SUNSHINE SECONDARY SCHOOL

PRE – MOCKS 2015

Physics 232/1

M/S

Paper 1

Time: 2 hours

NAME.....INDEX NO.....

CLASS..... **DATE.....**

Instructions to candidates

- Write your name and class in the space provided.
- This paper consists of two sections; **SECTION A** and **B**
- Answer **all** the questions in the spaces provided
- **ALL** working **MUST** be clearly shown.
- Mathematical tables and electronic calculators may be used
- Take: Acceleration due to gravity: $\mathbf{g = 10m/s^2}$

FOR EXAMINER'S USE ONLY

Section	**maximum score**	**Candidates score**
A	25	
B	**55**	
Total score	**80**	

1.The figures below shows the level of water before and after a stone was immersed into the measuring cylinder If the mass of the stone is 200g, determine its density. (3mks)

- Vol. of stone = $25-10 = 15\,cm^3$
- $D = \frac{m}{V} = \frac{200g}{15cm^3} =$

$= 13.33\,g/cm^3$

2. The figure below shows the shapes formed when drops of water and mercury are placed on the surface of a clean glass plate

Explain the difference in the shapes. (1mk)

- For mercury, cohesion is stronger than adhesion and the drops are spherical
- For water adhesion is stronger than cohesion and water spreads on glass surface.

3. Explain why air is not used as a brake fluid. (1mk)

Air will be compressed.

4.) Use kinetic theory to explain pressure law. (1mk)

Increase in temperature increases kinetic energy of gas molecules. This increases the rate of collision between the molecules and the walls of the container per unit area.

5.) In an oil drop experiment, it was found that one oil drop spread on water to form a patch of diameter 0.8cm and thickness 2.0×10^{-6}mm. Calculate the radius of the drop. (2mks)

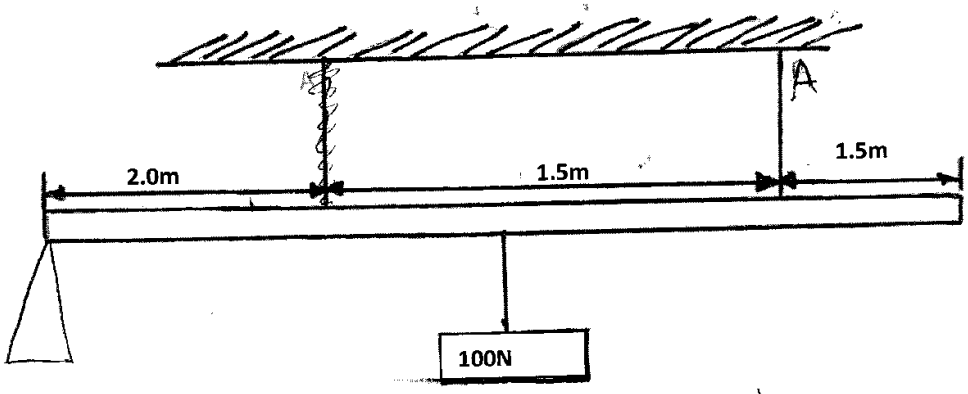
$V = \pi r^2 h = \frac{4}{3}\pi r^3$ ✓ ½

$\frac{22}{7} \times 4^2 \times 2\times10^{-6} = \frac{4}{3} \times \frac{22}{7} \times r^3$ $\quad r = \sqrt[3]{24\times10^{-6}}$

$r^3 = \frac{3\times4^2\times2\times10^{-6}}{4}$ ✓ ½ $\quad r = 0.0288\,mm$ ✓ 1

$r^3 = 24\times10^{-6}$

6.)A uniform wooden plank weighing 50N and 5m long is suspended by ~~two~~ one ropes A ~~and B, 1.5m apart. A is 2m from one end and B is 1.5m from the other end as shown in figure below.~~ A concrete block of weight 100N is suspended from the centre of the plank



Calculate the tension T_A in string A (2mks)

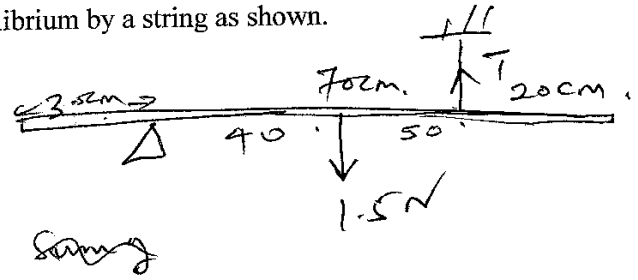
Clockwise moments = anticlockwise moments ✓ ½

$100 \times 2.5 + (50 \times 2.5) = T_A \times 3.5$

$\frac{375}{3.5} = \frac{3.5\,T_A}{3.5}$ ✓ ½

$T_A = 107.14\,N$ ✓ 1

7. The figure below shows a uniform bar of length 1.4m pivoted near one end. The bar is kept in equilibrium by a string as shown.



Given that the weight of the bar is 1.5N, determine the tension in the string. (3mks)

Sum of clockwise moments = Sum of anticlockwise moments

$1.5 \times 40 = T \times 90$ ✓ 1

$T = 0.6667$ ✓ 1

8. The table below shows results of an experiment carried out to study properties of a spring.

Force (N) added	0	5	10	15	20
Length of spring (cm)	10	11	12	13	14

State with a reason whether the experiment was done within elastic limit of a spring. (1mk)

It was done within elastic limit because it obey Hooke's law ✓ 1

9. A beaker is filled completely with water. A spoon full of common salt is added slowly. The salt dissolves and the water does not overflow. State the reason why water does not overflow. (1mk)

The salt particles fitted into the spaces between water molecules ✓

10. In a vacuum flask, the walls enclosing the vacuum are silvered on the inside. State the reason for this. (1mk)

To reduce heat loss through radiation.

11. A bullet is fired horizontally from a platform 15m high. If the initial speed is 300m/s, determine the maximum horizontal distance covered by the bullet. (3mks)

$S = ut + \frac{1}{2}gt^2$ ✓

$15 = S$

$u = 0$

$15 = 0t = \frac{1}{2}10t^2$

$t^2 = \frac{2 \times 15}{10}$

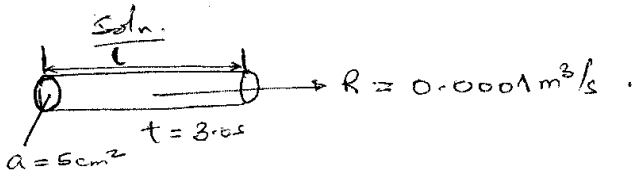
$t = \sqrt{3}$

$= 1.73\,s$

12. A high jumper usually lands on a thick soft mattress. Explain why. (1mk)

The mattress increases the stopping time which reduces the impulse (rate of change of momentum.)

13. If the rate of flow of water in the tube is 0.0001 m^3/s. Determine the length of tube it will take its flow in 3 seconds through a cross-section area of 5cm^2. (3mks)



$a = 0.0005\,m^2$.

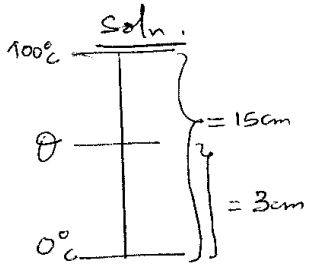
$R = av$ ✓

$0.0001\,m^3/s = 0.0005\,m^2 v$ ✓ 3

$v = \frac{0.0001\,m^3/s}{0.0005\,m^2} = 0.2\,m/s$. ✓

$l = vt = 0.2m/s \times 3.0s = 0.6m$.

14. The ice and steam points of a certain graduated thermometer are found to be 15cm apart.
What is recorded in ^{0}c when the length of the mercury thread is 3cm above the ice point?



$\theta = \frac{l_\theta - l_0}{l_{100} - l_0} \times 100$ ✓ 1

$= \frac{3}{15} \times 100 = 20^\circ c$ ✓ 1 (2mks)

15.a) Define heat capacity and state its SI units. (2mks)

Quantity of heat energy required to raise the temperature of any mass of a substance by 1K.

b) i) 200g of ice at -10°c was slowly heated by an immersion heater rated 200w. The graph below shows how temperature varied with time. Pg.78

ii) Given that the specific heat capacity for ice is 2100J/kgk, specific latent heat of fusion for ice 340000J/kg and the specific heat capacity for water is 4200J/kgk. Calculate the corresponding times for pints B and C. (4mks)

$Pt = mc\Delta\theta$

$200t = 0.2 \times 340 \, 2100 \times 10$

$200t = 4200$

$t = \frac{4200}{200} = 21$ sec.

$Pt = mL_f$

$200t = 0.2 \times 340000$

$200t = 68000$

$t = \frac{68000}{200} = 340$ sec.

B - 21. Sec

C - 340 Sec.

iii) What factors affect the melting point of a solid. (2mks)

- Impurities
- Pressure

at 20°C. It

c) i) A sauce pan of mass 0.7kg containing 0.5kg of water ~~is 20oc it~~ takes 5 minutes before the water starts to boil. Find the rate at which heat is supplied to the water by the burner. Take specific heat capacity of the sauce pan as $600Jkg^{-1}k^{-1}$. $C_W = 4200J/kgK$ (3mks)

$Pt = M_1C\Delta\theta + M_2C\Delta\theta$

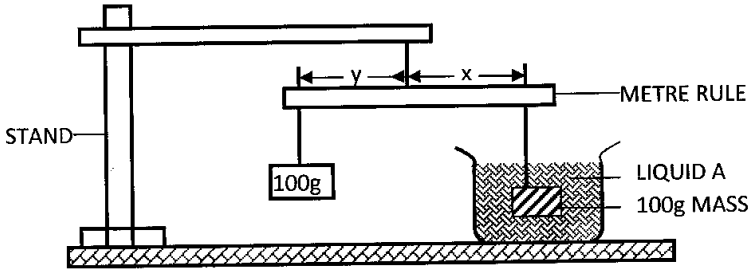
$P \times 5 \times 60 = (0.5 \times 4200 \times 80) + 0.7 \times 600 \times 80$

$P \times 300 = 168000 + 33600$

$300P = 201600$

$P = \frac{201600}{300} = 672\,W$

16. (a) In an experiment to determine the relative density of liquid A, the following set up was used.



$U_L = \frac{14}{17} = 0.8235$ $L_L = \frac{13}{18} = 0.7222$

(i) Determine the gradient, S, of the graph. $x \pm 0.5$ $y \pm 0.5$ (2 Marks)

$G = \frac{\Delta y}{\Delta x} = \frac{13.5 - 0}{17.5 - 0} = 0.7714$ Range:

$0.7222 \rightarrow 0.8235$

(ii) If $S = \frac{F}{W}$, where F is the apparent weight of mass in liquid A and W is the actual weight of the mass.

Calculate the value of F and the upthrust u. (3mks)

$W = \frac{100}{1000} \times 10 = 1N$

$0.7714 = \frac{F}{1}$ Range:

$F = 0.7714N$ $0.7222N \rightarrow 0.8235N$

(iii) Determine the relative density of the liquid a, Given that the weight of the 100g mass in water was 0.9N. (3mks)

$R.D = \frac{\text{upthrust in liquid}}{\text{upthrust in water}}$

$U_L = \frac{1 - 0.7222}{1 - 0.9} = 2.778$ $L_L = \frac{1 - 0.8235}{1 - 0.9} = 1.765$

$= \frac{1 - 0.7714}{1 - 0.9} = 2.286$ Range: $1.765 \rightarrow 2.778$

b) A balloon's fabric weighs 10N and has a gas capacity of $2M^3$. If the gas in the balloon weighs 2N and air has density 1.29kg/m3, Find the resultant force on the balloon when it is floating in air. (3marks)

Total weight $= 10 + 2 = 12N$

$U = \rho V g$

$= 1.29 \times 2 \times 10$

$= 25.8N$

Resultant $=$ upthrust $-$ weight

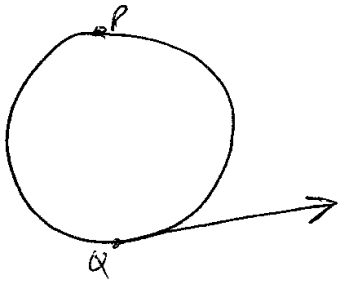
$= 25.8 - 12$

$= 13.8N$

17. a) A body having uniform motion in a circular path always accelerates. Explain. (1mk)

The instantaneous velocity changes with time hence accelerating the body ✓

b)the figure below shows the path of an object of mass 200g tied to a string 0.2m and being whirled in a vertical circle at a linear speed of 10m/s.



If the string gets cut when the object reaches point Q,

i) indicate with an arrow on the diagram, the path direction it is likely to move. (1mk)

ii) Determine the force that cuts the string at point Q (3mks)

$T = \frac{mv^2}{r} + mg$ ✓

$= \frac{0.2 \times 10^2}{0.2} + 0.2 \times 10 = 102N$ ✓

iii) Calculate the minimum tension (3mks)

$T = \frac{mv^2}{r} - mg$ ✓

$= \frac{0.2 \times 10^2}{0.2} - 0.2 \times 10$ ✓

$= 100 - 2 = 98N$ ✓

c) A body is whirled in a horizontal circle at a frequency of 5Hz. Determine its angular velocity. (3mks)

$\omega = 2\pi f = 2 \times 3.142 \times 5$
$= 15.71 \text{ rads}^{-1}$ (1mk)

SECTION B

18.a) State the law of conservation of energy.

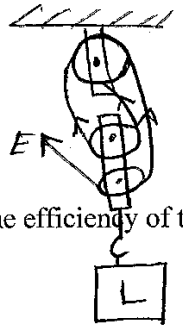
The sum of kinetic energy and potential energy of a system is constant.

b)What energy transformation takes place when a car battery is used to light a bulb? (2mks)

Chemical Energy ⟶ Light Energy

c) A pulley system has two pulleys on the lower block and one pulley on the upper block. In order to raise the load of 6N, an effort of 2N is applied.

i)Draw a sketch to show the pulley system. (2mks)



ii)Calculate the efficiency of the pulley system. (3mks)

V.R = 4

$M.A = \frac{L}{E} = \frac{6N}{2N} = 3$

$\eta = \frac{M.A}{V.R} \times 100\%$

$= \frac{3}{4} \times 100\%$

$= 75\%$

iii)If the lower block weighs 0.4N. What friction force oppose the motion. (3mks)

$\frac{25}{100} \times 2N = 0.5$

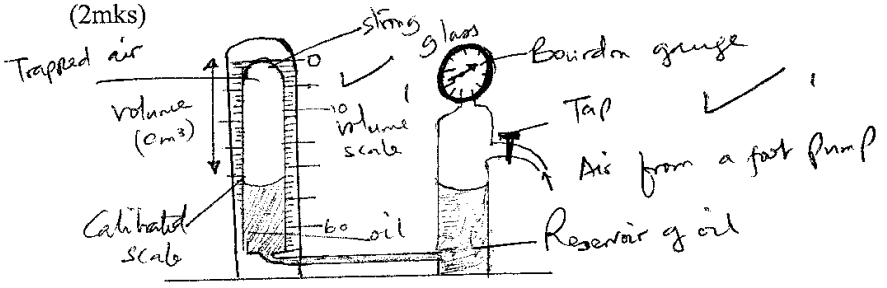
$0.5N - 0.4N$

$= 0.1N$

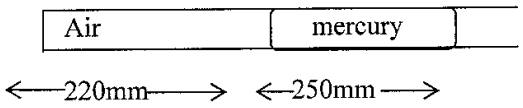
19 (a) State Boyle's law (1mk)

Volume of a fixed mass of a gas is inversely proportional to the pressure applied, provided temperature is held constant. ✓1

(b) Sketch a well labeled set up of apparatus that can be used to verify the Boyle's law (2mks)

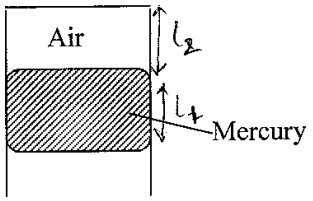


(c)Dry air is trapped inside a long glass tube by a thread of mercury 250mm long. The air column is 220mm when held horizontally.



Given that the atmospheric pressure is 750mmHg, determine the length of the air column when the tube is held as shown in the diagrams below:
(5mks)

(i)



Pressure due to mercury. ✓

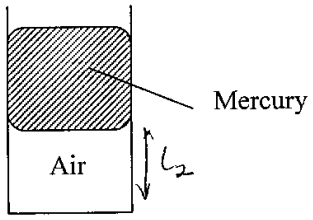
$P_2 = 750 - 250 = 500\text{mmHg}$.

$P_1L_1 = P_2L_2$ (Boyle's law)

$\frac{750 \times 250}{500} = L_2$ ✓1 ✓5

$L_2 = 375\text{ mm}$.

(ii)



$P_2 = 750 + 250 = 1000\text{mmHg}$.

$L_2 = \frac{P_1L_1}{P_2} = \frac{750 \times 250}{1000}$ ✓1

$= 187.5\text{ mm}$

NAME: ..... M/S .....INDEX NO: .....

CANDIDATES SIGNATURE:.....

DATE:.....

232 / 2
PHYSICS
PAPER 2
PRE MOCK 1 – MARCH / APIRL 2015
2 HOURS

SUNSHINE SECONDARY SCHOOL
Pre Mock 1 - 2015

INSTRUCTIONS:

- Answer all questions in the space provided.
- This paper consists of two sections A and B.
- All working must be shown clearly.
- Electronic calculators may be used.

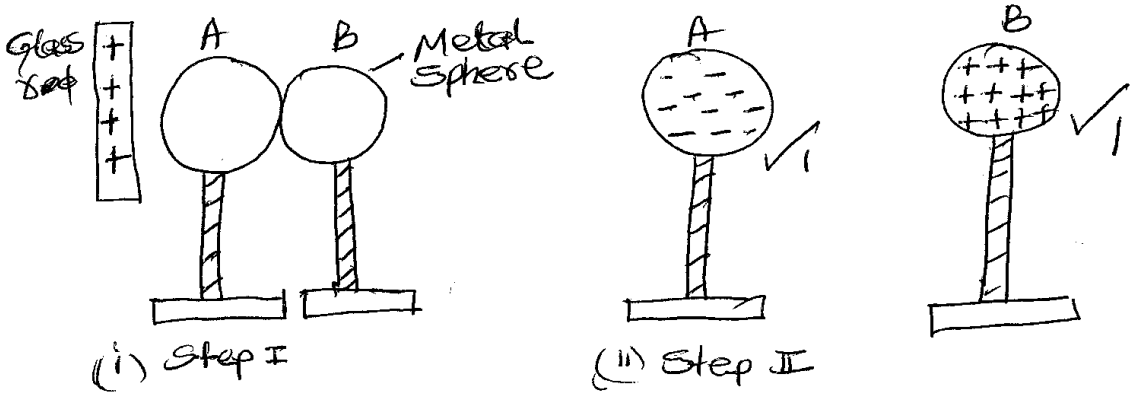
EXAMINERS USE ONLY

SECTION	QN	MARKS	CANDIDATES SCORE
A	1 – 13	25	
B	14	13	
	15	12	
	16	7	
	17	15	
	18	8	

1.State the laws of reflection. (2mks)

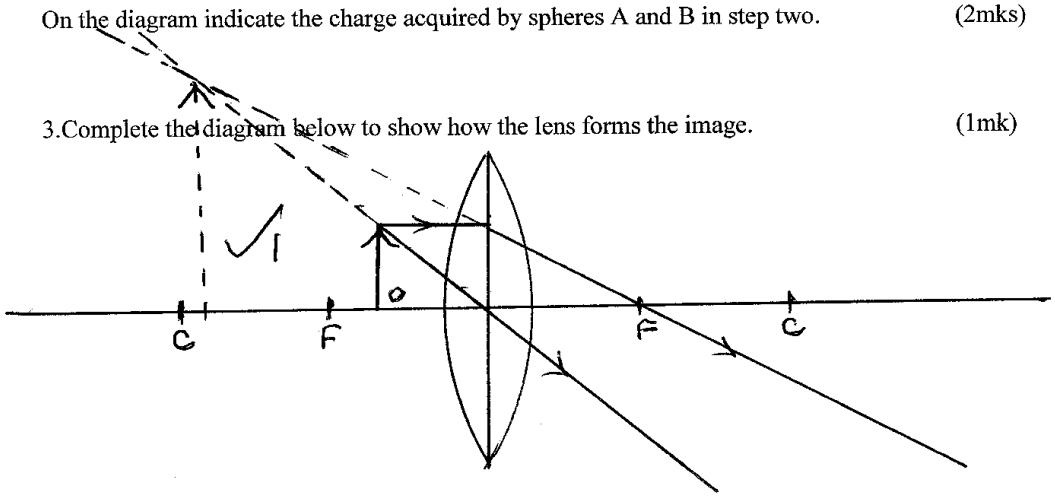
- At the point of incidence, the incidence ray, the Normal and reflected ray all lie on the same plane ✓1
- The angle of incidence is always equal to the angle of reflection. ✓1

2.The diagram below shows how to charge two spheres simultaneously.



On the diagram indicate the charge acquired by spheres A and B in step two. (2mks)

3.Complete the diagram below to show how the lens forms the image. (1mk)



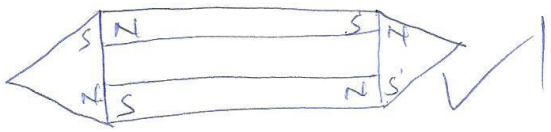
4.)Name one detector of infra-red radiations (1mk)

Athermameter ✓1

06

5.)Using a diagram explain how soft iron keepers are used to retain magnetism in stored magnets(2mks)

They acquire opposite polarity to that of the magnet at the point of contact which helps dipoles to form complete loops ✓1



6.)A battery is rated 30Ah,determine the amount of current it can supply in 20 minutes (2mks)

$I = \frac{\Phi}{t} = \frac{30}{\frac{20}{60}} = 90A$ ✓½ ✓½ ✓1

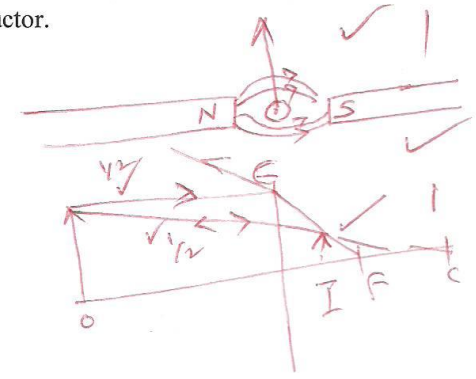
7.Sketckh rays to show the image formed by the object in the following. (2mks)

Space for diagram

8.Name any one common property of electromagnetic waves. (1mk)

- Travel at the speed of light in vacuum, ✓1
any other

9.The figure below shows a conductor carrying current placed within the magnetic field of two magnets. Complete the diagram by showing the field pattern and the direction of force F that acts on the conductor. (2mk)

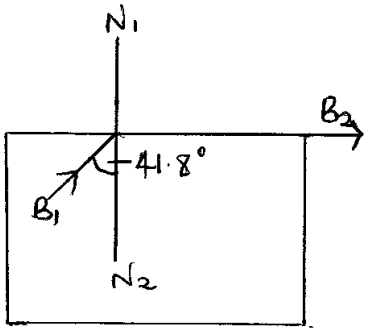


✓1 ✓1

10. What is meant by donor impurity in semiconductor. (1mk)

An atom introduced into the semi-conductor during the process of doping to give an excess electron

11. The figure below shows ray B_1 incident through a glass block to air interface.



B2 is the emergent ray of B1. Determine the refractive index of the glass block.

$$n = \frac{1}{\sin c} = \frac{1}{\sin 41.8} = 1.5$$

(2mks)

12. A pendulum bob takes 0.5 seconds to move from its mean position to a maximum displacement position. Calculate its frequency. (2mks)

A

$0.5 \times 4 = 2s$ = Periodic time, T.

$$f = \frac{1}{T} = \frac{1}{2} = 0.5Hz$$

13.A potential difference of 50kv is applied across an x-ray tube. Given that the charge of an electron e = 1.6×10^{-19} c and the mass of an electron $m_e = 9.1 \times 10^{-31}$ kg, calculate the velocity of the electron. (3mks)

Soln

$eV = \frac{1}{2} m_e v^2$ ✓ 1/2

$1.6 \times 10^{-19} \times 50000 = \frac{1}{2} \times 9.1 \times 10^{-31} \times v^2$

$3.2 \times 10^{-19} \times 50000 = 9.1 \times 10^{-31} \times v^2$ ✓ 1/2

$\frac{1.6 \times 10^{-14}}{9.1 \times} = v^2$ ✓ 1/2

$v = \sqrt{1.758 \times 10^{16}}$ ✓ 1/2

$= 1.326 \times 10^{6} \, m s^{-1}$ ✓ 1

14.An electric heater is rated 3kw and 240v when in operation. Calculate the cost of running the heater for 5 hours if the cost per kwh is ksh.6.70. (2mks)

Soln.

Power Consumed = 3kw x 5hrs = 15kwhr. ✓ 1/2

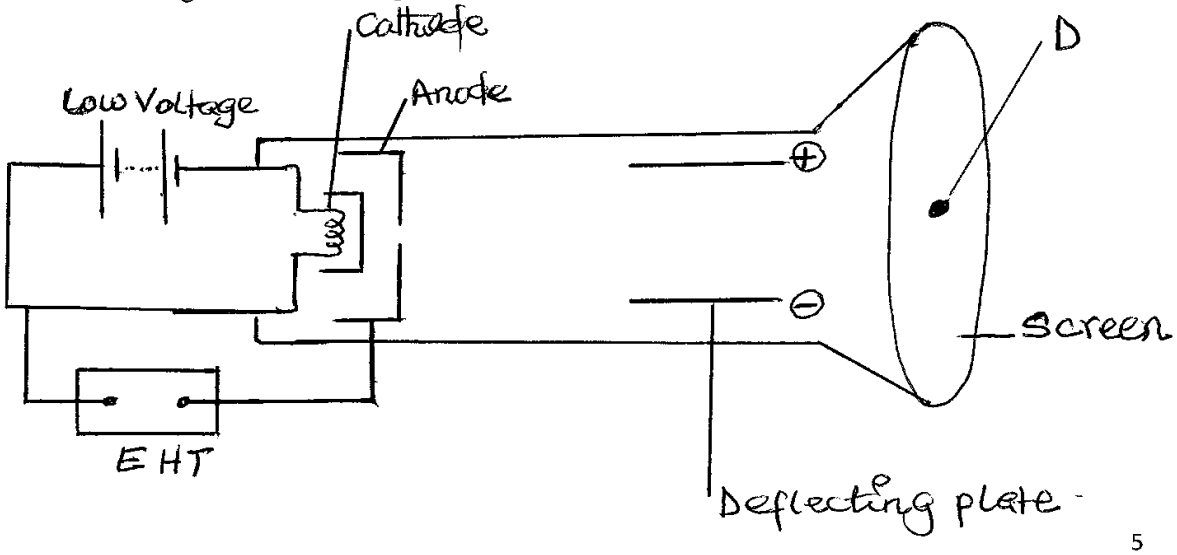
If 1kwhr = Ksh. 6.70.

15kwhr = ? ✓ 1/2

$\frac{15 \times 6.70}{1}$ ✓ 1

= ksh. 100.50

15.The diagram below shows part of a cathode ray tube.



i)Explain how the cathode rays are produced. (2mks)

The filament cathode is electrically heated by the low voltage and emits electrons by thermionic effect. ✓1 ✓1

ii)On the same diagram draw the path of the cathode rays to the spot produced on the screen at D. (2mks)

The bright spot disappears from ~~on~~ the screen. This is because the emitted electrons are repelled.

iii)Explain the observation made on the spot when the connection to the high voltage supply are interchanged so that the anode is made negative. (2mks)

- The bright spot disappears from the screen. ✓1
- This is because the emitted electrons are repelled. ✓1

iv)What behavior of cathode rays shows that they move on a straight line. (2mks)

The spot is formed at the centre on the screen. ✓2

v)Name the components of an electron gun of a cathode ray oscilloscope. (3mks)

Filament, Anode, deflecting system.
✓1 ✓1 ✓1

09

16.a) In a photoelectric effect experiment, a certain surface was illuminated with radiation of different wavelengths and stopping potential determined for each wavelength. The following results were obtained:

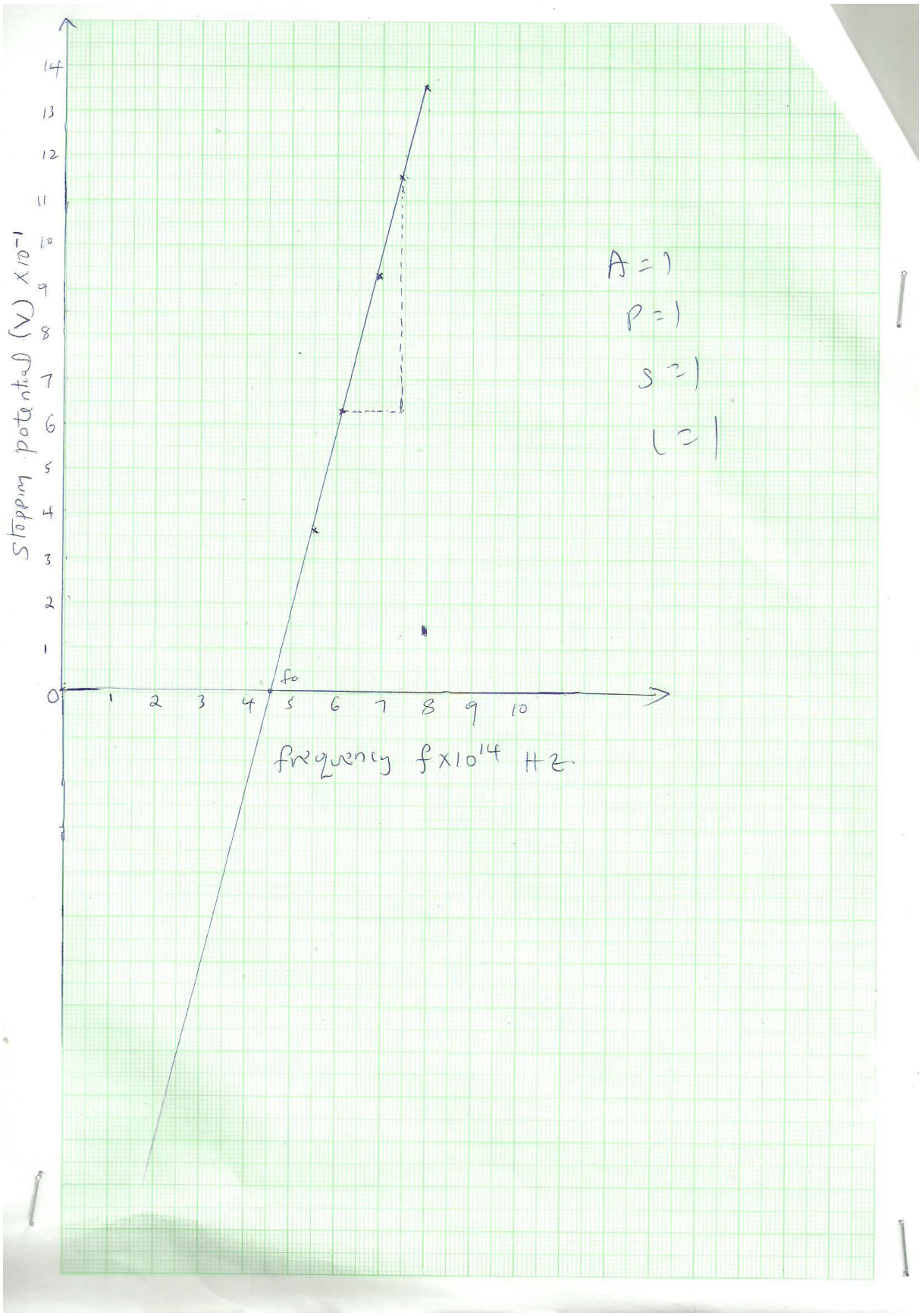
Wavelength ($\times 10^{-7}$ m)	3.77	4.05	4.36	4.92	5.46
Stopping potential, (V_s), (V)	1.35	1.15	0.93	0.62	0.36
Frequency ($\times 10^{14}$Hz)	7.95	7.41	6.88	6.10	5.49

1
All correct

i)complete the table above given that $c = 3.0 \times 10^8$ m/s (1mk)

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

ii)Plot a graph of stopping potential (Y-axis) against frequency (4mks)


Stopping potential (V) x10⁻¹
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
f₀
frequency f x10¹⁴ Hz.
A = 1
P = 1
S = 1
L = 1

iii) Determine plank's constant, h and the work function of the surface given that $eV_s = hf - hf_o$, where $e = 1.6 \times 10^{-19}$ C (3mks)

$G = \frac{\Delta V_s}{\Delta f} = \frac{(11.5 - 6.2) \times 10^{-1}}{(7.41 - 6.10) \times 10^{14}}$

$= \frac{5.3 \times 10^{-1}}{1.31 \times 10^{14}}$

$= 4.0458 \times 10^{-15}$

Gradient $= \frac{h}{e}$

$4.0458 \times 10^{-15} = \frac{h}{1.6 \times 10^{-19}}$

$h = 6.473 \times 10^{-34}$ JS

$W_o = hf_o \quad f_o = 4.6 \times 10^{14}$ Hz

$W_o = 6.473 \times 10^{-34} \times 4.6 \times 10^{14}$

$W_s = 2.97758 \times 10^{-19}$ J

b) A surface whose work function $Q = 6.4 \times 10^{-19}$ J is illuminated with light of frequency 3.0 $\times 10^{15}$ H_z. Find the maximum velocity of the emitted photo electrons (use value of h obtained in **a(ii)** above) (3mks)

$hf = 3.0 \times 10^{15} \times 6.473 \times 10^{-34}$

$= 1.9419 \times 10^{-18}$ J

$= 19.419 \times 10^{-19}$ J

$K.E = hf - \Phi$

$= 19.419 \times 10^{-19} - 6.4 \times 10^{-19}$

$= 13.019 \times 10^{-19}$ J

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

$\frac{1}{2} \times 9.11 \times 10^{-31} \times V^2 = 13.019 \times 10^{-19}$

$V^2 = 2.858 \times 10^{12}$

$V = 1.6906 \times 10^6$ m/s

17. a) State the difference between longitudinal and transverse waves. (1mk)

Longitudinal waves — vibration of particles parallel to direction of wave travel

Transverse wave — vibration of particles perpendicular to direction of wave travel.

b)The figure below shows a transverse wave travelling along X-axis. The frequency of the vibrations producing the waves is 20Hz.

i)Determine the amplitude in SI unit. (1mk)

1m ✓1

ii) If it takes 0.1375 seconds for the wave to move from O to A, determine the speed of the wave. (2mks)

f = 20Hz

2.75 waves — 11 cm.

1 wave $\lambda = \frac{11}{2.75} = 4cm$

$V = \lambda f$ ✓1

$= 0.04 \times 20$

$= 0.8 m/s$ ✓1

ii)Calculate the periodic time of the wave. (2mks)

$T = \frac{1}{f}$ ✓1 $= \frac{1}{20} = 0.05s$ ✓1

c i)State two factors affecting the speed of sound in air. (2mks)

— Temperature ✓1

— Wind ✓1

— Humidity

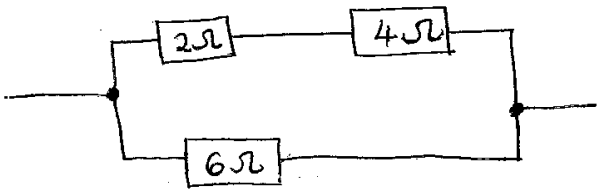
ii)A man makes a loud sound and hears the echo of the sound after 1.25 seconds. If the speed of sound in air is 330ms-1, calculate the distance between the man and the wall causing the echo. (3mks)

$v = \frac{2d}{t}$ ✓1 $= \frac{2 \times d}{1.25} = 330$ ✓1

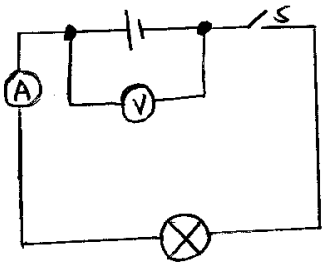
$d = \frac{330 \times 1.25}{2} = 206.25m$ ✓1

18. Three resistors of resistance 2Ω, 4Ω and 6Ω are connected together in a circuit. Draw a circuit diagram to show the arrangement of the resistor which gives

a) Effective resistance of 3Ω (2mks)



b) In the figure below, the voltmeter reads 2.1v when the switch is open. When the switch is closed, the voltmeter reads 1.8v and the ammeter reads 0.1A.



Determine :-

i) The e.m.f of the cell (1mk)

2.1V (switch open)

ii) The internal resistance of the cell. (3mks)

$E = V + Ir$ ✓

$2.1 = 1.8 + 0.1r$ ✓

$0.3 = 0.1r$ ✓

$r = 3\Omega$ ✓

iii) The resistance of the lamp. (2mks)

$R = \frac{V}{I} = \frac{1.8V}{0.1A} = 18\Omega$

c. Calculate the length of a wire required to make a resistor of 0.5Ω , if the resistivity of the material is 4.9×10^{-7} Ω m and the cross sectional area is 2.0×10^{-6} m2. (3mks)

$\rho = \frac{AR}{L}$ ✓

$L = \frac{AR}{\rho}$ ✓

$\frac{0.5 \times 2.0 \times 10^{-6}}{4.9 \times 10^{-7}} = 2m$ ✓ ✓ ✓

19.ai)Define half-life of a radioactive substance. (1mk)

✓ Is the time taken for half of the radioactive substance to decay. ✓

ii)The following radioactive equation, find the value of N and Z.

$^{238}_{90}U \longrightarrow {}^{N}_{Z}Th + \alpha$

N: 234 ✓½

Z: 88 ✓½

b) The half-life of radioactive substance is 4 years. How long will the sample take for the activity to decrease to 1/32 of its original value. (3mks)

Soln.

$t_{1/2} = 4yrs$ ✓

$1g \xrightarrow{t_{1/2}} \frac{1}{2}g \xrightarrow{t_{1/2}} \frac{1}{4}g \xrightarrow{t_{1/2}} \frac{1}{8}g \xrightarrow{t_{1/2}} \frac{1}{16}g \xrightarrow{t_{1/2}} \frac{1}{32}g$

$5t_{1/2} = T$ ✓

$T = 5 \times 4 = 20yrs$ ✓ 3

OR $\frac{1}{32} = \left(\frac{1}{2}\right)^{T/t_{1/2}}$ ✓ OR use of logs.

$2^{-5} = 2^{-T/4}$ ✓

$-5 = -T/4$

$T = 20yrs$ ✓ 3

c)The diagram below shows the cross section of a diffusion cloud chamber used to detect radiation from radioactive source.

i)State one function of each of the following Alcohol. (1mk)

- Vaporizes and forms droplets on the air ions produced by the radiation ✓ 1

i) Solid carbon dioxide (1mk)

✓ Acts as a drying agent. ✓1

ii) When ~~radio actions~~ radiations from the source enter the chamber some white traces are observed. Explain how these traces are formed and state how the radio action is identified. (4mks)

✓ Alcohol droplets formed on the air ions produced by the radiation are seen as tracks along the path of the radiation. α – Short, straight and thick. γ – Scanty disjointed tracks. β – thin and irregular in direction

ii) A leaf electroscope can also be used as a detector of radio ~~a~~tions. State two advantages of the diffusion cloud chamber over the leaf electroscope as a detector. (2mks)

✓ The leaf electroscope ~~can~~ not ~~detect~~ identify the type of radiation. ✓1

✓

M/S

SUNSHINE SECONDARY SCHOOL

NAME ---------- ADM NO ----------

SIGNATURE ----------

DATE ----------

233/3

PHYSICS PRACTICAL

PAPER 3

MARCH 2015

TIME 2 ½ HOURS

INSTRUCTIONS TO STUDENTS

a) Write your name and Adm No in the spaces provided above.
b) Answer ALL the questions in the spaces provided in the question paper
c) You are supposed to spend the first 15 minutes of the 2 ½ hours allowed for this paper reading the whole paper carefully before commencing your work.
d) Marks are given for a clear record of the observations actually made their suitability according and the use made of them
e) Candidates are advised to record their observations as soon as they are made
f) Use of electronic calculators only

Question 1

Maximum score	20
Candidate score	

Question 2

Maximum score	20
Candidate score	

GRAND TOTAL	X/40

1. You are provided with the following
   - A glass prism
   - A soft board
   - 4 optical pins
   - A white sheet of paper
   - 2 thump pins

a) Draw the outline of the glass prism on the plane paper mounted on the soft board. Label the vertices of the triangle as shown in the figure below. Note that AB and AC are sides of the prism that are equal in length. Mark a point O on the outline drawn. Draw a normal to the face AB via point O as shown in the diagram.

b) Measure an angle of incidence of 30° at the point of incidence O. From the normal. Stick two pins P_1 and P_2 to mark the incident ray.

Place the glass prism on the outline and view side AC to see the images of pins P_1 and P_2. Stick pins P_3 below side AC as shown in the figure such that it is in a straight line with the images of P_1 and P_2. Stick the fourth pin P_4 so that it has in the same straight line with P_3 and the images of P_1 and P_2.

ii) Remove the prism and pins. Join points P_3 and P_4 in a straight line to meet AC at E. Join points E to 0. Measure the angle of refraction r.

r = ---------- 75° ✓1 ± 2 ---------- (1mk)

c i) Repeat the experiment for different angles of incidence and complete the table.

Angle of incidence (i°)	35	40	45	50	55	60
Angle of refraction (r°)	72	60	53	46	40	40 ✓3
Sin i	0.574	0.643	0.707	0.766	0.819	0.866 ✓2
Sin r	0.951	0.866	0.799	0.719	0.643	0.643 ✓2

±2

ii) Plot a graph of sin r against sin i. (5mks)

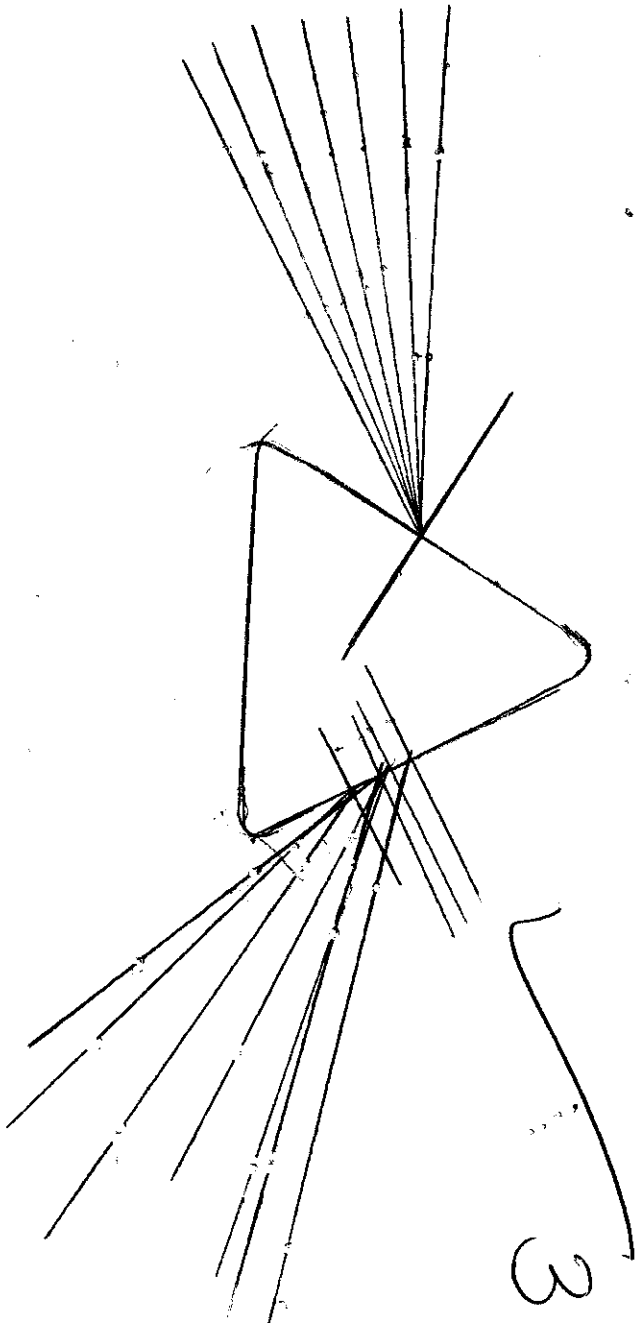
iii) Calculate the slope of graph. (4mks)

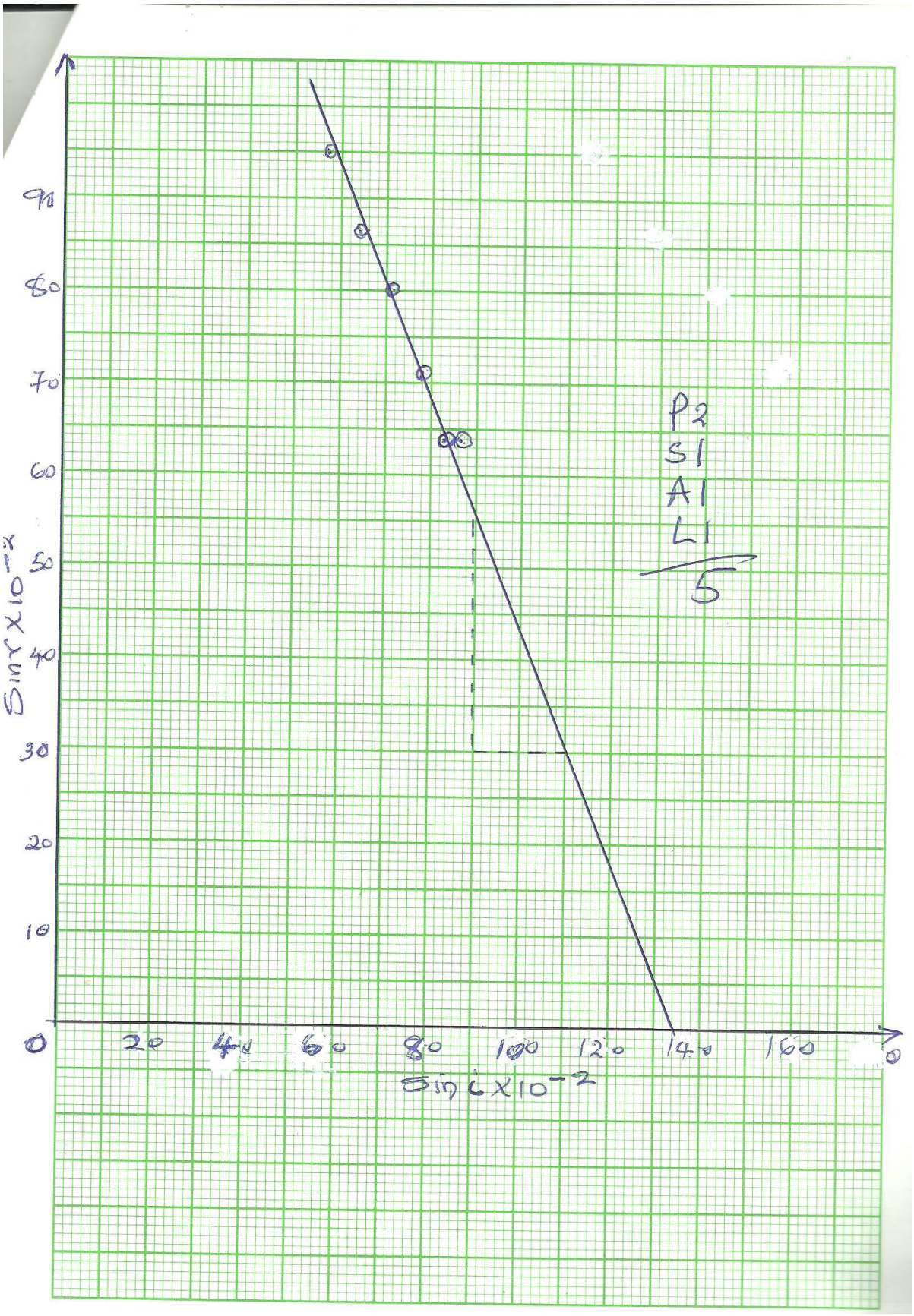
$$\text{Slope} = \frac{\Delta \sin r}{\Delta \sin i} \checkmark 1$$

$$= \frac{0.30 - 0.55}{1.10 - 0.90} \checkmark 1 = \frac{-0.25}{0.2} \checkmark 2$$

$$= -1.25$$

2


3


P2
S1
A1
L1
5
Sinr X 10⁻²
Sinθ X 10⁻²
0
20
40
60
80
100
120
140
160
10
20
30
40
50
60
70
80
90

2. You are provided with
- A voltmeter
- An ammeter
- Connecting wires
- 2 dry cells
- A switch
- A cell holder
- A jockey
- A resistance wire mounted on a scale
- Micrometer screw
- Gauge

a) Set up the apparatus as in the diagram below

i) Move the jockey to point Y and close the switch. Record the ammeter and voltmeter readings.

V ---------- 2.2V ✓ ½ ±0.3 ---------- (½ mk)

I ---------- 0.18A ✓ ½ ±0.05 ---------- (½ mk)

ii) Calculate the resistance of the wire

R = V/I ---------- 12.22Ω ✓ ½ ---------- (½ mk)

iii) Hence determine the resistance per unit length I of the wire from

K = R/100 ---------- $\frac{12.22}{100}$ = 0.1222Ω/cm ✓ ½ ---------- (1/2 mk)

iv) Use the micrometer screw gauge provided to measure the diameter D of the resistance wire.

D ---------- 0.38mm ✓ 1 ---------- (1 mk) ±0.05

b) i) Using the same circuit in (a) above vary the length of the resistance wire L by adjusting the position of the jockey to correspond with the length shown in the table and complete the table-given that the e.m.f E. of the cell is 3v.

c)

Length (cm)	70	60	50	40	30	20
Current (A)	0.20	0.22	0.24	0.28	0.32	0.36 ✓3
P.D (v)	1.8	1.6	1.5	1.4	1.3	1.1 ✓3
E - V	1.2	1.4	1.5	1.6	1.7	1.9 ✓2

ii) Plot a graph of (E - V) y –axis against current. (5mks)

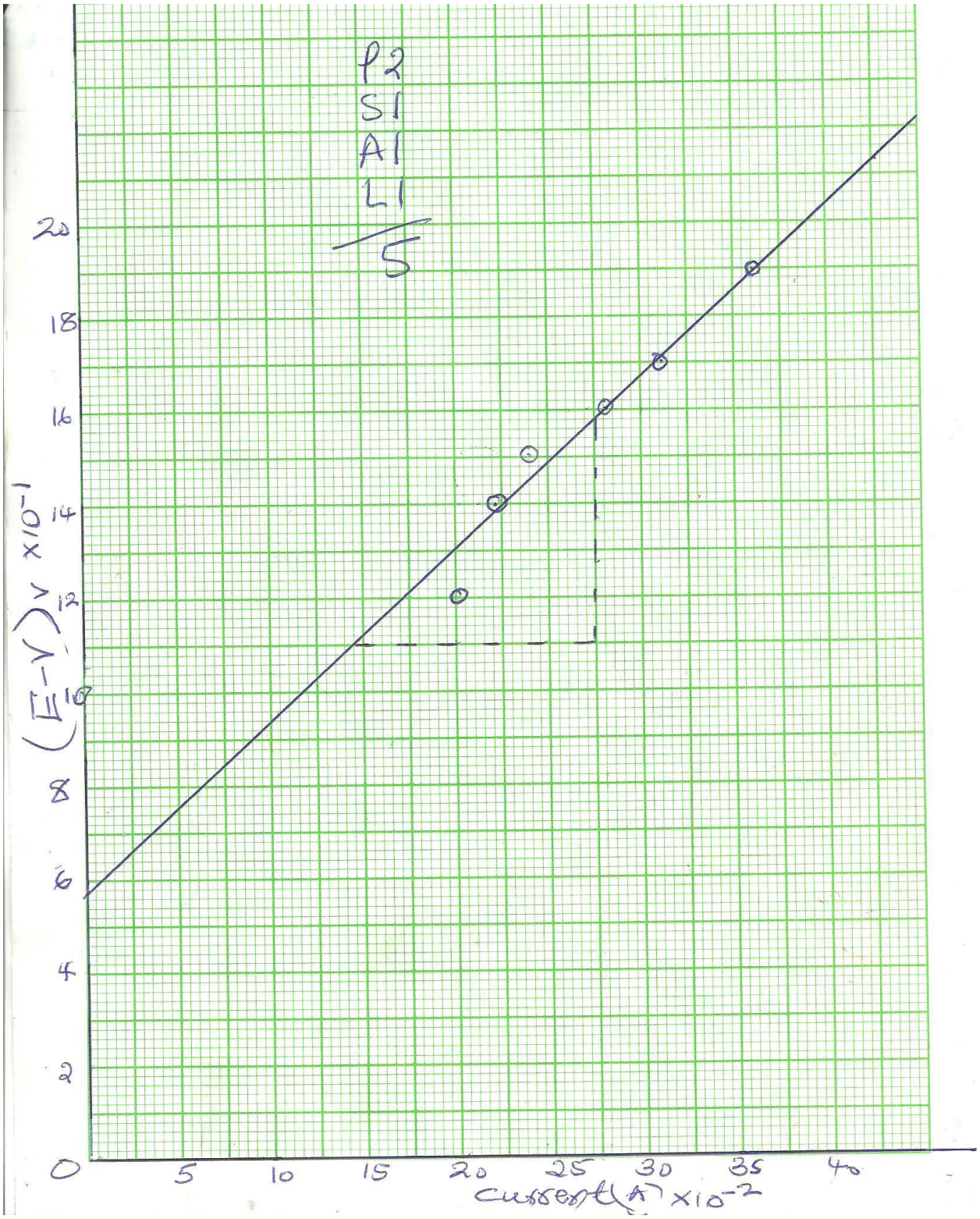
iii) Calculate the gradient of the graph. (3mk)

$$\text{Slope} = \frac{\Delta(E-V)}{\Delta I} \checkmark_1 = \frac{1.58-1.10}{0.275-0.145} \checkmark_1$$

$$= \frac{0.45}{0.13} = 3.46\,\Omega \checkmark_1$$

iv)What does the slope stand for? (1mk)

Internal resistance of the Battery. ✓1


P2
S1
A1
L1
5
20
18
16
14
12
10
8
6
4
2
0
$(E-V)V \times 10^{-1}$
5
10
15
20
25
30
35
40
current (A) $\times 10^{-2}$