100$

$= 0.125\times10^3$

$= 125\ W$ — ①

(iii)

Volume of tonk. $= 80\ m^3$

$80 = 0.4\times t$ — ①

$t = \frac{80}{0.4} = \frac{800}{4}$

$= 200\ s$ — ①

c (i) $Q = \frac{\pi r^4}{8\eta l}\Delta p$

$Q \propto \frac{1}{\eta}$

Since the flow rate is inversely propotional — ① to the viscosity, the flow rate decreases as the viscocity increases. — ①

(ii) $\frac{Q}{Q'} = \frac{\eta'}{\eta} = \frac{1.5\eta}{\eta}$

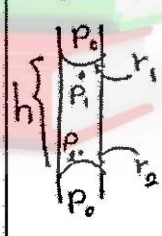
$Q' = \frac{1}{1.5}Q$

$Q' = \frac{2}{3}Q$ — ①

The percentage Change in the flow rate $= \frac{(Q-\frac{2}{3}Q)\times100\%}{Q}$ — ①

$= 33.3\%$ — ①

d) (i)



$P_0 - P_1 = \frac{2T}{r_1}$ —(1) — ①

$P_0 - P_2 = \frac{2T}{r_2}$ —(2)

$P_2 = P_1 + hdg$ —(3) — ①

$P_2 - P_1 = hgd$ —(4)

① − ②

$P_2 - P_1 = 2T\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$

from (4)

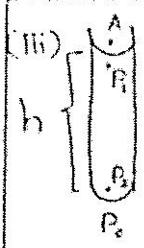
$hdg = 2T\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$

$h = \frac{2T}{dg}\left[\frac{1}{r_1} - \frac{1}{r_2}\right]$ — ①

$h = \frac{2\times7.2\times10^{-2}}{1\times10^3\times10}\left[\frac{1}{6\times10^{-4}} - \frac{1}{2\times10^{-3}}\right]$ — ①

$h = 1.68\ cm$ — ①

(iii)



$P_A - P_1 = \frac{2T}{r_1}$ — (1)

$P_B - P_c = \frac{2T}{r}$ — (2) — 1

$P_B = P_1 + h\rho g$ — (3)

$P_B - P_1 = h\rho g$

From (2) to (3)

$\frac{2T}{r} + P_0 = P_1 + h\rho g$

$P_1 = \frac{2T}{r} + P_0 - h\rho g$

$P_A - P_1 = \frac{2T}{r_1} - \frac{2T}{r} + P_0 - h\rho g$ — 1

$\Delta P = -1.68 \times 1000 \times 10 + 1 \times 10^5 - \frac{2 \times 7.2 \times 10^{-2}}{3 \times 10^{-3}} + \frac{2 \times 7.2 \times 10^{-2}}{4 \times 10^{-3}}$ — 1

$= 83188$ Pa — 1

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08)

(i) $F = Bqv$ — (1)

(ii) $\frac{mv^2}{r} = Bqv$ — (1)

$r = \frac{mv}{Bq}$ — (1)

(iii) $T = \frac{2\pi r}{v} = \frac{2\pi}{v} \times \frac{mv}{Bq}$ — (1)

$T = \frac{2\pi m}{Bq}$ — (1)

$f = \frac{1}{T}$ — (1)

$f = \frac{Bq}{2\pi m}$ — (1)

(iv) I) When entering obliquely at an angle θ, it exhibits a horizontal motion due to its horizontal component and a circular motion due to its vertical component. As a combination of both these motions, the charge moves along a helical path.

(Award marks even if explained using a diagram.) — (3)

II) $Bqv\sin\theta = \frac{mv^2\sin^2\theta}{r}$ — (1)

$r = \frac{mv\sin\theta}{Bq}$ — (1)

$T = \frac{2\pi r}{v} = \frac{2\pi m \cancel{v\sin\theta}}{Bq\,\cancel{v\sin\theta}}$

$T = \frac{2\pi m}{Bq}$ — (1)

→ $S = vt$ — (1)

$d = v\cos\theta \times \frac{2\pi m}{Bq}$ — (1)

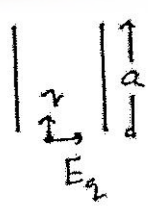
$d = \frac{2\pi m v\cos\theta}{Bq}$

v) $\frac{2\pi m}{Bq} : \frac{2\pi m}{Bq}$ — (1)

$1 : 1$ — (1)

b) The time period of the charge within the field $= \frac{T}{4}$ — (1)

$= \frac{2\pi m}{4Bq}$ — (1)



↑ $S = vt$ — (1)

$a = v \times \frac{\cancel{2}\pi m}{_2\cancel{4}Bq}$ — (1)

$d = \frac{\pi m v}{2Bq}$ — (1)

→ $F = ma$ — (1)

$Eq = ma$ — (1)

$a = \frac{Eq}{m}$ — (1)

$\rightarrow S = ut + \frac{1}{2}at^2$ —— (1)

$$a = \frac{1}{2} \times \frac{Eq}{m} \times \frac{4\pi^2 m^2}{16 B^2 q^2} \quad \text{—— (1)}$$

$$a = \frac{Eq\pi^2 m^2}{8 m B^2 q^2}$$

$$a = \frac{E\pi^2 m}{8 B^2 q^2} \quad \text{—— (1)}$$

c) $F = Bqv \sin\theta$

$B \uparrow \quad \theta \downarrow$

Since the parallel component decreases, V bends into the field. —— (1)
It is a helical motion with a gradually decreasing radius. —— (1)

$\overline{30}$

9A.

a) i) $C\theta = BINA$

$C \cdot 90 = 0.1 \times 1 \times 10^{-3} \times 450 \times 2 \times 10^{-4}$

$C = 1 \times 10^{-7}$ Nm

or

$C\frac{\pi}{2} = 450 \times 2 \times 10^{-8}$

$C = 1.20 \times 10^{-6}$ Nm rad^{-1} — (2)

(iii) $V = IR$

$0.1 = 1 \times 10^{-3} R$

$R = 100\ \Omega$ — (1)

b) i) $V_1 = 0.1\ V$ — (1)

ii) $V = IR$

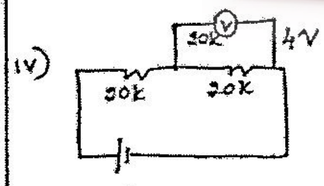
$V = 10^{-3}(900 + 100)$

$= 1V$ — (2)

iii) $20 = 10^{-3}(R_2 + 900 + 100)$

$R_2 = 19000\ \Omega$ — (2)

iv)



E

$V = IR$

$4 = I\ 100000$

$4 \times 10^{-4} = I$

$E = 4 \times 10^{-4}$

Battery $= 12\ V$ — (2)

$V = IR$

$12 = I \quad 40 \times 10^{-3}$

$I = 3 \times 10^{-4} A$

$= 0.3 mA$ — (2)

c)

i) $V = 10^{-3} \times 100$ — (1)

$V = 9 \times 10^{-3} \times (R_3 + R_4)$ — (2)

(1) & (2)

$100 = 9(R_3 + R_4)$ — (2)

ii) $R_3 + 100 = 999\ (R_4)$ — (2)

From (1)

$100 = 9\left(\frac{R_3}{1} + \frac{R_3 + 100}{999}\right)$

$100 = 9\left(\frac{1000R_3 + 100}{999}\right)$

$11100 - 100 = 1000\ R_3$

$\frac{11000}{1000} = R_3$

$R_3 = 11\ \Omega$ — (2)

$R_4 \times 999 = 111$

$R_4 = 0.1\ \Omega$ — (2)

d)

(i) Connect A & B. — (1)

Adjust for zero error — (1)

Then; $V = IR$

$3 = 1 \times 10^{-3}(1900 + R_5 + 100)$

$R_5 = 1000\ \Omega$ — (1)

ii) $5 = 1\times10^{-3}(1900+1000+100+R')$

$R' = 3000\,\Omega$ ——— (1)

iii) $3 = \frac{3}{4}\times1\times10^{-3}(1900+1000+100+R'')$

$R'' = 1000\,\Omega$ ——— (1)

iv) $K = \infty$ ——— (1)

$L = 3000\,\Omega$ ——— (1)

$M = 1000\,\Omega$ ——— (1)

$N = 0\,\Omega$ ——— (1)

v) $2.4 = 1\times10^{-3}(1900+R_s+100)$

$R_s = 400\,\Omega$ ——— (1)

30

9 (B)

(a)

(i)

A	B	Output
0	0	0
0	1	1
1	0	1
1	1	0

— (1)
— (1)
— (1)

(ii) $\overline{A}.B + A.\overline{B}$

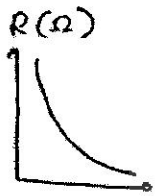
$A \oplus B$ —— (1)

(iii) XOR —— (1)

—— (1)

(b)

(i)



Must be a curve —— (1)

(ii) Open loop state. —— (1)

(iii) 6 V —— (1)

(iv) When intense light falls on.

$\frac{12V}{11} \times 1 = 1.09\ V$ —— (1)

└ (1)

When in low light,

$\frac{12}{2} \times 1 = 6V$ —— (1)

In dark,

$\frac{\cancel{12}^{3} \times 1}{\cancel{4}} = 3V$ —— (1)

(v) $V_{out} = A(V_1 - V_2)$ —— (1)

(vi) $-12V$ - Intense light — (1)

0 - low light — (1)

$+12V$ - In Dark — (1)

(c)

(i) To Control I_B Current. — (1)

(ii) When the potential of Z takes a positive value (+). the transistor turns into the active state. Consequently, the collector current (I_C) is generated, and a current flows through R_E. Then, R_E becomes an electromagnet, and the metallic rod is attracted towards R_E.
As a result, the circuit Connected to Y becomes closed, and the Y bulb light up.
Conversely, when the potential of Z becomes negative (-) no current flows through R_E and therefore, thy Y bulb does not light up.

(iii) ~~Does not~~ light up in the dark.

Does not light up in the light — 1

(iv)

$12 = I_B R_B + V_{BE} + \beta I_B R_E$ — 1 — 1

$12 = I_B 100 + 0.7 + 100 \times I_B \times 5$

$11.3 = 600\ I_B$ — 1

$I_B = \frac{11.3}{600}$

$= 0.018\ mA / 0.019\ mA$ — 1

$I_E = \beta \times I_B$

$= 0.019 \times 100$

$= 1.9\ mA$ — 1

10 (A).

(a) (i) $\Delta Q = mc\Delta\theta$ — 1

(ii) Heat energy released $= 200 \times 3600$ — 1

$= 720\,000\,J$ or

$7.2 \times 10^5\,J$ or

$720\,kJ$ — 1

(iii) $\Delta Q = mC\Delta\theta$

$720\,000 = 100 \times 3600 \times \Delta\theta$ — 1

$\Delta\theta = \dfrac{720\,000}{100 \times 3600}$

$= 2\,°C$ — 1

(iv) $\Delta Q = mL$ — 1

$720\,000 = m \times 2.4 \times 10^6$ — 1

$m = \dfrac{720\,000}{2.4 \times 10^6}$

$= 0.3\,kg$ or $300\,g$ — 1

(b) (i) $\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$ — 1

$\dfrac{4.5 \times 10^{-4}}{300} = \dfrac{4.65 \times 10^{-4}}{T_2}$ — 1

$T_2 = 310\,K$ or $37\,°C$ — 1

(ii)

Exhale volume of air $= 4.65 \times 10^{-4} \times 100$ — 1

Exhale volume rate of air $= 4.65 \times 10^{-4} \times 100 \times \dfrac{20}{60}$ — 1

Mass rate of exhale air $= 4.65 \times 10^{-4} \times 100 \times \dfrac{20}{60} \times 1.15$ — 1

Mass of exhale air $= 4.65 \times 10^{-4} \times 100 \times \dfrac{20}{60} \times 1.15 \times 3600$

$= 64.17\,kg$ — 1

(b)

(iii) $\Delta Q = mc\Delta\theta$

$= 64.17 \times 1150 \times (37 - 27)$ — 1

$= 737\,955\,J$ or

$737.955\,kJ$ — 1

(iv) Heat energy release by metabolism $= 10 \times 100 \times 3600$ — 1

$= 36 \times 10^5\,J$ or

~~3606~~ kJ — 1

3600 kJ

(v) Total heat energy inside the room $= 737.955 + 3600$ — 1

$= 4337.955\,kJ$

(vi) Mass of air inside the hall $= 1.2 \times 300$

$= 360\,kg$ — 1

(vii) $\Delta Q = mc\Delta\theta$

$\Delta\theta = \dfrac{4337.95 \times 10^3}{(360 + 64.17) \times 1000}$ — 1 — 1

$= 10.2\,°C$ — 1

(c)

(i) Relative humidity $= \dfrac{\text{Absolute humidity of air inside hall}}{\text{Absolute humidity Saturated water vapour}} \times 100$

$\dfrac{75}{100} = \dfrac{AH}{30}$ — 1

$\therefore$ Water Vapour Mass $= \dfrac{75}{100} \times 30 \times 300$

$= 6750\,g$ or

$6.75\,kg$ — 1

(ii) Total water vapour mass

$= 6750 + 300 \times 100$ — (1)

$= 36750$ g or 36.75 kg

(iii) Remaining absolute humidity inside hall.

$= \frac{36750 - 32250}{300}$ — (1)

$= 15$ gm^{-3}

$\therefore$ Relative humidity $= \frac{15}{20} \times 100$ — (1)

$= 75\%$ — (1)

30

10 (B)

a.

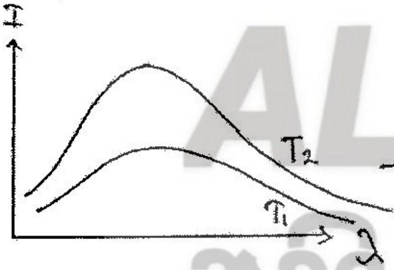
i) A black body is an object that can emit as well as absorb radiations of all wavelengths. — (1)

ii) $E = \sigma T^4 - \sigma T_0^4$

or

$\sigma (T^4 - T_0^4)$ — (1)

iii)



— (2)

(iv). As the temperature increases, the intensity of radiation emission increases.

• As the temperature increases, the wavelength corresponding to the maximum intensity decreases

• The product of the wavelength corresponding to the maximum intensity and its absolute temperature is a constant

• The area under the curve gives the total intensity of emission. — (3)

(Consider if there more points)

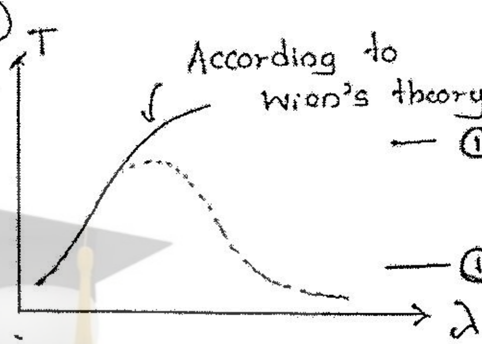
v) $\lambda_1 T_1 = \lambda_2 T_2$

$500 \times 2000 = \lambda_2 \times 2500$ — (1)

$\lambda_2 = 400$ nm — (1)

vi)

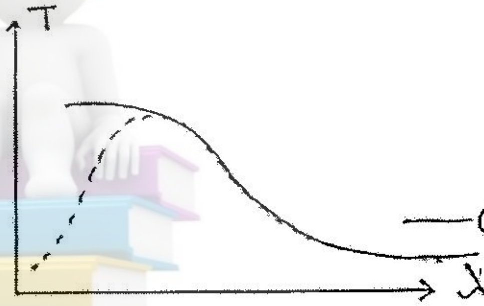
a)



— (1)

— (1)

b)



— (1)

b) (i)

A. Blackened surfaces exhibit a higher absorption of radiant heat — (2)

ii) a. Can't. — (1)

Since the distance from the coil to the plate is constant. — (1)

b. Can. — (1)

Since the power can be varied by changing the supply potential and the current — (1)

c) Can. By maintaining the temperature at various values before activating the coil. — (1)

d) Can't — (1)

The area of the plate is constant. — (1)

c) (i) The radiant energy incident per unit per unit area of the surface. / The radiation power incident per unit area. — (1)

(ii) $I = \frac{P}{4\pi r^2}$

$$1400 = \frac{P \times \frac{79.2}{100}}{4 \times \frac{22}{7} \times (150 \times 10^6 \times 10^3)^2}$$ — (1) — (1)

$\frac{79.2}{100} P = 1400 \times \frac{22}{7} \times 4 \times 225 \times 10^{22}$

$\frac{79.2}{100} P = 39600 \times 10^{22}$

$P = \frac{396}{79.2} \times 10^{26}$

$P = 5 \times 10^{26}\ W$ — (1)

(iii) $E = eA\sigma T^4$

$5 \times 10^{26} = 4 \times \frac{22}{7} \times (7 \times 10^5 \times 10^3)^2 \times 5 \times 10^{-11}\ T^4$ — (2)

$5 \times 10^{26} = \frac{88}{7} \times 49 \times 10^{16} \times 5 \times 10^{-11}\ T^4$

$\frac{10^{26}}{88 \times 7} = 10^{5}\ T^4$

$T^4 = \frac{10^{21}}{88 \times 7}$ — (1)

$T = \frac{(10^{21})^{1/4}}{(88 \times 7)^{1/4}} = \frac{10^5 \sqrt{10}}{3 \times 7^{1/4}}$

ඔබ දක්ෂයෙක් නම්
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නිගමනය කළ යුත්තේ ඔබමය.

You will not feel hurt
If you are truly talented and wise,
When you witness the gifts and skills of others.
If you are genuinely creative,
You will not be jealous
When you see creativity shine in others.
Marking Scheme - PHYSICS
Grade 12 - Third Term Test
October 2025
And above all,
If you are a good and kind-hearted person,
You will not feel pain
When others show their goodness and compassion.
Remember —
You will always be judged by many,
But in the end,
You should decide whom you shouldn't be.