KCSE PHYSICS REPLICA SERIES 2022

SEPTEMBER-DECEMBER 2022.

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2022 PHYSICS REPLICA

SERIES 1-10

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KCSE REPLICA 1

PAPER 1

SECTION A: (25 MARKS)

1. The figure7 below shows a soap film in a loop of wire.

Figure7

Sketch a diagram to show the behaviour of the film when punctured at P. (1 mark)

2. A toy boat containing a leaking container of oil was placed on the surface of still water as shown in figure 9 below.

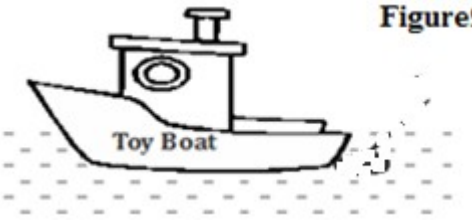

Figure9

The boat was seen moving forward due to the leakage.

(i) On the diagram, indicate the point of the leakage (1mark)

(ii) Explain your indication in (i) above. (1mark)

3. The figure below shows a vernier caliper scale.

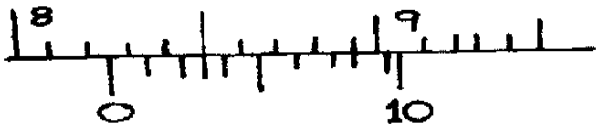

Fig. 1

If the vernier calipers used had a zero error of -0.02 what is the actual reading of the scale. (2mks)

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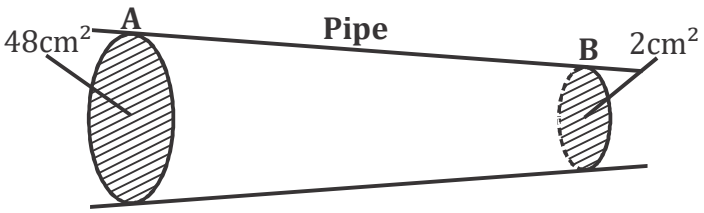
4. The diagram in fig 5.0 shows a section of a pipe with different cross-sectional area.



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If water flows with a velocity of 10m/s in section A, what would be the velocity of water in section B? (3 marks)

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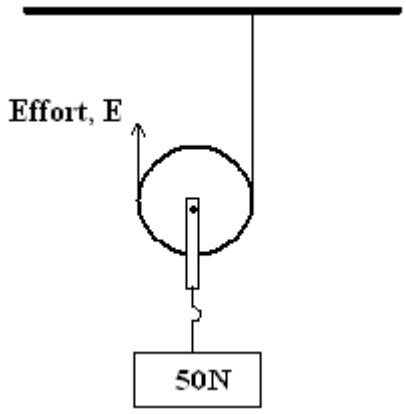
5. State a reason why transfer by radiation is faster than by conduction. (1 mark)

6. The pulley system in the figure below supports a load of 50N.



Given that the efficiency of the system is 80% calculate the effort, E. (3 marks)

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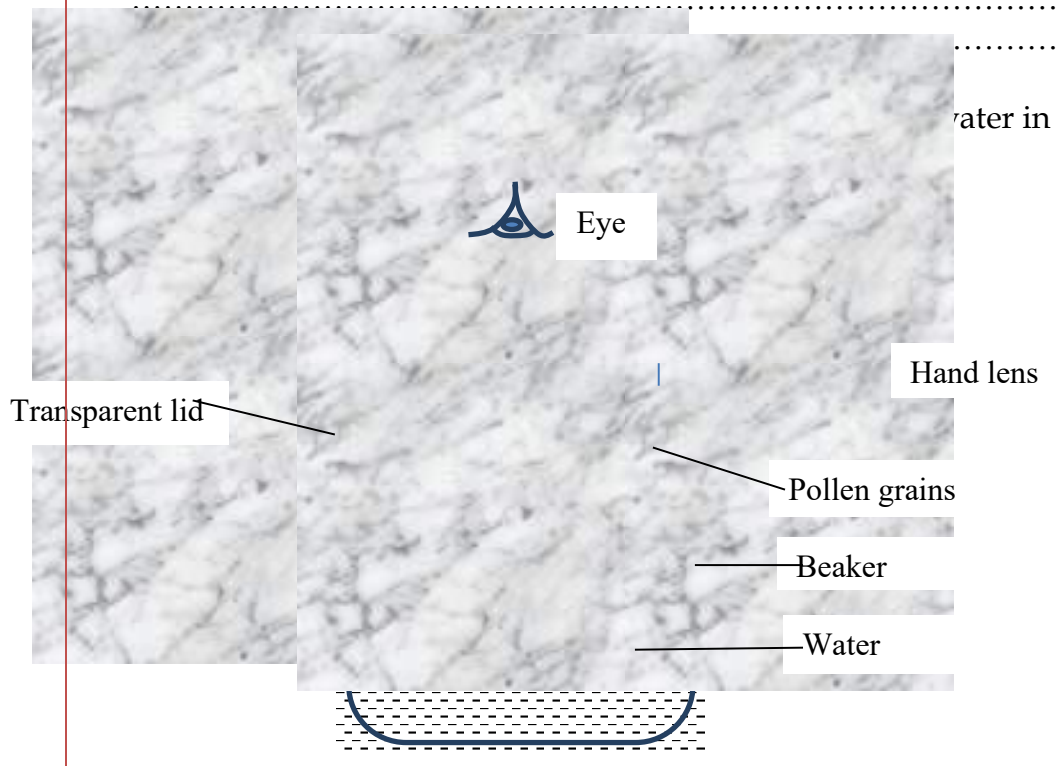

ıte the observation made. (1 mark)

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(b) Explain the observation in (a) above. (1 mark)

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(c) What conclusion can be drawn from the above experiment? (1 mark)

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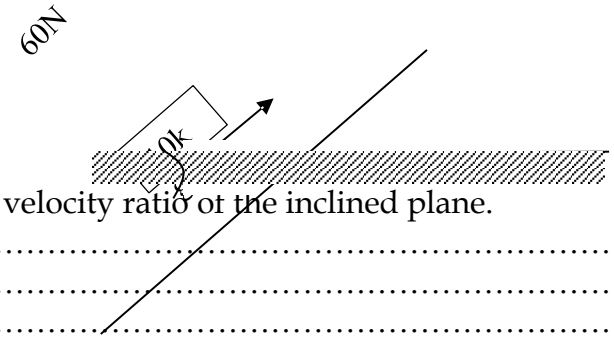
8. A smooth wooden plane is inclined at an angle of 30^0 to the horizontal as shown in Figure 5 below. An object of mass 10kg is pulled steadily up the plane by a force of 60N. Determine;



(a) the velocity ratio of the inclined plane. (2 marks)

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(b) efficiency of the system. (2 marks)

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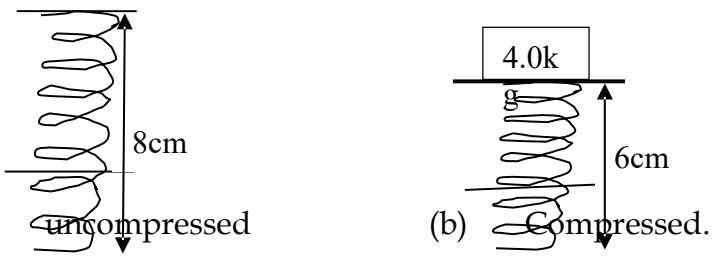
9. The Figure 6 below shows a spiral spring when not compressed and when compressed by a mass of 4.0kg.

Fig. 6



(a) uncompressed (b) Compressed.

Determine the elastic potential energy stored by the compressed spring in .

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(2 marks)

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10. Figure 3 shows a uniform wooden plank which weighs 10N. The plank is balanced at 0.8m from one end by a mass of 2.5Kg.

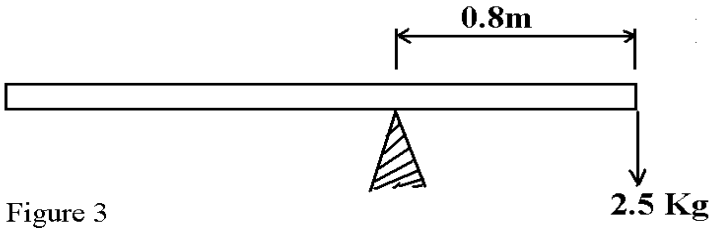

Figure 3

What is the length of the wooden plank in metres. (2mks)

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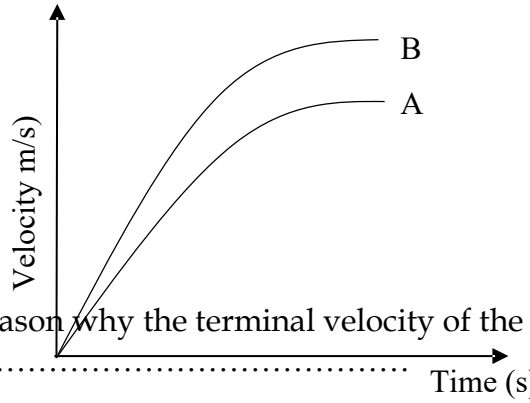
11. The figure shows the velocity time graph of two identical spheres released from the surfaces of two liquids A and B.



Give a reason why the terminal velocity of the sphere In B is higher than in A. (1mark)

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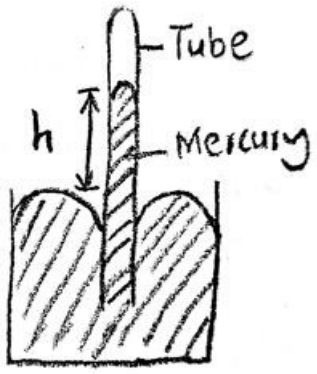
SECTION B: 55 MARKS

12. a) The figure below shows a simple mercury barometer



=

i. when the tube was tilted mercury did not fill the tube completely. Give areason for the observation (1 mark)

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ii. give a reason why mercury is preferred as a liquid in a glass barometer (1mark)

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iii. A town at an altitude of 548m has abarometric height of 70cmHg.Given that the standard atmospheric pressure is 76cmHgand that the density of mercury is 13600kg/m^3, determine the density of air (4marks)

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b) A student half-filled a container with water, boiled the water for several minutes with the cork removed. Then later replaced the cork and poured some cold water on the container. State and explain the observation made (2marks)

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c) Determine the pressure on a piston of cross-sectional 20cm^2 when a force of 50MN is applied to its surface (2marks)

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13. In an experiment to determine the approximate diameter of an oil molecule, the following measurements were obtained:

-diameter of oil drop=0.05cm

-diameter of oil patch=0.2m

Determine:

i. volume of oil drop (3marks)

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ii. area of oil patch (3marks)

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iii. thickness of oil molecule (3marks)

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iv. state two assumptions made in the above experiment (2marks)

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14. (a) Define absolute zero temperature for an ideal gas **(1 mark)**

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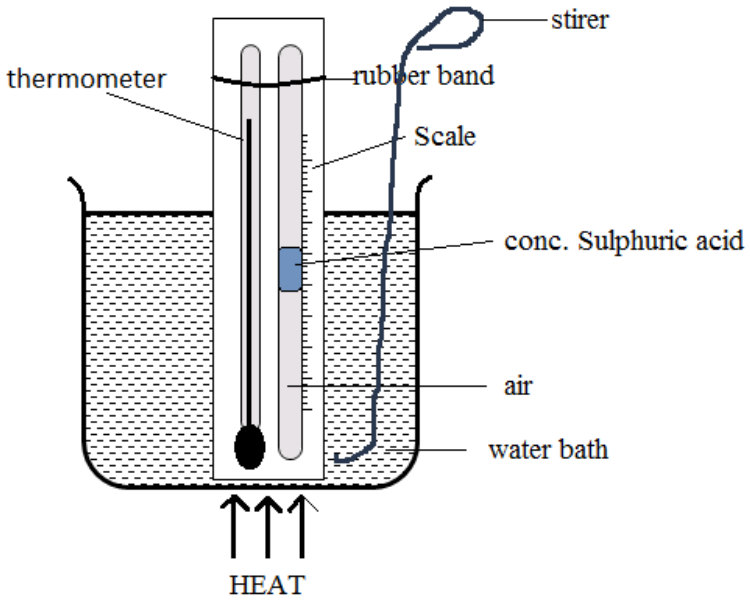
(b) The diagram in figure 12 below shows an experiment to investigate the relationship between volume and temperature of a fixed mass of gas at constant pressure



Explain the functions of:

(i) Concentrated sulphuric acid **(2 marks)**

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(ii) Stirrer **(1 mark)**

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(c) Which measurements are taken in the above experiment **(2 marks)**

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(d) How are the measurements used to verify Charles Law **(3 marks)**

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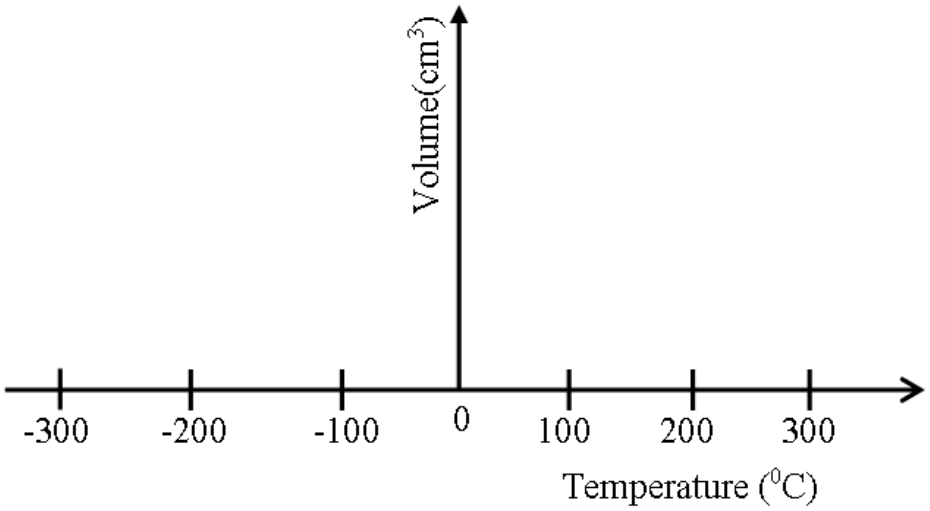
(e) On the grid shown in the figure below sketch a graph of volume (cm^3) against temperature (^0C) for the experiment above. Clearly mark with the letter T the absolute zero temperature. **(2 marks)**



(f) What two assumptions are made in the experiment **(2 marks)**

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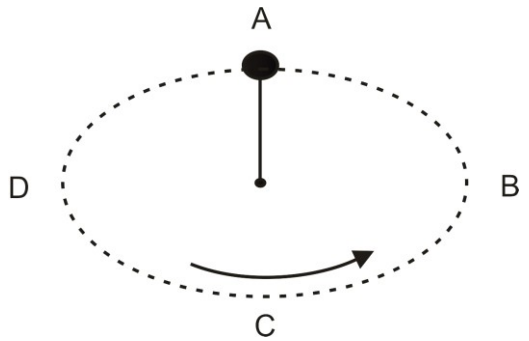
15. A stone is whirled in a vertical circle as shown below. A, B, C, and Dare various positions of the stone in its motion.



The stone makes 2 revolutions per second in a circle of radius 0.4m, and has a mass of 100g.

i) Calculate the centripetal force acting on the stone **(3marks)**

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ii) The string cuts after acquiring constant angular speed. Identify the likely position where this occurred and on the same diagram sketch the new path followed by the stone. **(1 mark)**

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iii) The stone takes 0.5 seconds to land on the ground. How high is this point in (ii) above the ground? **(3marks)**

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iv) How far does it travel horizontally before hitting the ground? **(3marks)**

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16. a) State Newton's second law of motion. (1 mark)

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b) The legal speed limit on motorways is approximately 30m/s. In an incident on a motorway, a car of mass 900kg leaves a skid mark 75m long when stopping. The maximum deceleration of the car when skidding is approximately $10m/s^2$.

i) Show that before the incidence, the car must have been travelling above the legal speed limit. (3 marks)

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ii) Calculate for this skid, the maximum average braking force between each of the four tyres and the road. (3 marks)

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iii) When the motorway is wet, the braking force provided by each wheel is reduced to 50% of the calculated in (ii) above. What is the effect of this reduced breaking force on stopping distance, explain your answer. Assume that the speed of the car before breaking is the same in both cases. (2 marks)

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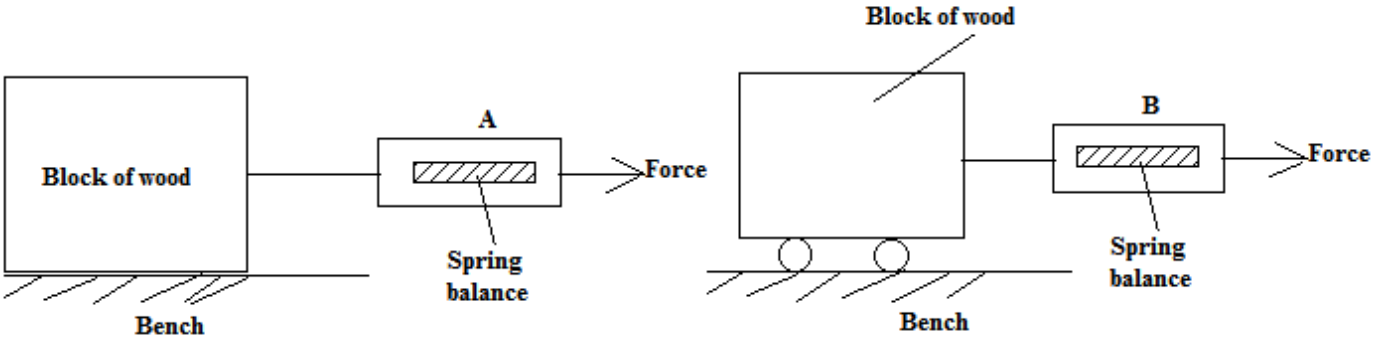
c) A student carried out an experiment to measure static friction using identical wooden blocks arranged as shown in the figure.



State and explain which spring balance will indicate a smaller reading when the block just starts to move. (2 marks)

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PAPER 2

SECTION A: (25 MARKS)

1. Differentiate between primary and secondary cells (1mk)

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2. The diagram in figure 1 below shows the displacement against time for a wave whose wavelength is 4.0mm.

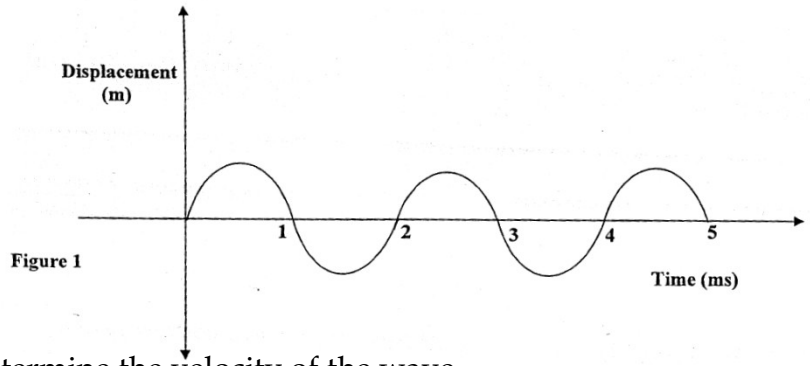

Figure 1

Determine the velocity of the wave. (3mks)

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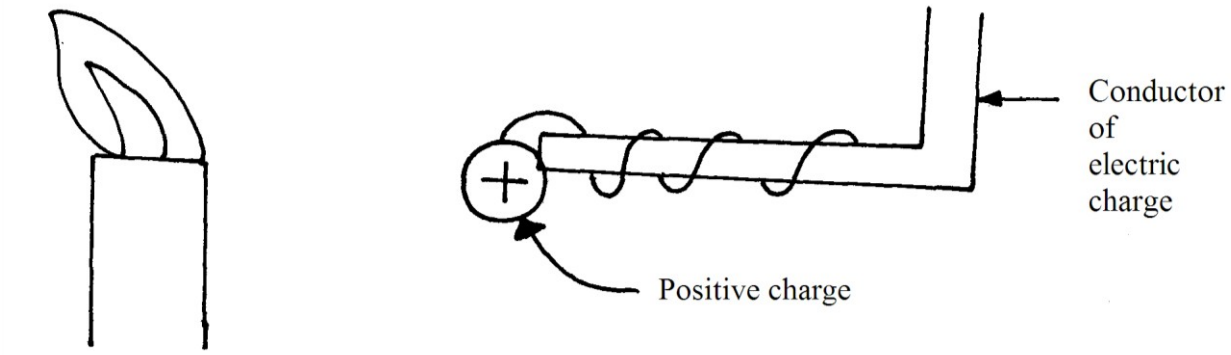
3. The figure 2 below shows a thin wire connected to a charge generator and placed close to a candle flame.



Explain why the candle flame is deflected as shown. (2mks)

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4. What is thermionic emission? (1 mk)

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5. Ultraviolet radiation incident on a zinc plate releases electrons from the zinc surface. The energy of each incident proton is 5.4eV. Zinc has a work function of 4.3eV.

(i) State the name given to this effect. (1 mk)

……

(ii) What is meant by work function of the metal? (1 mk)

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……

(iii) An electron is emitted from the surface of zinc. Calculate the maximum kinetic energy of the electron in Joules. (2 mks)

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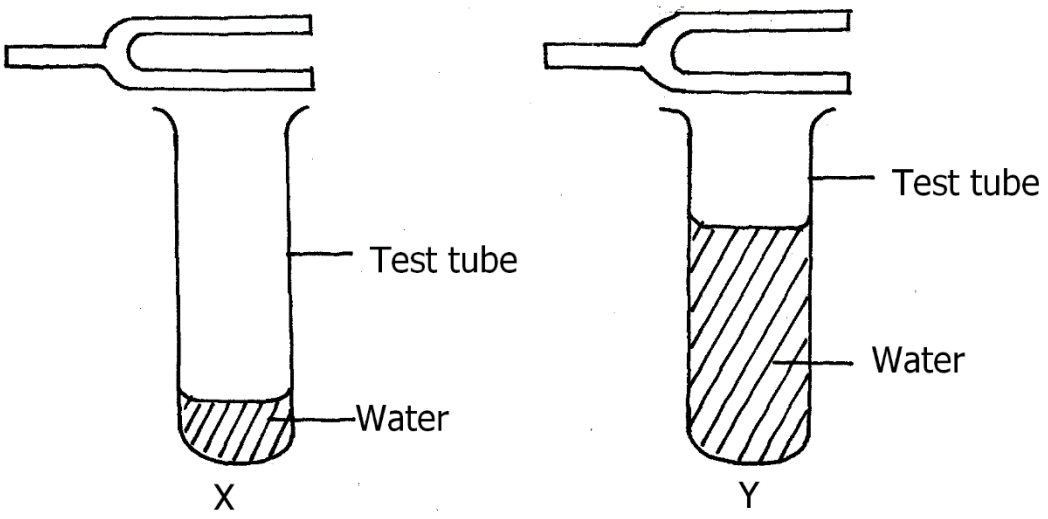
6. A vibrating tuning fork of frequency 512Hz was brought close to two test tubes X and Y With water levels as shown in fig. 3

Fig. 3



It was observed that loud sound is produced in test tube X but not in Y. Explain this observation. (2mks)

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7. The chart below shows an arrangement of different parts of the electromagnetic spectrum.

Radio	A	Visible	Ultra-violet	X-rays	Gamma-Rays

Name the radiation represented by A
(1mk)

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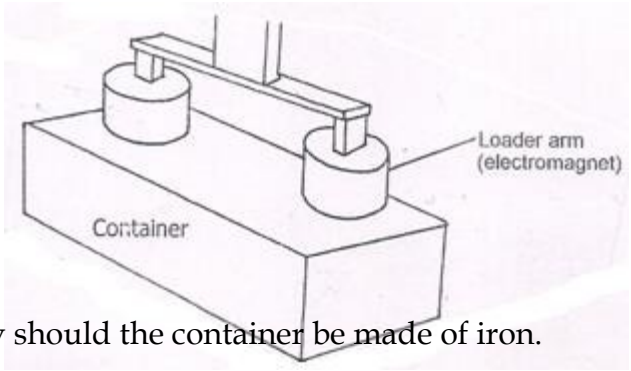
……

8. The figure 4 below shows a container loader which uses electromagnet to offload containers from a ship.



(i) Why should the container be made of iron. (1 mrk)

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(ii) State **two** ways in which the loader can be made to lift a heavier container. (2 mrks)

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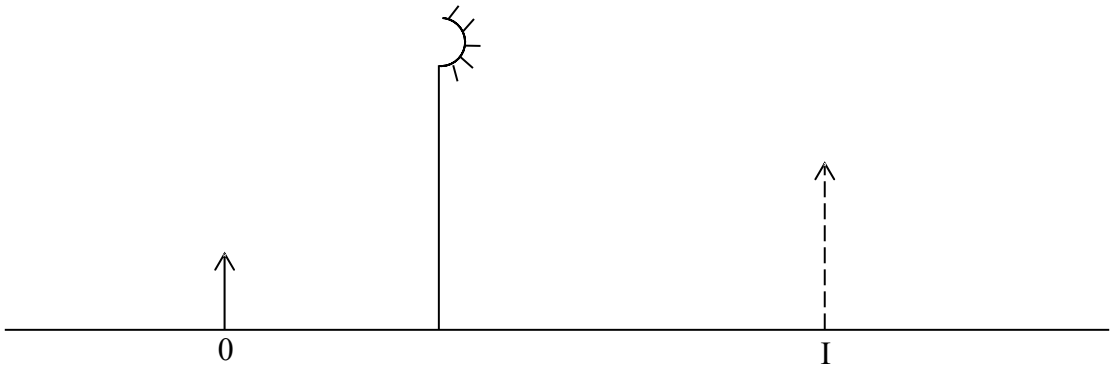
9. The figure below shows an object O and it's image I formed by a concave mirror. The diagram is drawn to scale.



Using a suitable ray, determine the focal length (f) and the radius of curvature (r) of the mirror. (3 marks)

f …… cm

r…….. cm

10. State two differences between pinhole camera and the human eye. (2 marks)

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..

11. Give a reason why soft iron is used as a core of the coil of an electric bell. (1 mark)

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……...

12. State two uses of gold leaf electroscope. (2 marks)

SECTION B: (55 MARKS)

13. a) Define a resistor. (1 mark)

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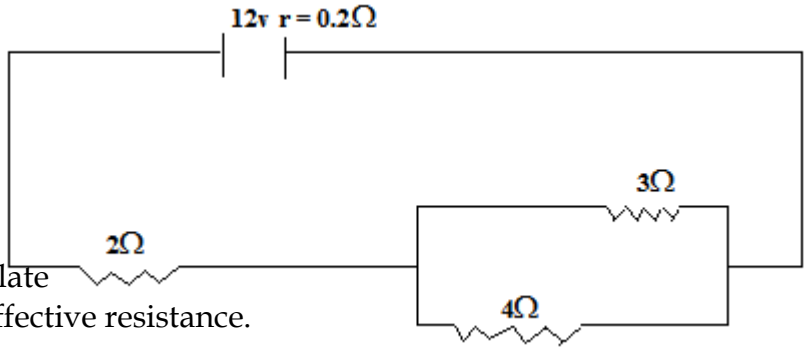
b) The figure below shows three resistors connected to 12v supply of internal resistance of 0.2Ω.



Calculate

i) The effective resistance. (3 marks)

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ii) The total current in the circuit. (2 marks)

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iii) the current through the 4Ω resistance. (3 marks)

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c) If the current flows for 2 minutes calculate the total energy dissipated. (2 marks)

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d) State two applications of resistors in real life situation. (2 marks)

(i) .....

(ii).....

14.

a) Define the following terms.

i) Capacitor (1 mark)

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ii) Capacitance (1 mark)

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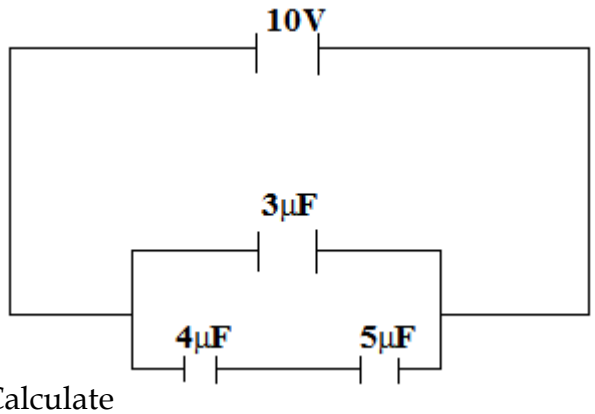
b) Three capacitors are connected to a 10v battery.



Calculate

i) The effective capacitance (3 marks)

……
……
……
……

ii) The total charge (3 marks)

……

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……

……

c) State three factors that determine the capacitance of a capacitor. (3 marks)

i) .....

ii) .....

iii) .....

15. (a) X- rays are used for detecting cracks inside metal beams;

(i) State the type of the X- rays used. (1mark)

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……

(ii) Give a reason for your answer in (i) above. (1mark)

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(b) Figure shows the features of an X- ray tube

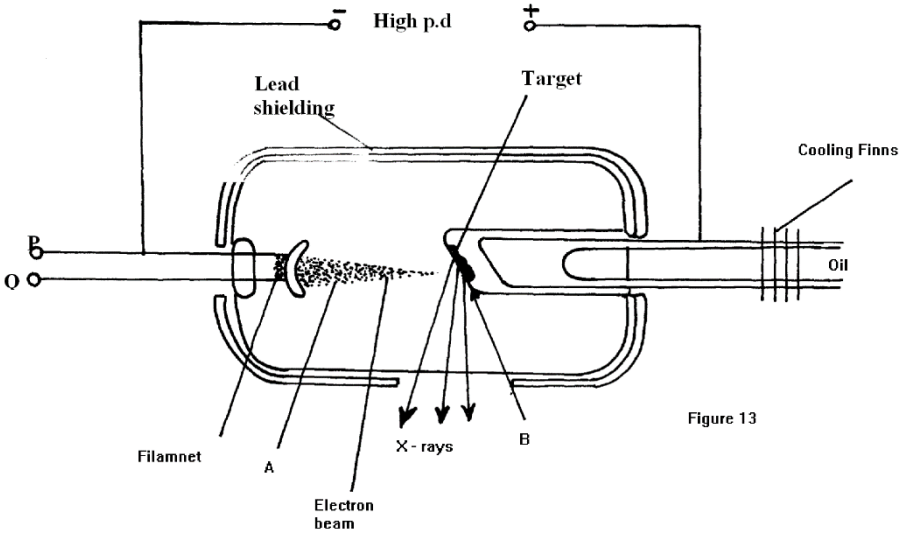

Figure 13

i) Name the parts labelled A and B. (2marks)

A……

……

B……..

(ii) Explain how a change in the potential across P changes the intensity of the X-rays produced in the tube. (2 marks)

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(iii) During the operation of the tube, the target becomes very hot. Explain how this heat is caused. (2 marks)

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(iv) What property of lead makes it suitable for use as shielding material?(1mark)

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(c) In a certain X- ray tube, the electrons are accelerated by a Pd of 12000V. Assuming all the energy goes to produce X- rays, determine the frequency of the X- rays produced. *(Planck's constant h= 6.62 x 10^{-34} JS and charge on an electron, e = 1.6 x 10^{-19}C).*
(4marks)

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16. A student connected a circuit as shown in figure 16 below hoping to produce a rectified out put

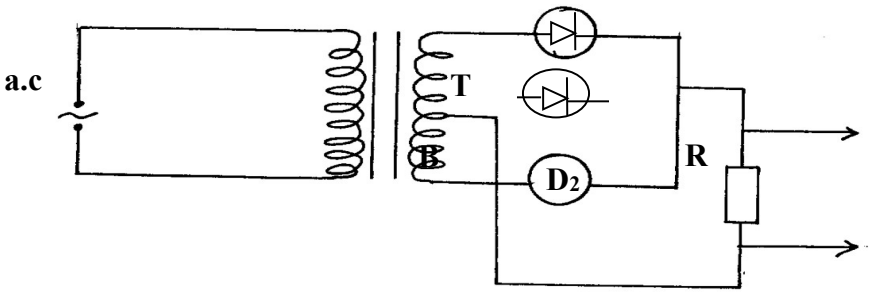

Fig 16.

(a) Sketch the graph of the output on the **CRO** screen (2mark)

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……
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(b) Explain how the output above is produced (2marks)

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(c) Name other **two** uses of a junction diode (2marks)

17. (a) Thorium decays to protactinium by emission of a beta particle (β) as shown.

$$Th \xrightarrow{\beta} {}^{234}_{91}Pa$$

Determine the atomic and mass number of thorium
Atomic number ……mass number ……(2marks)

(b) The figure 15 below shows the path taken by three radiations A,B and C from a radioactive source through an electric field.

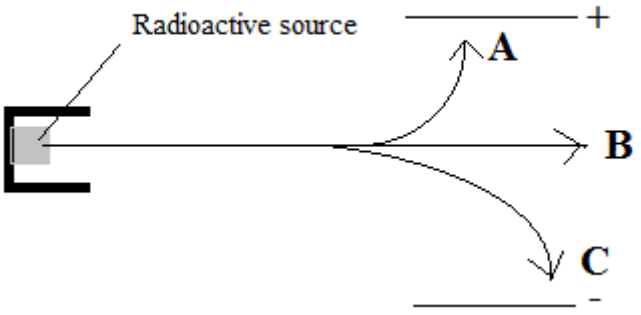

Fig.15

(i) Identify the radiation B (1 mark)
……
……

(ii) Give a reason for the difference in deviation shown by A and C (2 marks

(c) The table 1.Below shows results obtained from a G-M tube when a radioactive sample was placed near it.

Time (min)	0	1	2	3	4	5	6
Counts per (min)	1048	994	926	838	719	557	330
Correct count							

(i) Given that the background radiation was 30 counts per minute, fill in the blank spaces in the table. (3mark)

(ii) Draw a suitable graph on the grid provided. (5marks)

EMBED Excel.Chart.8 \s

(ii) From the graph determine the half-life of the sample. (1mark)
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PAPER 3

QUESTION 1

You are provided with the following

- A voltmeter
- Two dry cells and a cell holder
- A switch
- A resistor labelled R (3.9Ω)
- A wire mounted on a mm scale and labelled G
- A micrometer screw gauge (to be shared)
- Six connecting wires with six crocodile clips

Proceed as follows.

(a) Record the length L_O of the wire labelled G

L_O = ...

Use the micrometer screw gauge provided to measure the diameter of the wire labelled G at two different points and determine the average diameter, d

The diameter d_1 = ... mm, d_2 = ... mm **(1 mark)**

Average diameter d = ... mm **(1 mark)**

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.....

Determine the radius r of the wire in metres. **(1 mark)**

Radius r = ... m

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(b) Set up the apparatus as shown in the circuit diagram in figure 1.

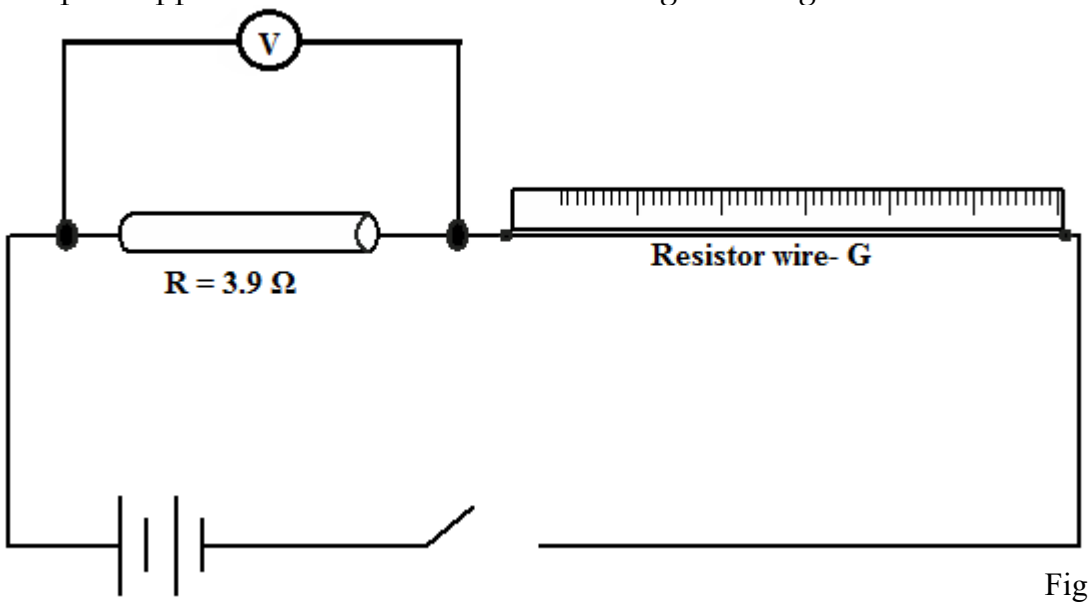


Fig 1

(i) Use the voltmeter provided to measure the p.d. V_R across R and p.d. V_G across G when the switch is closed.

V_R = ... volts **(1 mark)**

V_G = ... volts **(1 mark)**

Open the switch

(ii) Use the value of R provided and the value of V_R in *b(i)* above to calculate the current I flowing through R when the switch was closed. **(1 mark)**

.....

.....

.....

I = ... Amperes.

(iii) Determine the constant H given that

$$H = \frac{100V_G}{1 \times L_O}$$ **(1 mark)**

.....

.....

.....

H = ...Ωm^{-1}

(c) Connect the voltmeter across R as shown in *figure 2* below.

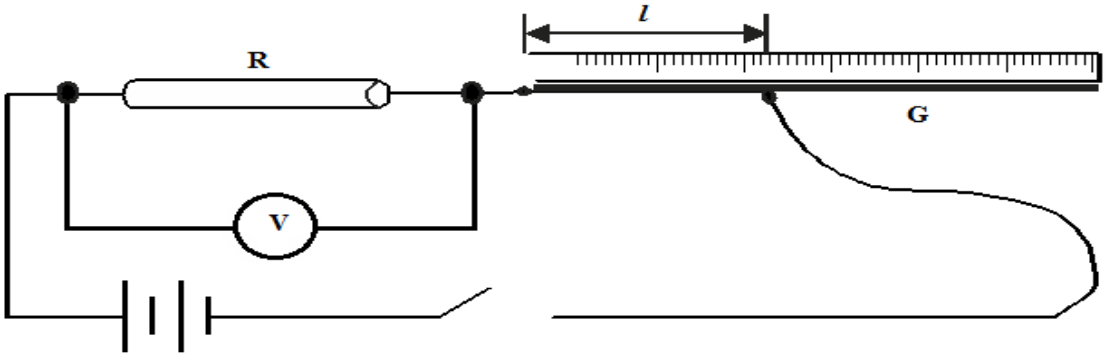


Fig 2

Adjust the position of one crocodile clip on the wire G to a point such that the length *l*of the wire in the circuit in 5cm*(see figure 2 above)* close the switch.

Read and record in table 1 the value of p.d. across R. Open the switch.

(d) Repeat the procedure in (c) above for the other values of L shown in the table 1. **(3 marks)**

Table 1.

Distance L (cm)	0	2	10	20	30	40	50	70
p.d. V across RV								

(e) i) On the grid provided next page, plot the graph of V*(y-axis)* against *l*. **(5 marks)**

ii) From the graph, determine l_1, the value of *l* when $V = \frac{V_o}{2}$where V_O is the p.d. where $l = 0$ **(1 mark)**

(f) Determine the constant D for the wire given that $D = \frac{R}{l_1} \times \frac{300}{V_o}$ **(2 marks)**

.....

.....

.....

(f) Determine the constant p given that $p = \frac{\pi r^2}{2}(D + H)$, where r is the radius of the wire in metres.

(2 marks)

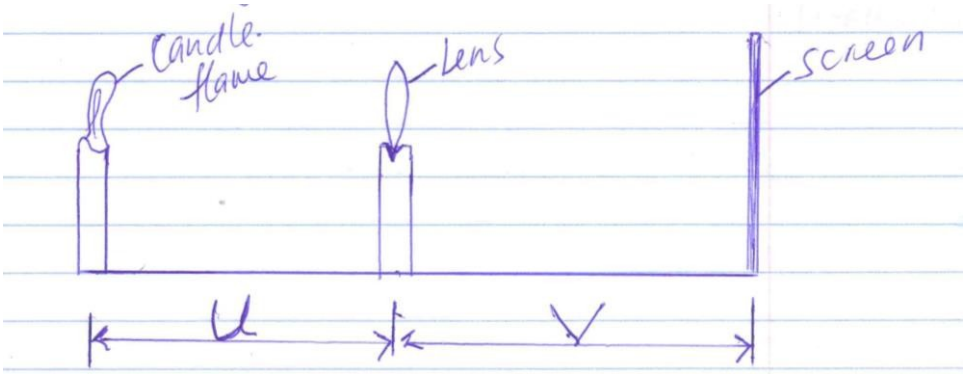
QUESTION 2

Section A

You are provided with the following

- A candle
- A lens and a lens holder
- A screen
- A metre rule

a) Set up the apparatus as shown in figure below (ensure that the candle flame and the lens are approximately the same height above the bench)



b) Set the position of the lens so that the 40cm from the candle (U=40). Adjust the position of the screen until a sharp image of the candle flame is obtained. Measure the distance, V between the lens and the screen. Record the value of V_1 V = …… cm)

1mk)

c) Repeat the procedures in b) above for other values of U in the table b below.

Table b)

U(cm)	45	50	55
V(cm)			
Magnification (m) $\frac{v}{u}$			

d) Given that f = $\frac{v}{m+1,}$

where f is the focal length of the lens, use the results in table above to determine the average values of f. 4mks)

PART B.

You are provided with the following:

- rubber bung.
- vernier calipers.
- beam balance.

Proceed as follows:

a) Using a vernier caliper, measure the lengths D, d, and h as shown in **figure 2.**

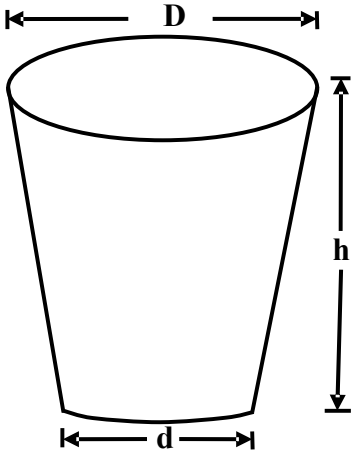


Figure 2

D = ... m (1 mark)
d = ... m (1 mark)
h = ... m (1 mark)

b) (i) Measure the mass, M of the rubber bung using the beam balance.
M = ... kg (1 mark)

(ii) Given that $Q = \left(\frac{d + D}{4}\right)$, determine the value of Q. (1 mark)

(iii) Determine the value of r given that $\pi r Q^2 = \frac{M}{h}$ (3mark)

(iv)what are the units of r (1 mark)
(v) what is the significance of r (1 mark)

SECTION C

You are provided with the following

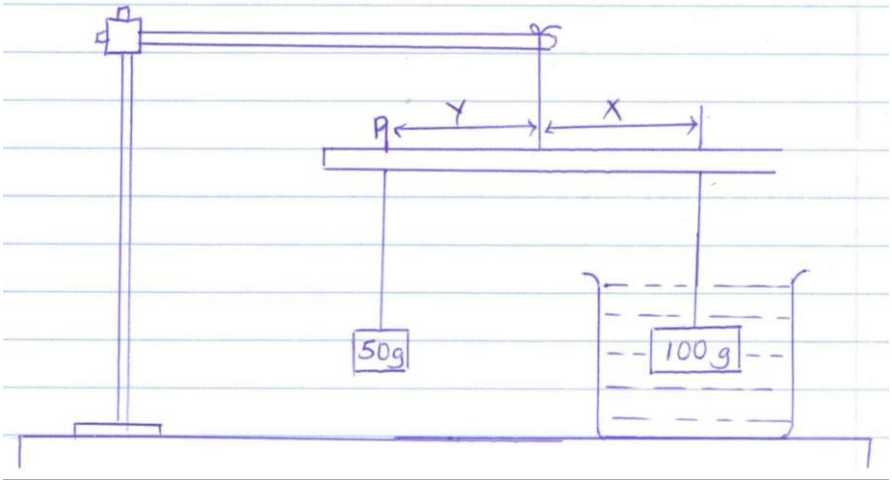
- a metre rule
- a retort stand, one boss, one clamp
- One 500ml beaker ¾ full of water
- One 100g mass
- One 50g mass
- 3 pieces of thread approximately 30cm long

Procedure
a) Balance the metre rule horizontally by suspending it from the stand and clamp with one of the threads.
Record the balance point G

G = _____ cm (1mark)

b) suspend the 100g mass from the metre rule at a point such that x =5cm from point G, with the 100g mass completely immersed in water in the beaker hang the 50g mass from the metre rule. Note the point of suspension (p) of the mass

P=_____ (1mark)



c) Calculate the apparent weight of the 100 g mass in water. (3mark)

d)Find the upthrust of 100g mass in water. (2marks)

KCSE REPLICA 2
PAPER 1

SECTION A (25 MARKS)

Answer All Questions In This Section In The Spaces Provided

1. Figure 1 shows part of the scales of a micrometer screw gauge when it is completely closed.

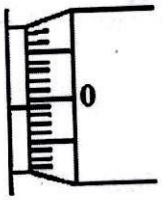


Figure 1

Find the zero error of this micrometer screw gauge. (1 mark)

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2. A barometer reads 760mmHg at sea level. Find it's reading at an altitude of 2500m above sea level. (Density of mercury = 13600kgm^{-3} and density of air 1.25kgm^{-3}) (3 marks)

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3. Figure 4 shows a velocity-time graph of a small metal sphere falling through water in a tall jar.

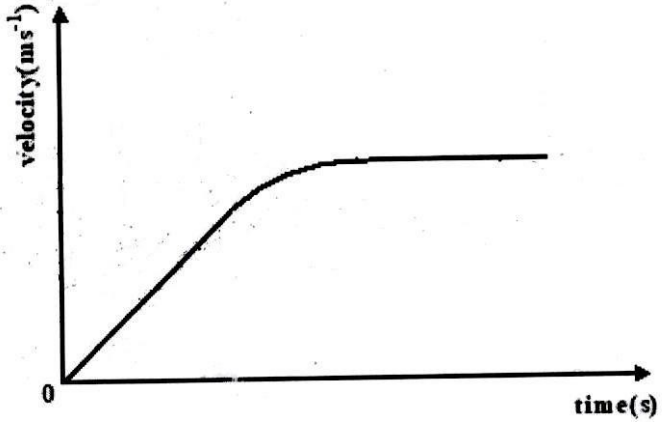

Figure 4

On the same axes, draw a velocity-time graph for the same metal sphere falling through air. (1 mark)

4. Figure 5 shows the tension, T on a pendulum bob suspended from a support.

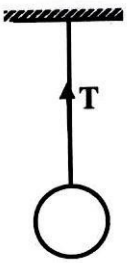

Figure 5

Indicate on the diagram the other force acting on the pendulum bob. (1 mark)

5. A stone and a feather are dropped from rest from a building 20m tall. If they reach the ground at the same time,

a) State the condition under which they fall. (1 mark)

……

b) Find the velocity with which they reach the ground. (take g = 10m/s^2) (2 marks)

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6. Define a radian as applied in circular motion. (1 mark)

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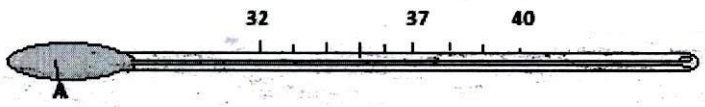
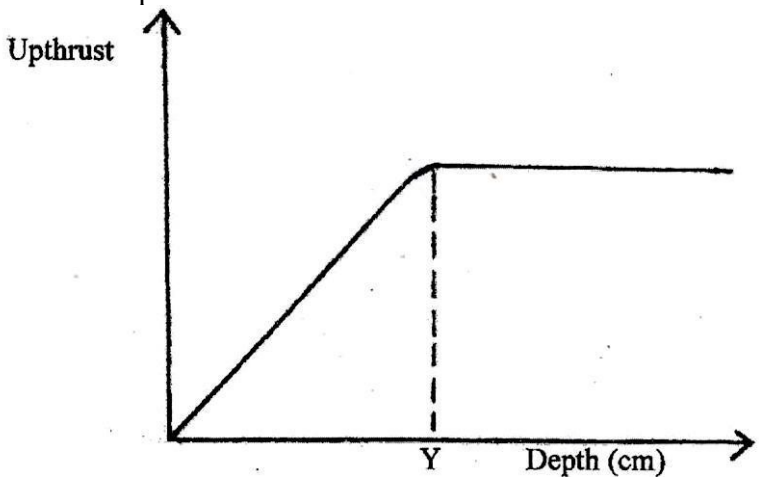
7. The figure below shows a thermometer used by a doctor to determine the temperature of a patient. Why is it difficult to work with this thermometer? (2 marks)



8. A glass block is suspended from a spring balance and held inside a beaker without touching the beaker. Water is added gradually into the beaker. The figure below shows the variation of the upthrust on the block with depth of water in the beaker.



State the reasons for the observation at Y (2 marks)

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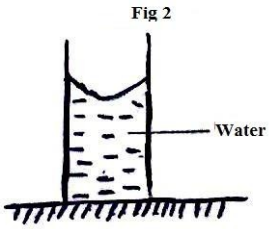
9. Which branch of Physics deals with kinetic energy within matter? (1 mark)

……

10. The figure 2 below shows a beaker containing water placed on a flat bench. State and explain the changes in stability of the beaker when the water freezes to ice. (2 marks)

Fig 2



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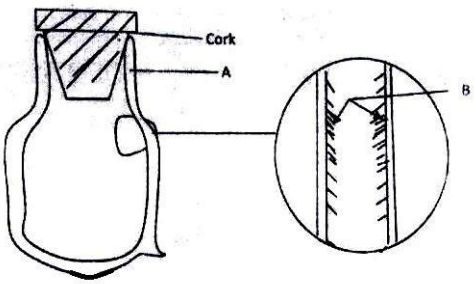
11. Figure 5 is a simple diagram of a vacuum flask with an enlarged view of the part of it in the circle. Use it to answer question (a) and (b).



a) Name the material in A and B.

A: ..... (1 mark)

B: ..... (1 mark)

b) What type of energy losses are minimized or prevented by the parts A and B?

A: ..... (1 mark)

B: ..... (1 mark)

12. (a) State Newton's Third Law of Motion (1 mark)

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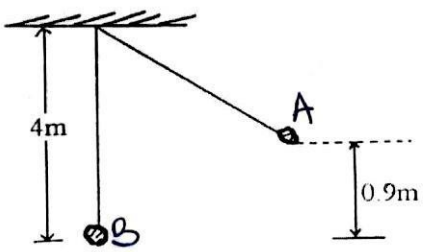
(b) A car of mass 900kg is initially moving at 20m/s. Calculate the force required to bring the car to rest over a distance of 15m. (3 marks)

SECTION B – 55 MARKS

Answer All the Questions

13. (a) A body of mass 20Kg hangs 4m and swings through a vertical height of 0.9m as shown in the figure below.



Determine;

(i) The potential energy at position, A (2 marks)

(ii) The speed of the body when passing through the lowest point, B (2 marks)

(b) A Crane lifts a load of 2000kg through a vertical distance of 3.0m in 6 seconds. Determine the:

(i) Work done by the crane. (Take g= 10N/Kg) (2 marks)

(ii) Power developed by the crane. (2 marks)

(iii)Efficiency of the crane given that it is operated by an electric motor rated 12.5kW (3 marks)

14. (a) Figure 9 shows a suspended copper solid immersed in a fluid.

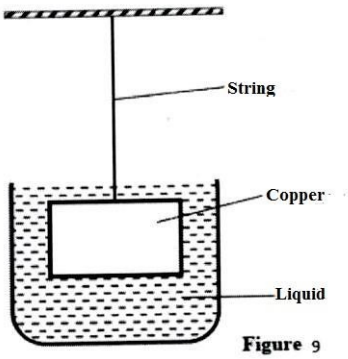


Figure 9

Explain what will happen to the tension in the string if a liquid of higher density is used. (2 marks)

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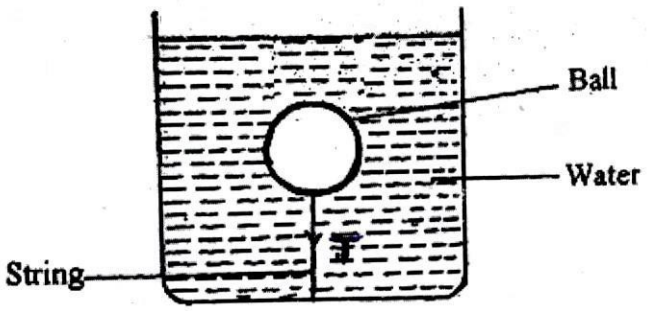
(b) Figure 10 below shows a ball fully immersed in water and held with a string attached at the bottom.



(i) If the mass of the ball is 0.5kg, calculate the weight of the ball. (1 mark)

(ii) The volume of the water displaced by the immersed ball is 8.0×10^{-4} m³. Calculate the up thrust on the ball. (ρ water = 1000 kg m^{-3}) (3 marks)

(iii)Determine the tension T on the string (2 marks)

(c) An object weighs 5.0N in air, 3.0N when fully immersed in water and 4.0N when fully immersed in a certain liquid. Determine the density of the liquid. (3 marks)

15. a) Define the term 'heat capacity' (1 mark)

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b) A block of metal of mass 150g at 100^0C is dropped into a well lagged calorimeter of mass 215g and specific heat capacity of 400J/Kg/K containing 100g of water at 25°C. The temperature of the resulting mixture is 34°C (Specific heat capacity water is 4200J/Kg/K).Determine;

(i) Heat gained by calorimeter. (2 marks)

(ii) Heat gained by water. (3 marks)

(iii)Specific heat capacity of the metal block (3 marks)

c) A copper block of mass 500g is electrically heated with a heater rated 5W.The heater is on for 8 minutes. Calculate the temperature rise in the block. (Specific heat capacity of copper is 460J/Kg/K) (3 marks)

16. a) A car negotiating a corner at a constant speed is said have a change of momentum. Explain this observation. (1 mark)

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b) Figure 15 shows the overview of a turn table on which glass blocks A and B are placed at different radii from the centre along a straight line. The radius **r1** is 50cm while that of **r2** is 120cm. The mass of A is 300g that of B is 900g.

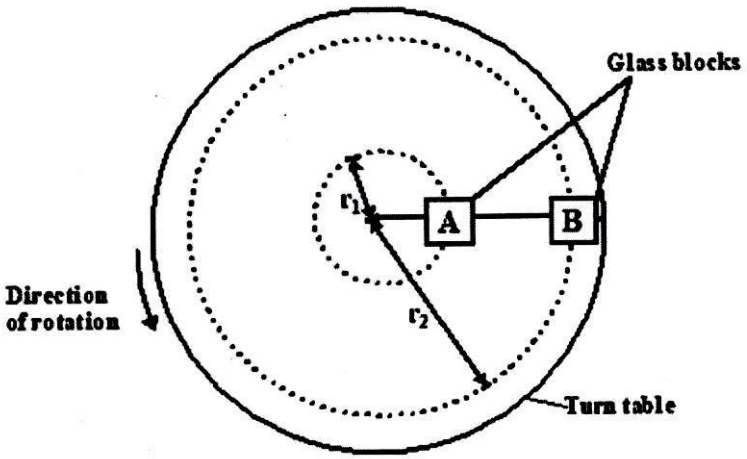

Figure 15

Both blocks maintain the same straight line as the turn table moves in uniform circular motion. Block A has a linear velocity of $40ms^{-1}$.

I. Determine the:

(i) Centripetal force on block A. (3 marks)

(ii) Linear velocity of block B. (3 marks)

II. (i) State which block is likely to slide off the turn table. (1 mark)

……..

(ii) Explain your answer in (II) (i) above. (2 marks)

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17. (a) Figure 8 shows a sealed glass syringe that contains smoke particles suspended in air.

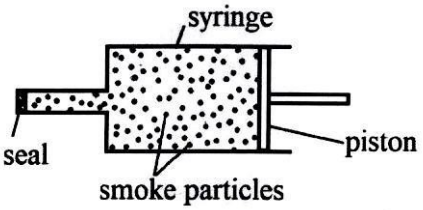

Figure 8

(i) Explain why the smoke particles are suspended in the air and do not settle to the bottom. (2 marks)

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(ii) The air in the syringe is at a pressure of 2.0×10^5 Nm^{-2}. The piston is slowly moved into the syringe until the volume of the air is reduced from 80 cm^3 to 25 cm^3.

i. State why the piston must be moved slowly. (1 mark)

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ii. Calculate the final pressure of the air in the syringe. (3 marks)

b) State what is meant by an ideal gas. (1 mark)

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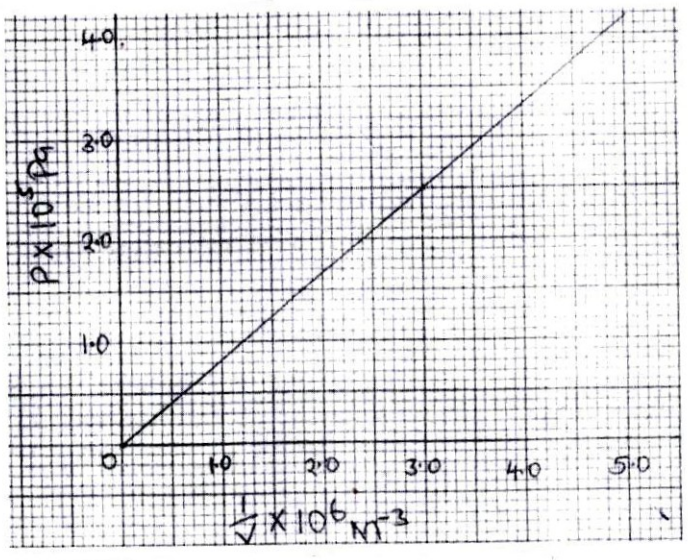
c) The pressure acting in a gas in a container was changed steadily while the temperature of the gas was maintained constant. The value of volume, V, of the gas was measured for various values of pressure. The graph in the figure A shows the relation between the pressure. P_1 and the reciprocal of volume, I/V.



(i) Given that the relation between the pressure P and the volume V of the gas is given by PV=k, where k is a constant use the graph to determine the value of k. (3 marks)

(ii) What physical quantity does k represent? (1 mark)

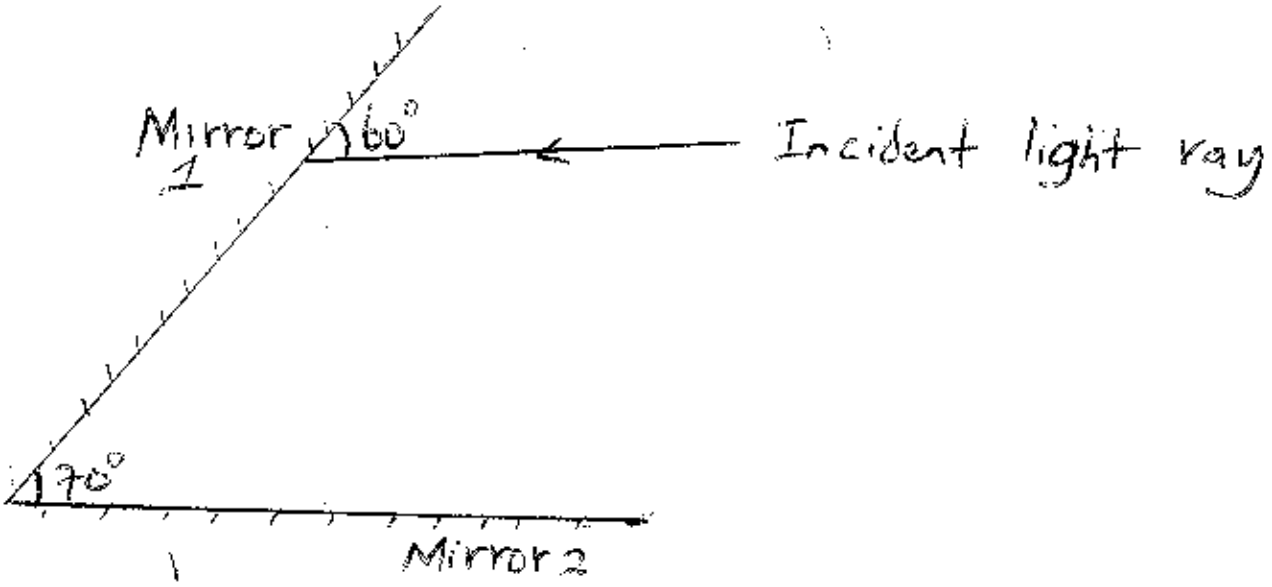
……

PAPER 2

SECTION A (25 MARKS)

Answer all the questions in this section in the spaces provided.

1. The figure 1 below shows a ray of Light incident on the surface of one plane mirror.



Sketch the path of the ray on the diagram after striking mirror 2 indicating all the angles.(2 marks)

2. An observer watching a fireworks displays sees the light from an explosion and hears the sound 4 seconds later. How far was the explosion from the observer (speed of sound in air =330m/s. (2 marks)

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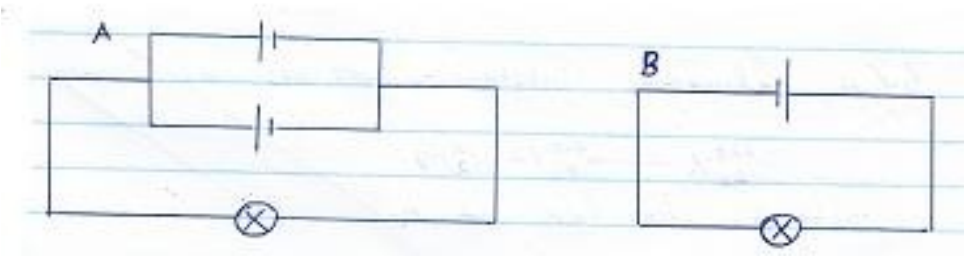
3. In the circuit diagram shown in figure 2 below the lamps are identical and the cells are also identical.



State with a reason in which circuit the lamp will be lit for a longer period. (2 marks)

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4. A bulb is rated 100W, 240V. Determine the amount current through the filament of the bulb. (2 marks)

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5. A negatively charged rod is brought near the cap of a leaf electroscope. The cap is then earthed momentarily by touching with the finger. Finally the rod is withdrawn. State the final charge on the electroscope. Explain your answer. (3 marks)

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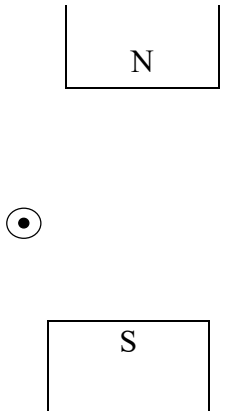
6. Figure below show a wire carrying current whose direction is out of the paper. The paper is placed in a magnetic field. .



(a). Indicate on the figure the direction of the forced F, acting on the wire. (1 mark)

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(b). State what would be observed on the wire if the direction of the current is reversed (i.e. into the paper). (1 mark)

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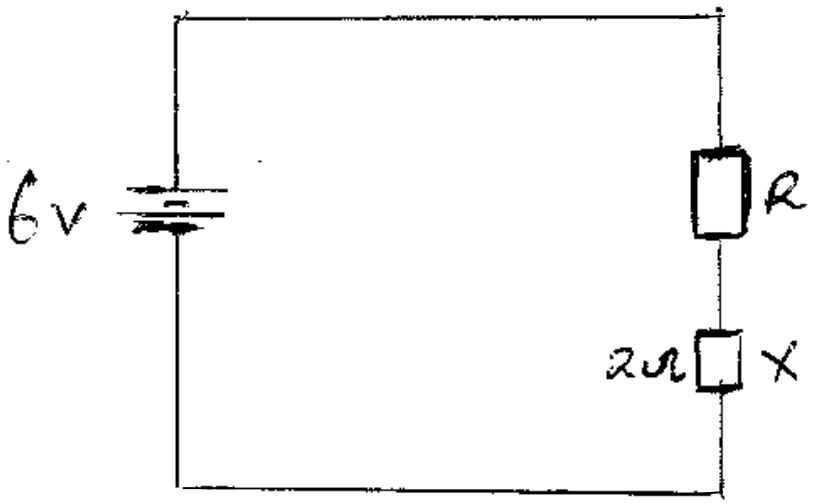
7. The figure 4 below shows a device x connected in series with a resistor of resistance R, the voltage across x is 0.14v. .



Calculate the value of resistance R. (3 marks)

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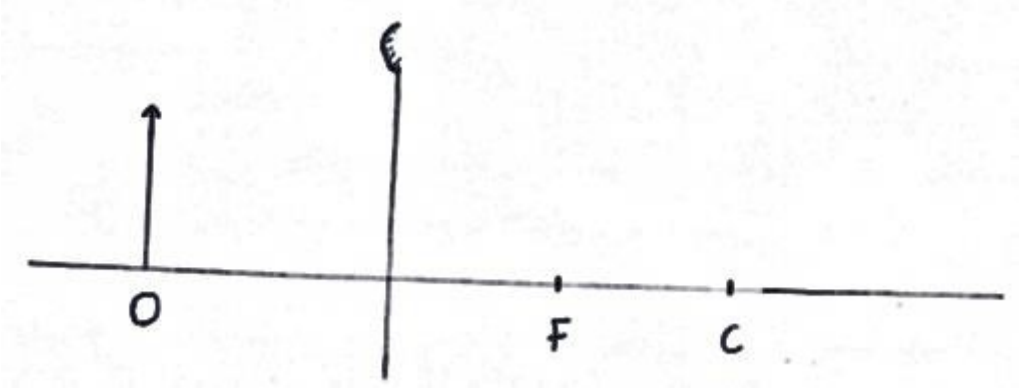
8. The Table below shows the type of radiation detection method and uses of electromagnetic radiations. Complete the table. (1 mark)

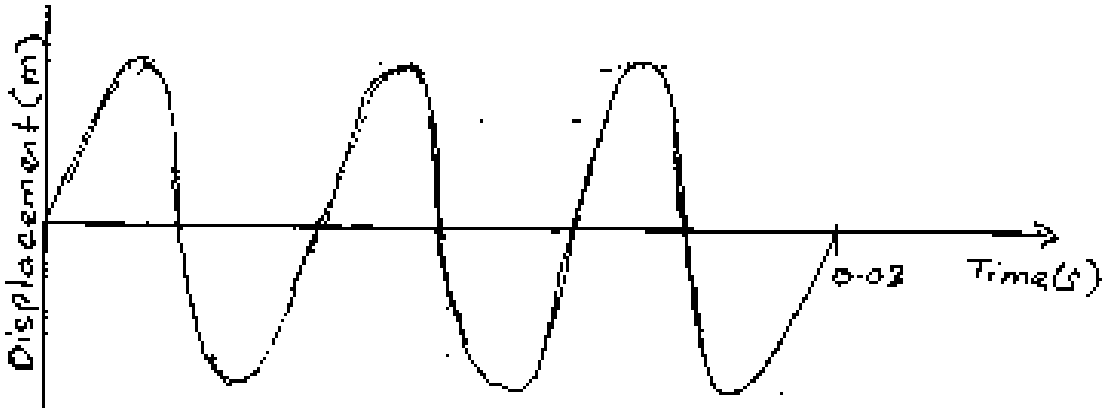
Type of radiation	Detection	Use
	Blackened thermometer	warming

9. An object O is placed in front of a convex mirror as shown in the diagram below.

Complete the diagram to show the position of the image I. (3 marks)



10. The sketch shown below is a displacement-time graph of a wave travelling at 320m/s.



Determine the wavelength of the wave. (3 marks)

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11. Give a reason why repulsion in magnetism is the surest way of testing polarity. (1 mark)

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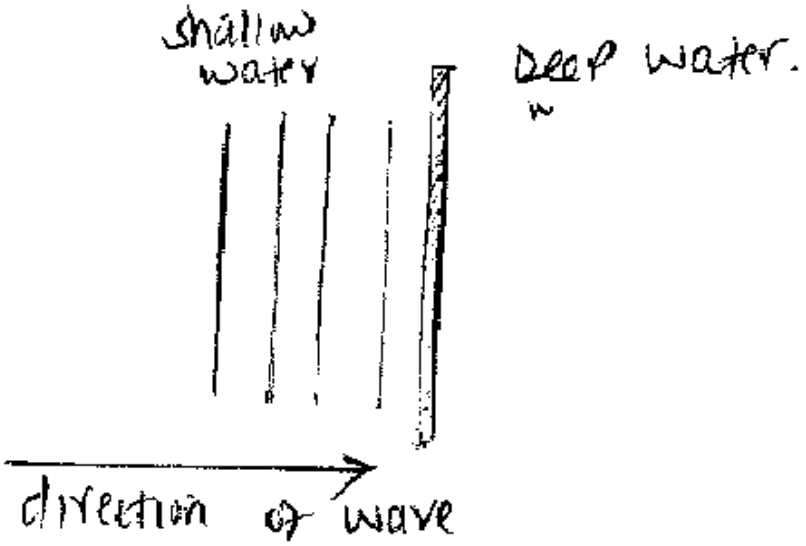
12. The diagram below shows plane waves moving from shallow to deep end of a pond.



Complete the diagram to show the waves on the deep end. (1 mark)

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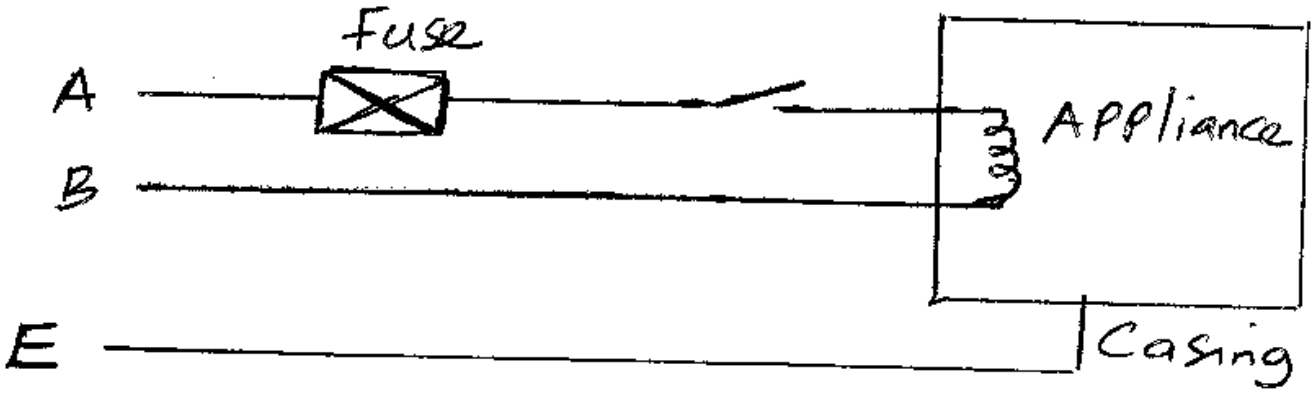
SECTION B (55 MARKS)
Answer all questions in this section

13. (a). Figure 4 below shows a modern mains appliances



(i). Name wire A and B (2 marks)

A ……

B ……

(ii). State the purpose of Lead E (1 mark)

……

……

(iii). State the function of the fuse in the circuit. (1 mark)

……

……

(b). A heater is marked 3kW, 240V. The fuses available are marked 10A, 13A and 20A. Which fuse is most suitable? 2 marks)

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(c). Give a reason why power is transmitted at high voltage. (1 mark)

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(d). A 2kW electric heater is used for 10 hrs. Calculate the cost of electricity if it costs sh.30 per unit. (3 marks).

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(e). A step down transformer has 600 turns in the primary coil. The input voltage is 120V while the output voltage is 24V. Determine the number of turns in the secondary oil. (2 marks)

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(f). State how energy lost through eddy currents is minimized in a transformer. (1 mark)

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14. (a).State Snell's law. (1 mark)

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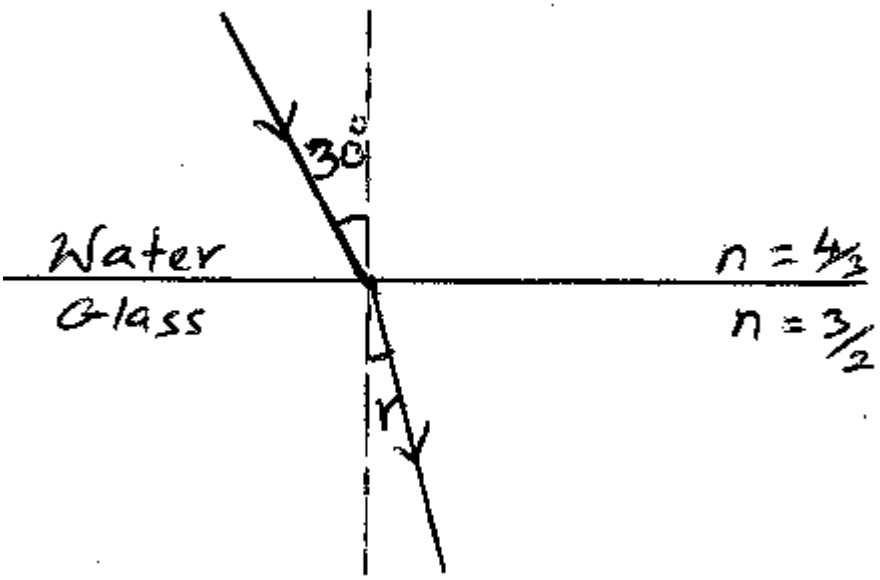
(b). A ray of light travelling from water to glass makes an angle of incident of 30° as shown below.



Determine the angle of refraction in the glass. (3 marks)
(Refractive index of water = $^{4}/_{5}$ and Refractive index of glass = $^{3}/_{2}$)

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(c). State the necessary and sufficient conditions for total internal reflection to occur. (2 marks)

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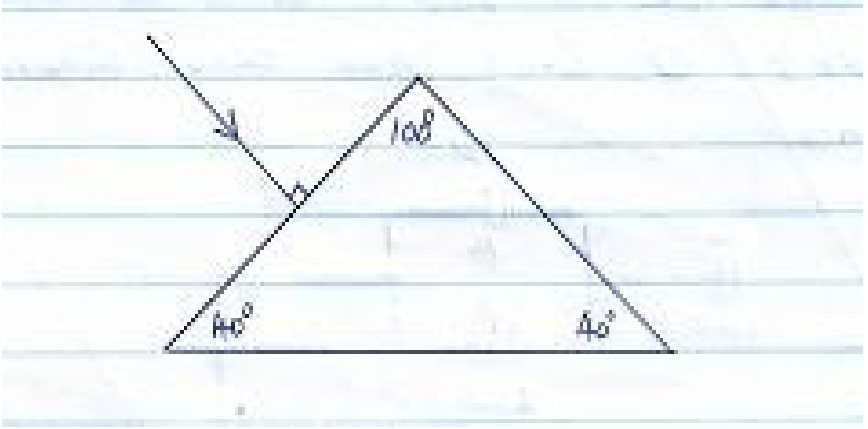
(d). The figure below shows a ray of Light incident on an isosceles triangle of right angle.



Complete the diagram to show how the ray travels through the Prism. Take the critical angle of the glass prism to be 39°. (2 marks)

(e). State two advantages of optical fibre when used in communication over ordinary copper wires. (2 marks)

……

……

15. (a). Define work function (1 mark)

……

……

(b). Name two factors that affect photoelectric effect. (2 marks)

……

……

(c).The threshold frequency of sodium is 5.6×10^{14}Hz. Planks constant 6.63×10^{-34}Js. Find

(i). Work function of sodium. (2 marks)

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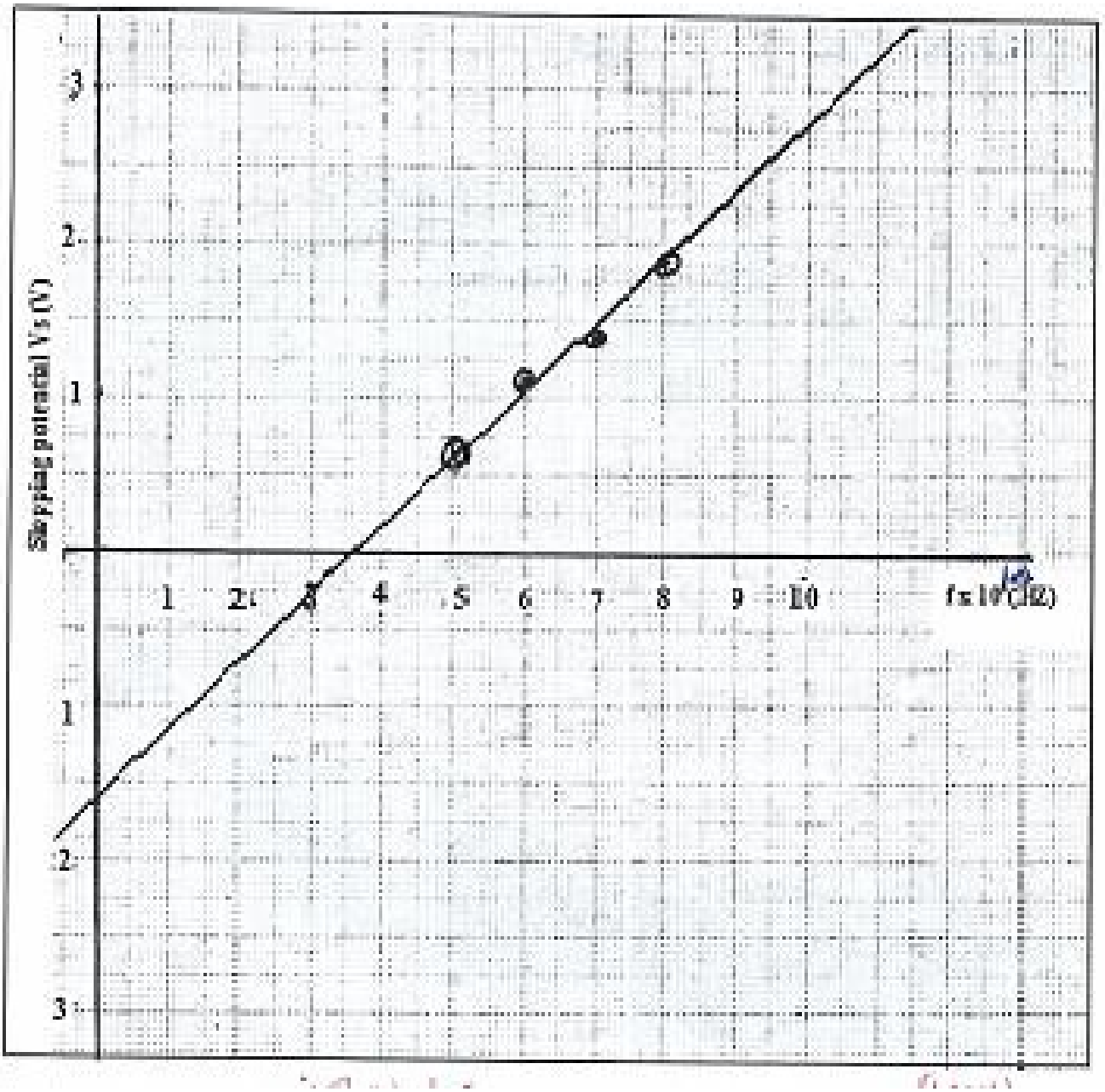
……..

(d). A certain metal is illuminated with radiation of different frequencies and corresponding stopping potential determined. The graph below shows how the stopping potential vary with frequency. (Electronic charge, $e = 1.6 \times 10^{-19}$c)



Using the graph determining

(i). Threshold frequency. (1 mark)

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(ii).Planks constant. (3 marks)

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(iii). Work function of the metal. (3 marks)

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16. (a).Distinguish between nuclear fusion and nuclear fission. (1 mark)

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(b). The equation below represents a nuclear reaction

$$^{218}_{84}Po \dashrightarrow {}^{218}_{85}A + {}^{p}_{q}y$$

(i). Determine the values of P and q. (2 marks)

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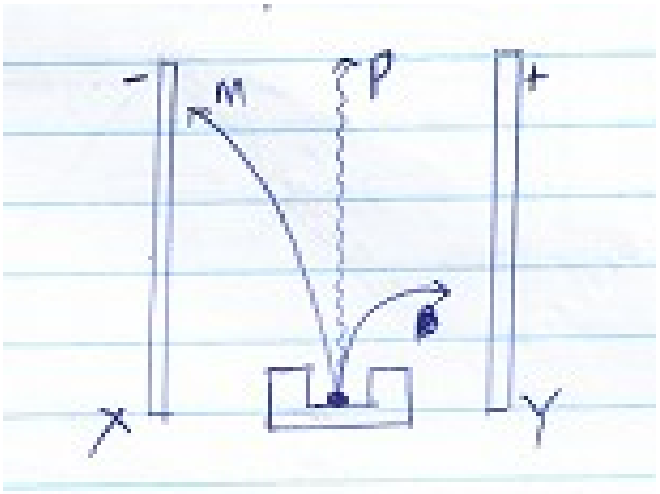
(c). The figure below represents diffusion of various radiations from a radioactive source S placed in an electric field between two plates X and Y (1 mark)



Identify the radiations marked with letters M and P. (2 marks)

M .....

P ……..

(d). Given that 5g of cobalt-60 is kept in a laboratory and it has a half-life of 5 years. Determine the mass that will have decayed after 15 years. (3 marks)

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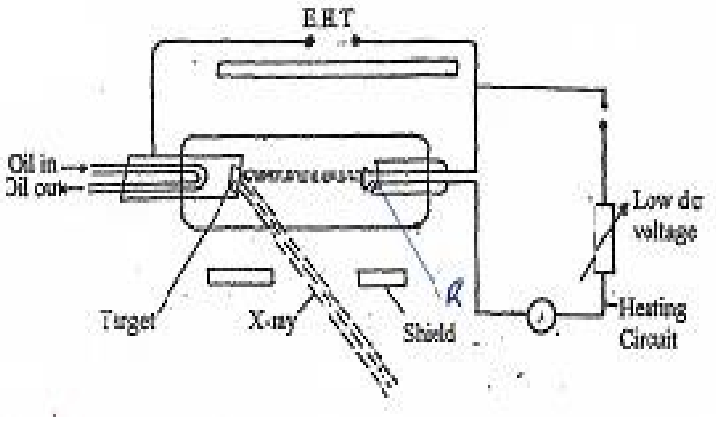
17. The figure below represent the important parts of an x-ray tube used in an industry



(a). Name the part labelled R. (1 mark)

……

(b). Name a suitable material used for the target, give reason for your answer. (2 marks)

……

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(c). State the reason why R is concaved in shape. (1 mark)

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(d). Explain how x-rays are produced in the x-ray tube. (3 marks)

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(e). Explain why the x-ray tube should be evacuated. (1 mark)

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……

(f). The shields are usually made from lead metal.
Explain why lead is the preferred material for shield. (1 mark)

……

……

……

(g). Explain the effect on the x-rays produced when:
(i). The magnitude of the extra-high tension. Voltage is increased. (1 mark)

……

……

(ii). The ammeter reading is increased. (1 mark)

……
……

PAPER 3

QUESTION 1

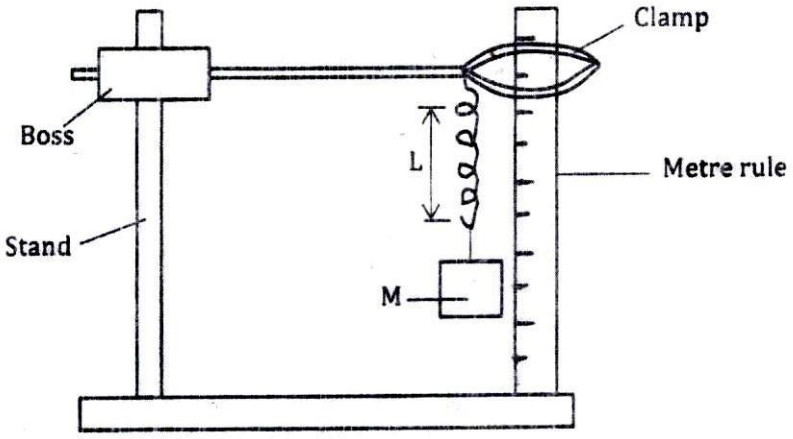
Part A

You are provided with the following apparatus.

- Helical spring with pointer.
- One clamp, one stand and one boss
- A stop watch
- One 50g mass
- Two 100g masses

Proceed as follows:

(i) Suspend the spring vertically alongside a clamped metre rule as shown in the diagram so that the pointer slide along the millimeter scale of the metre rule as shown in the figure below.



(ii) Measure the length L_o of the unloaded spring. (½ mark)

Lo - …….

(iii) Attach a mass of 100g on the spring and measure the new length L of the spring. Record this in the table. (5 marks)

Table

Mass (g)	Weight… (N)	L (M)	E = (L – L_0) (M)	K = $\frac{w}{e}$ ($\frac{N}{M}$)
100				
150				
200				

(iv) Calculate the change in length e = (L-L_o)m due to the mass of 100g and record in the table.

(v) Repeat the procedure in (i) - (iv) for mass of 150g and 200g.

(vi) Calculate the value of K given:

$K = \frac{w(N)}{e(M)}$ and find the average value of K.

K Average = (1 mark)

PART B

(i) Using the same set up as in Part A above, attach the 100g on the spring and support it to stop oscillating.

(ii) Pull the mass through a small distance vertically downwards and release it to make vertical oscillations and record the time for 10 oscillations and determine the periodic time(s).

(iii) Hence complete the table to get $T^2(S^2)$ and the value of $K = \frac{39.49\ x\ M(Kg)}{T^2(S^2)}$ where M = mass used and T^2 (S^2) is its periodic time (T) squared.

(iv) Table (3/marks)

Mass m(kg)	Time for 10 oscillations t(s)	T (s) $T = (\frac{t}{10})$	T^2 (S^2)	$\frac{39.49\ x\ M(Kg)}{T^2(S^2)}$
1.00				
1.50				
2.00				

(v) Find the average value of K (½ mark)

PART C

You are provided with the following:

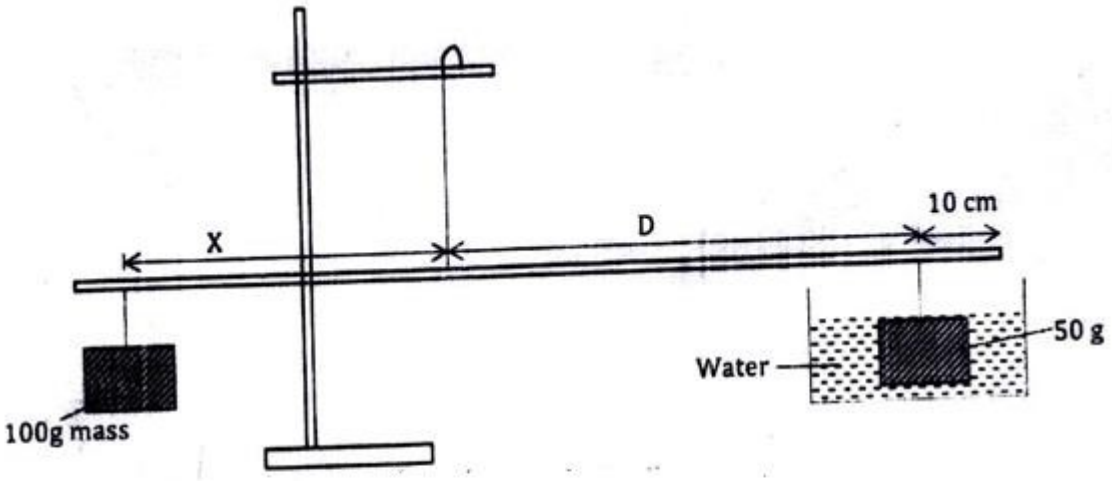
- A meter rule
- Complete stand

- One 50g mass and a 100g mass
- Three pieces of thread 30cm each.
- Some water in a beaker
- Liquid L in a beaker
- Tissue paper.

Proceed with the experiment as follows:

(i) Balance the meter rule on the stand and record the reading at this point.
Balance point = ……(1 mark)
(For the rest of the experiment, the balancing thread must be placed at this position)

(ii) Set up the apparatus as shown in the figure 4 below: Use the thread provided to hang the masses such that the positions of the support can be adjusted.



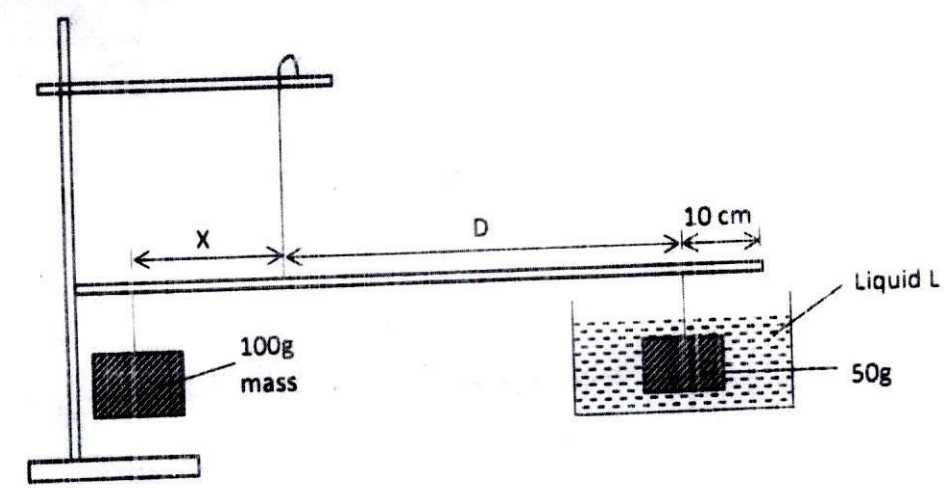
The balance point is attained by adjusting the position of the 100g mass. Note that the distance X and D are measured from the supporting string and the 50g mass is fully submerged in water.

Record the values of
X = …… (1 mark)
D = …… (1 mark)
Apply the principle of moments to determine the weight W_1 of the 50g mass in water and hence determine the upthrust U_w in water. (2 marks)

W_1 = ...
U_w = ...

Remove the 50g mass from the water and dry it using the tissue paper.

(iii).Now changing distance D obtained in (ii) balance the metre rule when the 50g mass is fully immersed in the liquid. Record the new value of the distance X.



X = …… (1 mark)

Apply the principle of moments to determine W_2 of the 50g mass in the liquid L and hence determine the upthrust U_L in the liquid. (2 marks)

W_2 = ……..

U_L = ……..

(iv) Determine the relative density R.D of the liquid L given that: (1 mark)

$$R.D = \frac{UL}{Uw}$$

(v) Find the density of liquid L in Kg/m^3 (1 mark)

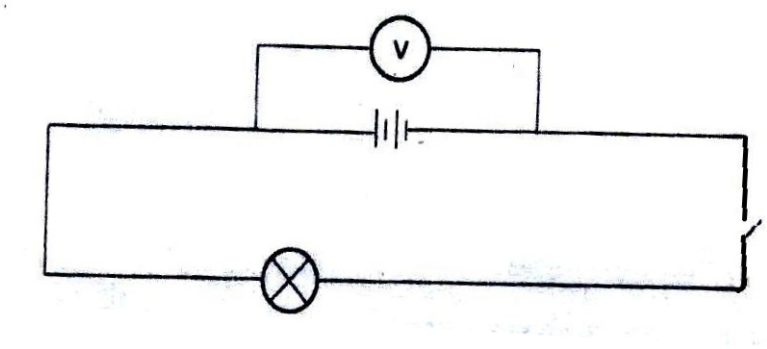
QUESTION 2

You are provided with the following apparatus

- Two dry cells and a cell holder
- A voltmeter
- An ammeter (0-1A)
- Potentiometer P
- A bulb and bulb holder
- 7 connecting wires
- 4 crocodile clips
- A switch S

PART A

Set up the circuit as shown below.
Ensure the switch is off.



(i) Record the reading of the voltmeter when the switch is open (1 mark)

V_1 ……

(ii) Close the switch and record the voltmeter reading. (1 mark)

V_2 .....

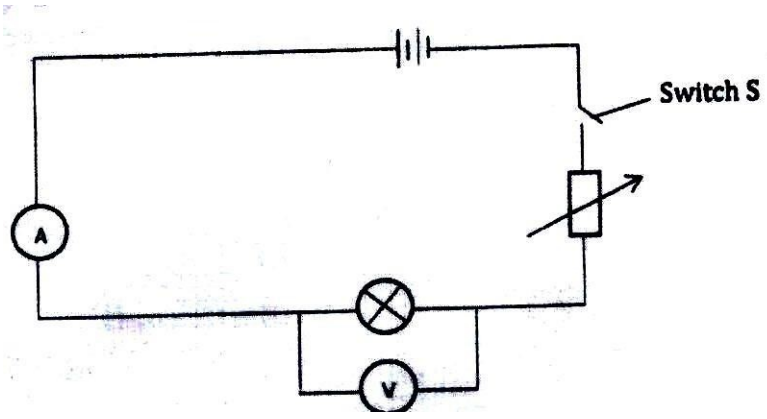
(iii)Explain the differences in the value of V_2 and V_1 (1 mark)

……
……
……..

PART B

a) Set up the circuit as shown below.

P



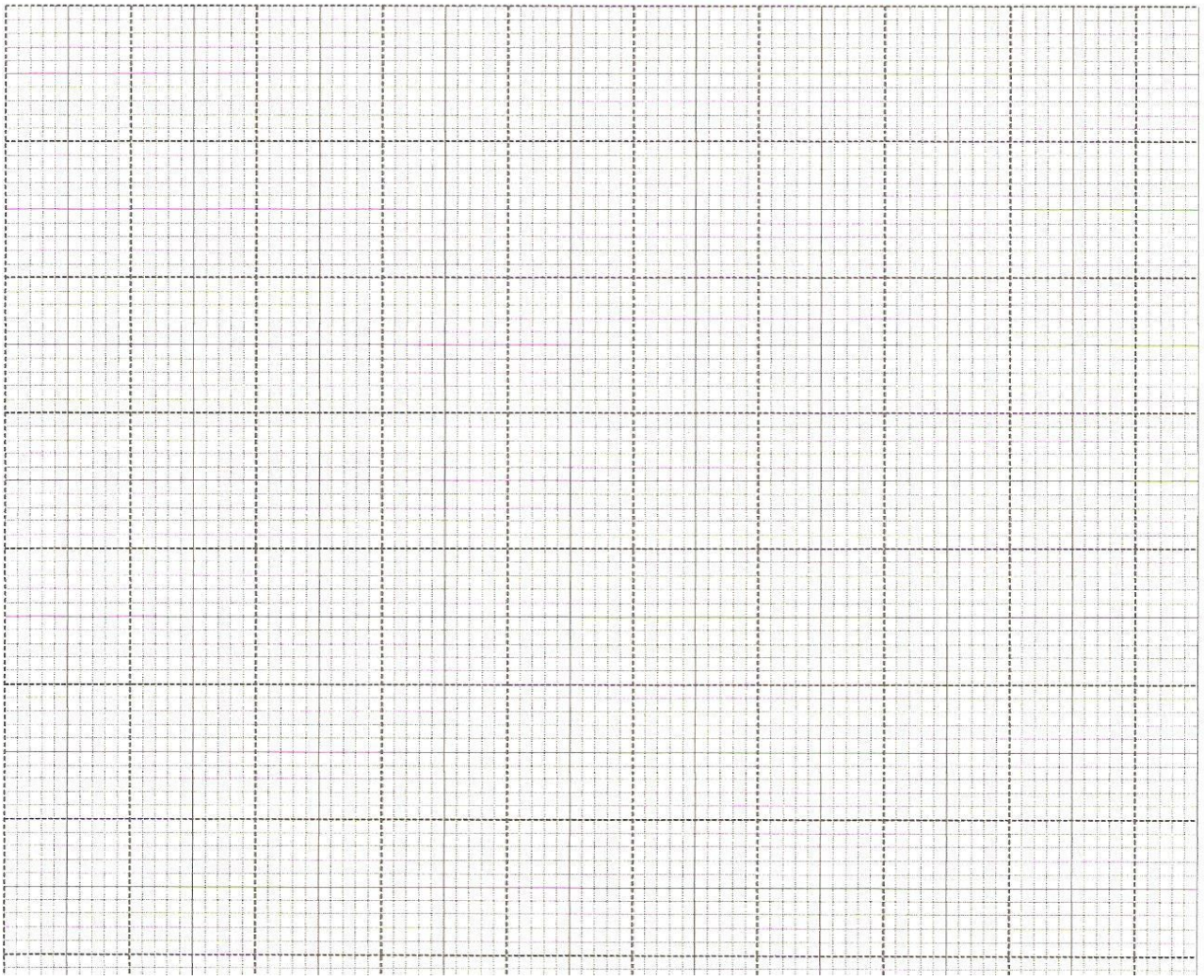
Close the switch S and adjust the potentiometer P till the bulb lights brightest. Record the ammeter and voltmeter reading.

I ……(½ mark)
V ……..(½ mark)

b) (i) By adjusting the potentiometer P obtain the corresponding ammeter readings of the values of voltmeter readings given in the table. (4 marks)

Volts (V)	1.5	1.4	1.2	1.0	0.8	0.6	0.4	0.2
Current I (A)								

(ii) Plot a graph of voltage against current. (4 marks)



(iii)Determine the resistance of the bulb when voltage is 0.9v. (2 marks)

(iv)Explain the nature of the curve in the graph. (1 mark)

……
……
……....

PART C

You are provided with the following:

- A lens holder
- Convex lens
- A white screen
- A metre rule
- A candle

Proceed as follows:

(i) Set up the apparatus as shown in **Figure 4**

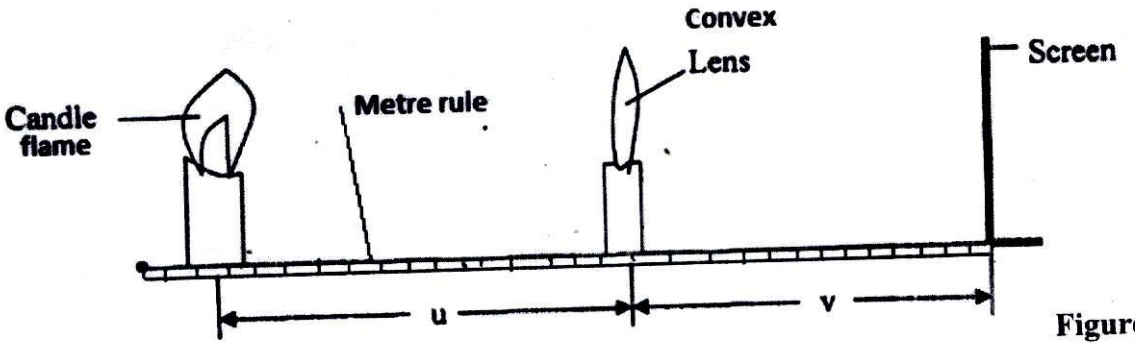


Figure 4

(ii) Starting with u=30 cm, adjust the position of the screen to obtain a sharp image of the candle flame. Record the value of v in Table 3.

Repeat the procedure for u-50 cm. Complete Table 3 (3marks)

u (cm	v(cm)	$m = \frac{v}{u}$
30		
50		

Table 3

(iii)Given that the focal length f of the lens satisfies the equation $f = \frac{v}{m+1}$, determine the average value of the focal length, f. (2 marks)

KCSE REPLICA 3
PAPER 1

SECTION A (25 MARKS)

1. Figure 1, shows a Vernier caliper of zero error 0.02 cm being used for measuring the diameter of a cylindrical container of height 10 cm. The scale reading of the Vernier is as shown alongside.

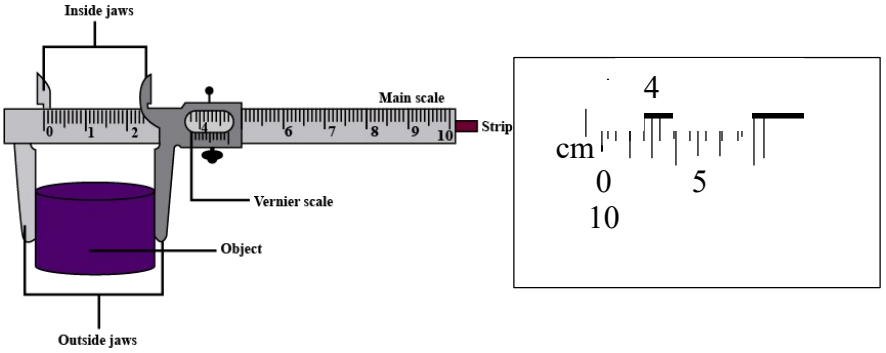


Figure 1

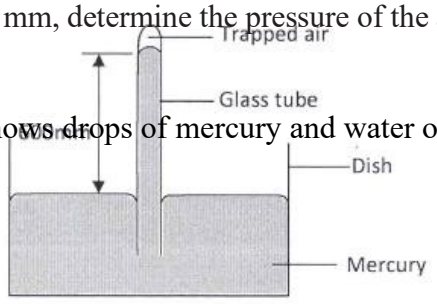
a. Determine the diameter of the container (2 marks)

b. Estimate the volume of a liquid which can completely fill the container (2 marks)

2. State **one** factor that affects the turning effect of a force on a body. (1 mark)

3. **Figure 2** shows some air trapped by mercury in a glass tube. The tube is inverted in a dish containing mercury.

Given that the atmospheric pressure is 760 mmHg and the height of mercury column in the tube is 600 mm, determine the pressure of the air trapped in the tube in mmHg. (2 marks)



4. Figure 3 shows drops of mercury and water on a glass surface, Explain the difference in the shapes of the drops.

(2marks)

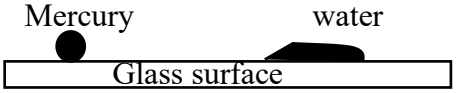


Figure 3

5. A ball is thrown from the top of a cliff 20m high with a horizontal velocity of $10ms^{-1}$. Calculate the distance from the foot of the cliff to where the ball strikes the ground. (3 marks)

6. Explain o**n**e advantage of mercury over alcohol as a thermometric liquid. (1mark)

7. A body of mass **M** is allowed to slide down an inclined plane. State **two** factors that affect its final velocity at the bottom of the inclined plane. (2marks)

8. A stopwatch reads 08:10:84 and 09:10: 90 before and after an experiment respectively. Determine the duration of the event in SI units. (2marks)

9. Explain the meaning of thermodynamics as a branch of physics. (1 mark)

10.
   a. State the Hooke's Law. (1mark)

   b. **Figure 4** shows identical spiral springs supporting a load of 90N. Each spring has a spring constant k = 200N/m

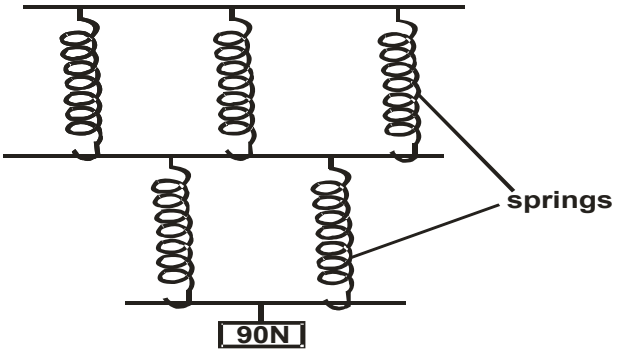


Figure 4

Determine the total extension of the system (take the weight of the cross bars and springs to be negligible) (2 marks)

11. **Figure 5** shows a rectangular loop with a thin thread loosely tied and dipped into a soap solution.

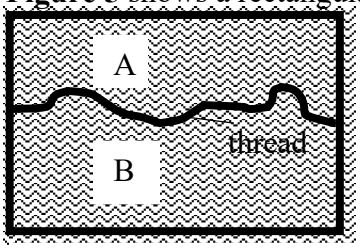


Figure 5

Draw on the space provided what is observed when point **A** is punctured. (1mark)

12. Two horizontal strings are attached to a block, resting on a frictionless surface, as shown in figure 6.

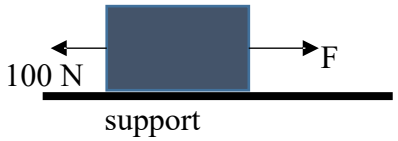


Figure 6

A force of 100N pulls on one string. The block does not move. Find the value of the force, F on the other string. (1 mark)

13. A wooden bench feels neither warm nor cold when touched by your bare hands. Explain this observation. (2 marks)

SECTION B (55 MARKS)

14.

a) Explain why bodies in circular motion undergo acceleration even when their speed is constant. (1mark)

b) A particle moving along a circular path of radius 5cm describes an arc of length 2cm every second. Determine:

i. Its angular velocity. (1mark)

ii. Its periodic time. (2marks)

c) A stone of mass 150g is tied to the end of a string 80cm long and whirled in a vertical circle at 2rev/s. Determine the maximum tension in the string. (3marks)

d) State **one** factor affecting centripetal force (1mark)

e) State the principle of conservation of linear momentum (1 mark)

f) A bullet of mass 60g is fired horizontally with a velocity of 200 m/s into a suspended stationary wooden block of mass 2940g. Determine:

i. Common velocity of both the bullet and the block, if the bullet embedded into the block. (2 marks)

ii. Height to which the block rises. (2 marks)

15.

a) State two factors that affect the boiling point of a liquid (2 marks)

b) 100g of a liquid at a temperature of 10^0 C is poured into a well lagged calorimeter. An electric heater rated 50W is used to heat the liquid. The graph in figure 7 shows the variation of the temperature of the liquid with time.

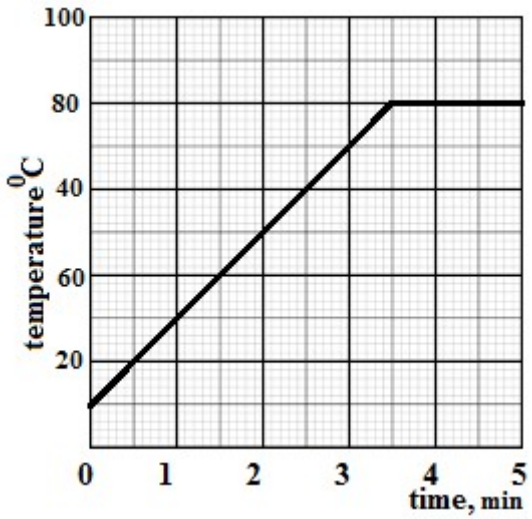


Figure 7

(i) From the graph, determine the boiling point of the liquid (1 mark)

(ii) Determine the heat given out the by the heater between the times t = 0.5 minutes and t = 5.0 minutes (3 marks)

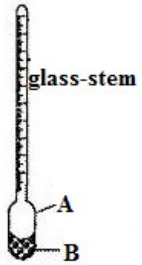
c) From the graph determine the temperature change between the times t = 0.5 minutes and t = 5.0 minutes, hence determine the specific heat capacity of the liquid (3 marks)

d) 1.8 g of vapor was collected from above the liquid between the times t= 3.5 minutes and t= 4.5 minutes. Determine the specific latent heat of vaporization of the liquid (4 marks)

16.

a) State the law of floatation (1 mark)

b) Figure 8 below shows a simple hydrometer



A ……

B ……

Figure 8

i. Identify the parts labelled A and B (2 marks)

ii. State the purpose of the part labelled B (1 mark)

c) How would the hydrometer be made more sensitive? (1 mark)

d) Describe how the hydrometer is calibrated to measure relative density (3 marks)

e) Figure 9 shows a cork floating on water and held to the bottom of the beaker by a thin thread.

i. Name the forces acting on the cork (3 marks)

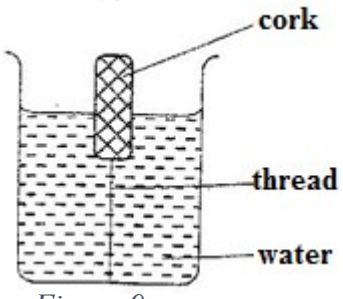


Figure 9

ii. Describe how each of the forces mentioned in (i) above changes when water is added until the container is completely filled (3 marks)

17.

a) Figure 10 shows a graph of pressure against volume for a fixed mass of a gas at constant temperature.

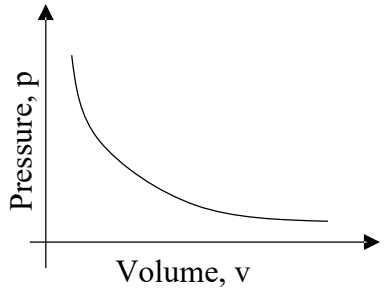


Figure 10

In the space provided, sketch a graph of pressure, p against $\frac{1}{v}$ (1 mark)

b) Explain the pressure law using the kinetic theory of matter (3 marks)

c) $20cm^3$ of a gas exerts a pressure of 760mmHg at 25^0C. Determine the temperature of the gas when the pressure increases to 900mmHg and the volume decreases to 15 cm^3. (3 marks)

18.

a) Define the term velocity ratio of a machine (1 mark)

b) The figure 11, below shows part of the hydraulic lift system. State any **one** property of the liquid under which the hydraulic system works (1 mark)

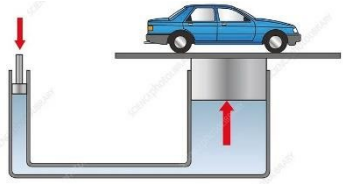


Figure 11

c) The hydraulic lift machine above has velocity ratio 45 and it overcomes a load of 4500 N when an effort of 135 N is applied. Determine:

i. The mechanical advantage of the machine (2 marks)

ii. Efficiency of the machine (3 marks)

iii. The percentage of work that goes to waste (1 mark)

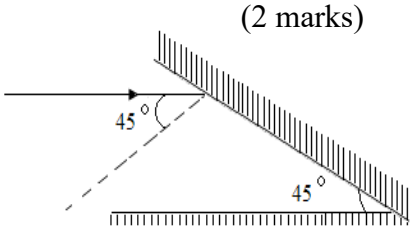
PAPER 2

SECTION A 25 MARKS

Answer all the questions in the spaces provided.

1. The figure below shows a ray of light incident on a mirror at an angle of 45°. Another mirror is placed at an angle of 45° to the first one as shown. Sketch the path of the ray until it emerges.

(2 marks)



50 **for marking sch**

2. State any two ways of reducing the magnetic force of attraction of a magnet (2 marks)

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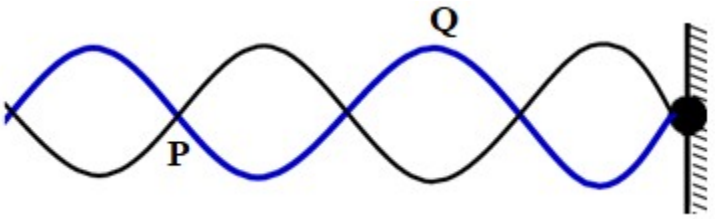
3. The figure below shows a transverse stationary wave along a string.



Name P and Q and explain how each is formed. (3 marks)

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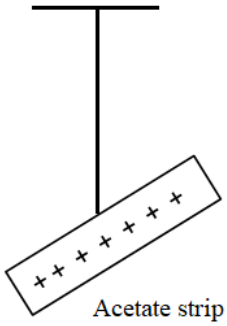
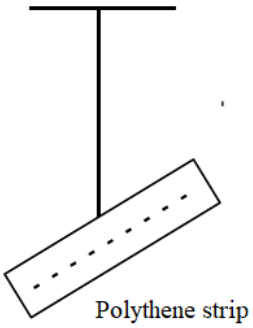
4. The diagrams below show a positively charged acetate strip and a negatively charged polythene strip freely suspended and isolated.



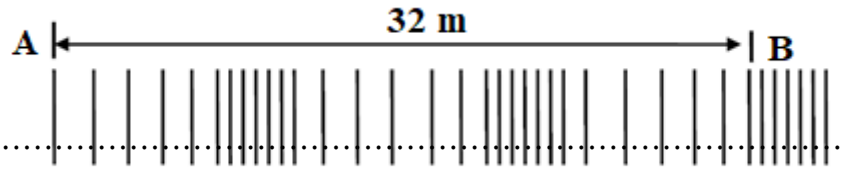


Two rods X and Y are brought up in turn to these strips. X attracts the acetate strip but repels the polythene strip. Rod Y does not repel either the acetate or the polythene. State the type of charge on each rod.

X ..... (1 mark)

Y ..... (1 mark)

5. The diagram below shows waves generated from a tuning fork. If the wave takes 0.1 second to move from point A to B. determine the frequency of the wave. (4 marks)



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6. Name two detectors of microwave (2 marks)

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……

7. Other than current state two other factors that affect the magnitude of force on a current carrying conductor placed in a magnetic field. (2 marks)

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……..

8. Give a reason why a concave mirror is not preferred as a driving mirror. (1 mark)

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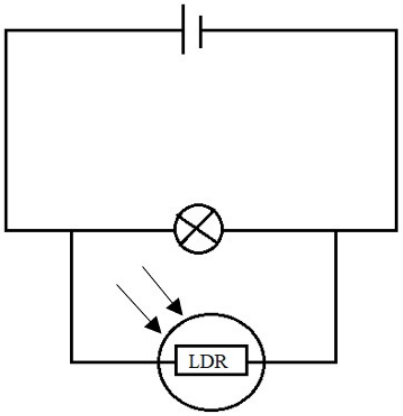
9. A student connected the set up below in the laboratory. Explain the observation made on the bulb when the set-up below is taken to a dark room (2 marks)



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10. A person standing 110 m from the foot of a cliff claps his hands and hears a sound 0.75 seconds later. Find the speed of sound in air. (3 marks)

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11. The figure below is part of electromagnetic spectrum.

A		Visible light	UV	

Identify radiation A and state its source. (2 marks)

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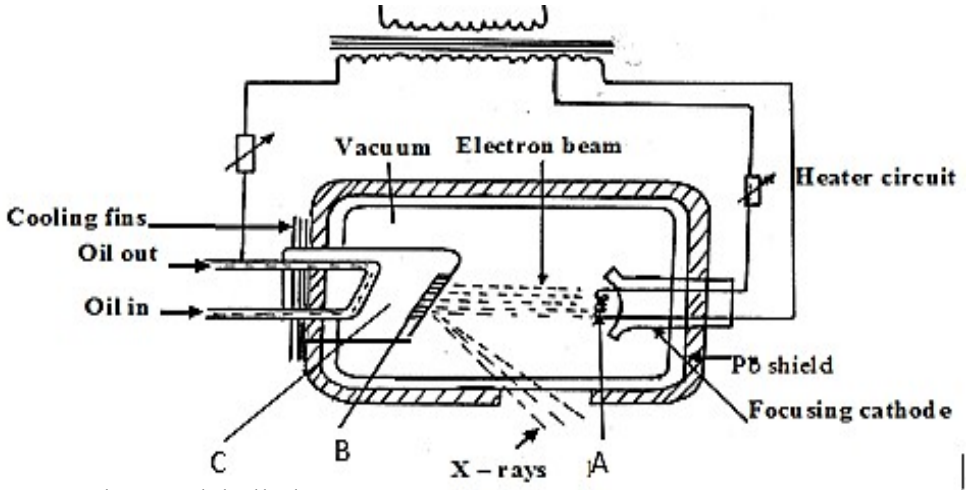
SECTION B 55 MARKS

Answer all the questions in this section in the spaces provided.

12. (a) The figure below shows a X-ray tube.



(i) Name the part labelled C (1 mark)

……

(ii) State the property of the material labelled B on the diagram which makes it suitable for use in the X-ray tube. (1 marks)

……

……

(iii) Why is C inclined at an angle of 45º? (1 mark)

……

……

(iv) State the adjustment that can be made to vary

I. The quality of X-rays (1 mark)

……

……

II. The quantity of the X-rays. (1 mark)

……

……

(v) An x-ray tube has an accelerating potential of 100KV. Determine the maximum frequency of the x-rays produced.

(Plank's constant = 6.63 × 10 $^{-34}$ Js, e = 1.6 × 10^{-19}C) (3 marks)

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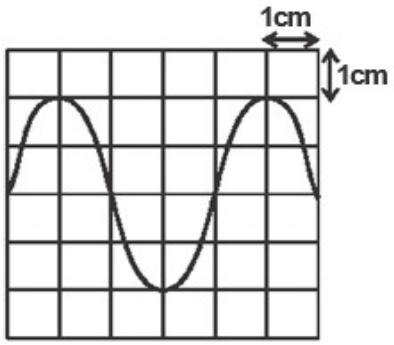
(b) In a CRO, waveform given below was displayed on the screen when the sensitivity at the Y plate was10V/cm and time base set at 20 milliseconds/cm.



Determine:

(i) peak voltage (2 marks)

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……

(ii) frequency of the signal (2 marks)

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……
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……

13. a) $88226\ Ra$ decays into $86222\ Rn$ by emission of an alpha particle. Write a nuclear equation for the decay (1 marks)

b) i)What do you understand by the term half-life of a radioactive substance? (1 mark)

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ii)A G.M tube registers 20 counts. When a radioactive source is brought close to it, it registers 3220 counts and 120 counts 30 hours later. What is the half-life of this substance?
(3 marks)

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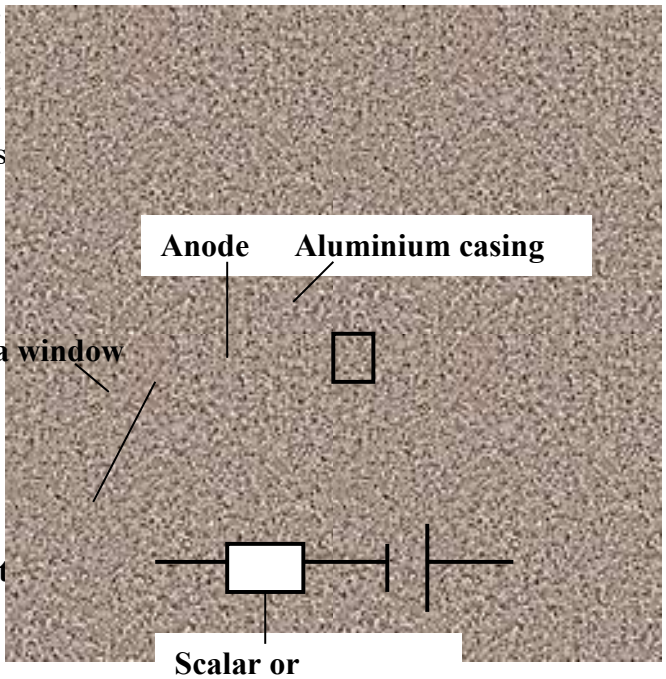
c) The figure below shows



i) What is the purpose of the mica window? (1 mark)

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ii) Explain the purpose of the bromine (2 mark)

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iii) Why should argon gas be kept at low pressure (1 mark)

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iv) What is meant by the term "*dead time*" as used in GM tube (1 mark)

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v) Briefly explain how GM tube works. (2 marks)

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14. (a) State the Ohm's Law (1 mark)

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(b) You are provided a rheostat, 2 cells, a voltmeter, an ammeter, a switch and a fixed resistor.

i) Draw a circuit diagram that can be used to verify Ohm's law. (2 marks)

ii) Describe how the above set up can be used to determine Ohms law. (4 marks)

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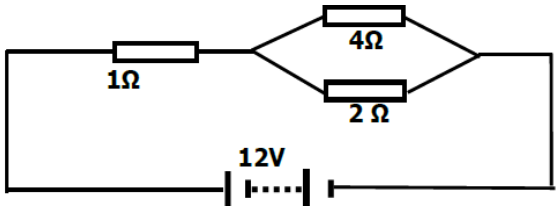
……

(b) Study the circuit diagram below and answer the questions that follow.



Calculate

(i) Determine the total resistance in the circuit. (2 marks)

……
……
……

(ii) The current through the 4Ω resistor (3 marks)

……
……
……
……
……
……

15. a) State Snell's law (1 mark)

……
……
……

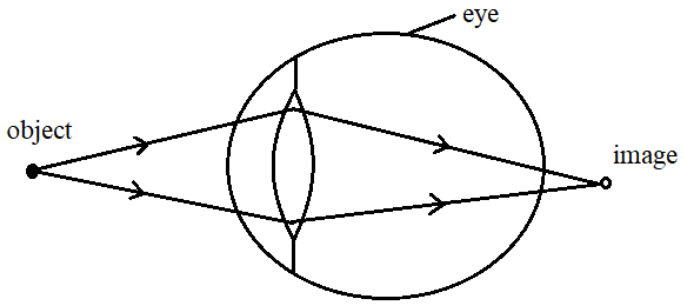
b) A ray of light travelling from water to glass makes an angle of incident of 30^0. Find the angle of refraction in the glass. Refractive index of water $= \frac{4}{3}$. Refractive index of glass $= \frac{3}{2}$ (3 marks)

……
……
……
……
……

c) State the necessary and sufficient conditions for total internal reflection to occur. (2 marks)

……
……

d) The figure below shows a human eye defect.



(i) State one possible cause of this defect. (1 mark)

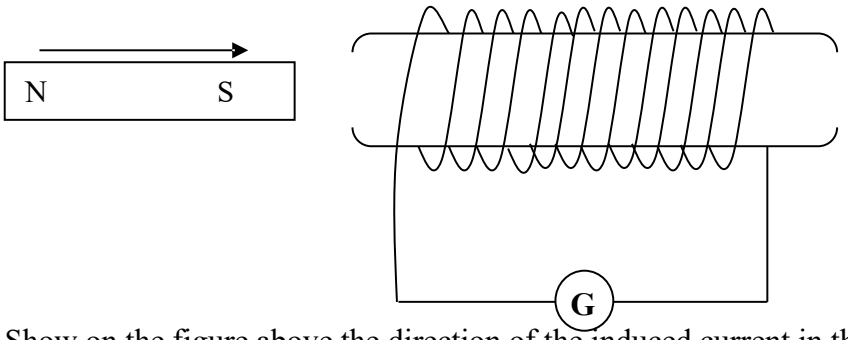
……
……
……

(ii) On the diagram, show how the defect is corrected. (2 mark)

16. (a) State the Lenz's law of electromagnetic induction. (1 mark)

……
……
……

(b) A bar magnet is moved into a coil of an insulated copper wire connected to a zero centre galvanometer as shown below



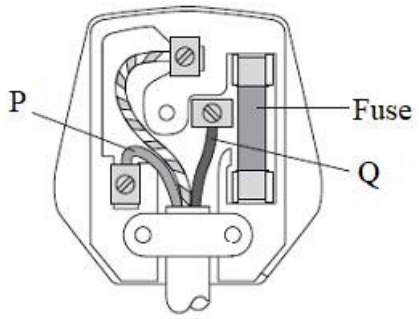
(i) Show on the figure above the direction of the induced current in the coil
(1 mark)

(ii) State and explain what is observed on the galvanometer when the south pole of the magnet is moved into and then withdrawn from the coil. (2 marks)

……
……
……

(c) A transformer has 800 turns in the primary and 40 turns in the secondary winding. The alternating voltage connected to the primary is 240V and current of 0.5.A. If 10% of the power is dissipated as heat within the transformer, determine the current in the secondary coil.
(3 marks)

(d) The diagram below shows a three-pin plug.



(i) Name the colour of conductors P and Q (2 marks)

P……Q……
……

(ii) Why is the earth pin longer than the rest in the three-pin plug shown above?
(1 mark)

PAPER 3

QUESTION ONE

You are provided with the following apparatus:

- Two new size 'D' dry-cells
- switch
- milli-ammeter
- voltmeter (0-3V)
- two enameled copper rods
- rheostat ($0 - 100\Omega$)
- eight connecting wires with at-least 4 fitted with crocodile clips
- Micrometer screw-gauge (to be shared)
- 50 ml beaker (labelled, A)
- 75 ml of distilled water (labelled, B)
- solid X
- Measuring cylinder
- Thermometer
- Glass-rod for stirrer
- Sand-paper

Proceed as follows:

a) Measure the temperature of the distilled water in beaker, B

Temperature, θ = ... (1 mark)

b) Place the provided solid X into the beaker labelled, A. measure 50 ml of the distilled water and gently pour it into beaker A and stir gently until all the solid X is dissolved to form solution, C.

c) Measure the diameter, d of one of the copper rods.

i. diameter, d = ... m (1 mark)

ii. determine the cross-section area, A of the copper rod (2 marks)

A =

d) Using the sand paper, remove the insulating coating at the both ends of each of the copper rods. Now set-up the apparatus as shown in figure 1 below.

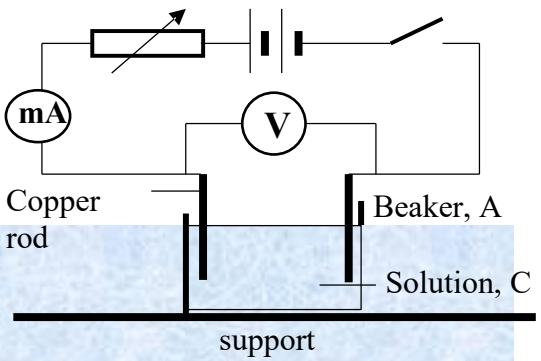


Figure 12

e) With the help of the rheostat, set the current value to 30 mA and measure its corresponding voltage, V.

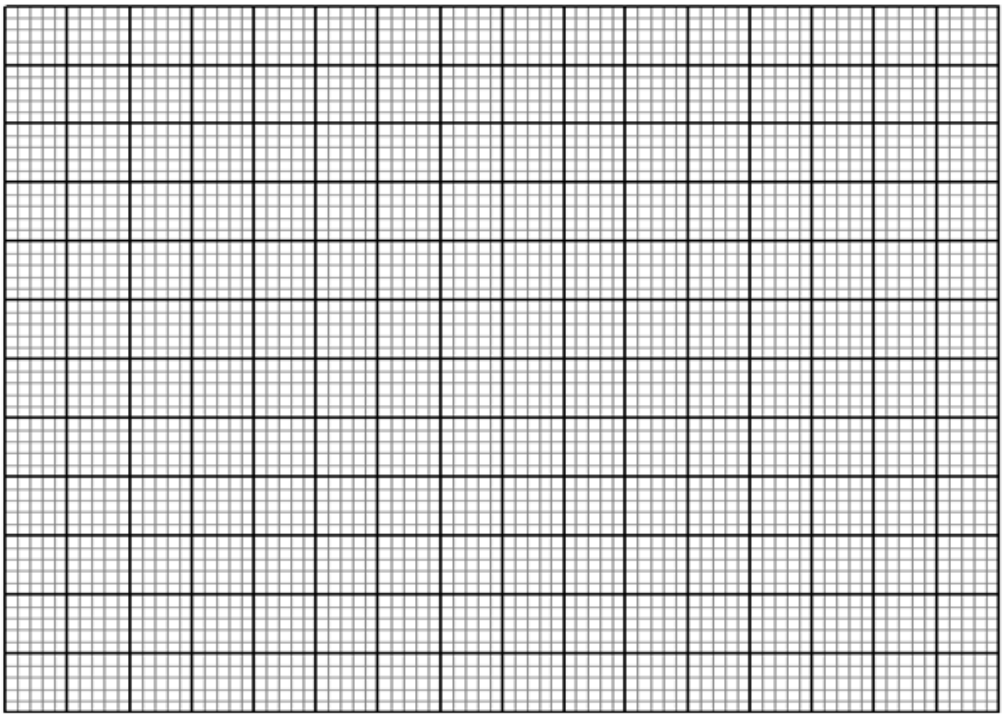
V = ... (1 mark)

f) Repeat the above procedure for the values of current indicated in the table, 1 below and note their corresponding voltages. Complete the table. (5 marks)

Table 1

Current, I (mA)	**30**	**40**	**50**	**60**	**70**
Current, (A)					
Voltage, V					

g) In the grid provided, plot a graph of voltage (y-axis) against current (A) (X-axis) (5 marks)



h) Determine the slope, S of the graph (3 marks)

i) The voltage and current are related by the equation: $V - \frac{bI}{A} = 0$

Determine the value of b. (2 marks)

$b =$ .....

QUESTION TWO

You are provided with the following apparatus:

- Complete retort-stand (clamp, boss and stand)
- Half metre-rule
- Metre-rule
- G-clamp
- Office pin
- Four 100g masses (or its equivalent)
- Some celotape
- Vernier calipers (to be shared)
- String/thread (about 30 cm long)
- One 50g mass
- Knife-edge

PART A

Proceed as follows:

a) Arrange the apparatus as shown in figure 2, below. Ensure the 10 cm mark of the half metre-rule is at the edge of the table and firmly held by the G-clamp while the pin (pointer) is at the 90 cm mark on the scale of the metre-rule. (The clamp should not be removed for the entire duration of carrying-out this experiment

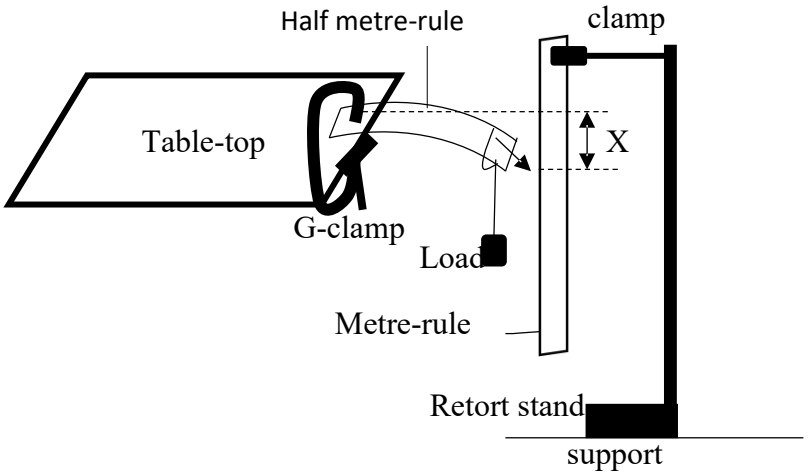


Figure 13

b) Suspend one 100 g mass at the 49.5 cm mark and record the new pointer reading, P_1

P_1 =..... (1 mark)

c) Continue adding the load in 100 g steps, each time recording the pointer position. Ensure that the half metre-rule is not overloaded.

d) Determine the amount of sagging, X and complete the table, 2 below. (6 marks)

Table 2

Mass (g)	Load (N)	Pointer position (cm)	Amount of sagging, X (m)
100			
200			
300			
400			

PART B

Procedure

e) Use the Vernier calipers to determine the width, a and breadth, b of the half metre-rule

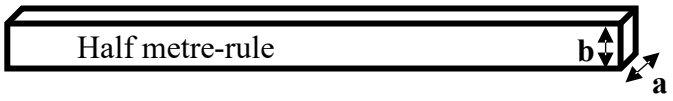


Figure 14

Width, a = ... cm (1 mark)

breadth, b = ... cm (1 mark)

f) Using a loop of thread suspend the 50g mass at the 49.5cm mark on the half-metre rule.

g) With the 50g mass fixed at that position adjust the position of the half-metre rule on the knife edge until it balances horizontally as shown in figure 4.

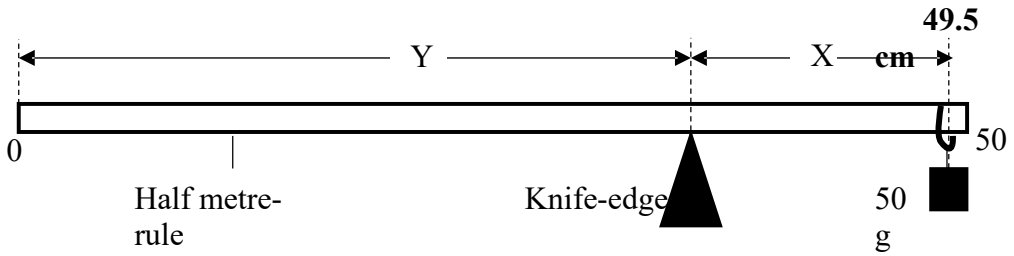


Figure 15

h) At the balance position, read off the length x and y and record in table 3.

i) Using the values of x and y obtained in 'h' above, determine the weight, W of the half metre-rule (3 marks)

W = ...

j) Move the suspended mass 2cm towards the centre of the rule and repeat parts (g) and (h) to obtain other values of x and y so as to complete table 3. (4 marks)

Table 3

Position of the mass of 50g	X (cm)	Y (cm)
49.5 cm mark		
47.5 cm mark		
45.5 cm mark		
43.5 cm mark		
41.5 cm mark		

k) Given that quantity, P is given by: $p = \frac{W}{g\ (5ab \times 10^{-5})}$; determine the value of P (3 marks)

l) State the significance of the quantity, P (1 mark)

KCSE REPLICA 4
PAPER 1
PAPER 1

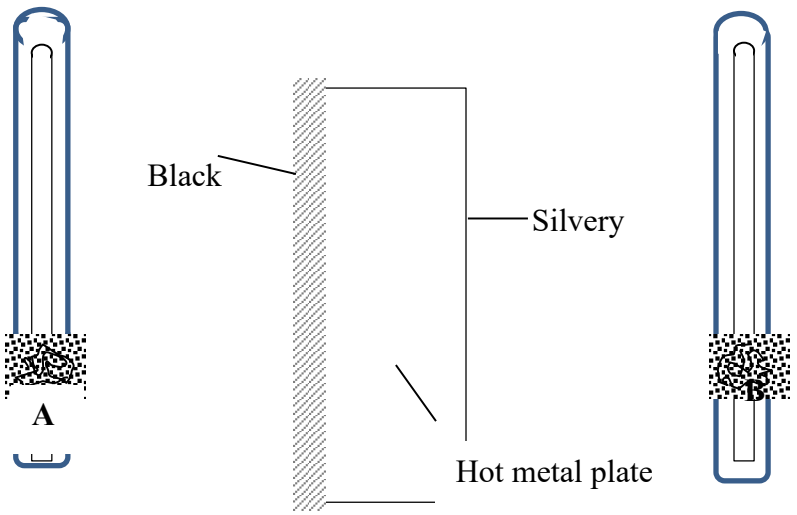
SECTION A (25 marks)

*Answer **all** the questions in this section in the spaces provided.*

1 A micrometer screw gauge with a zero error –0.02mm was used to measure the diameter of a marble whose actual radius is 2.17mm. Determine the reading expected and hence draw the scale seen on the gauge (Pitch = 0.5mm). **(2 marks)**

2 Explain the variation of density of water when its temperature falls from 10°C to freezing point. (2 marks)

3 The figure below shows two identical thermometers **A** and **B** placed near and at equal distances on either sides of a hot metal plate painted black on the side **A** and silvery on side **B**.

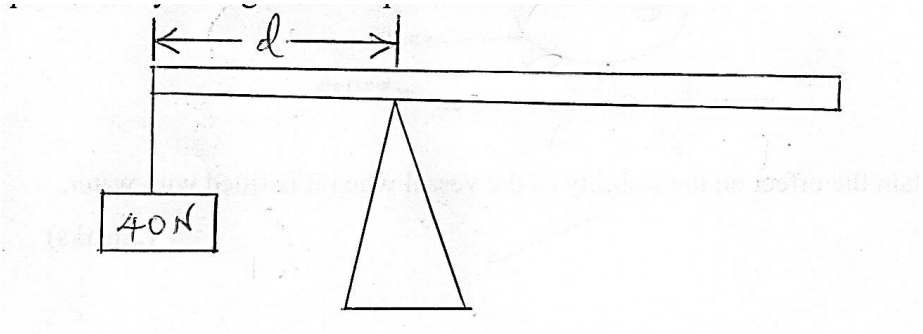


State and explain the observation made on the reading of the thermometers after some minutes. **(2 marks)**

4 A body is acted upon by a force of 10N towards the right hand side and 6N towards the left hand side. Determine the resultant force. (2marks)

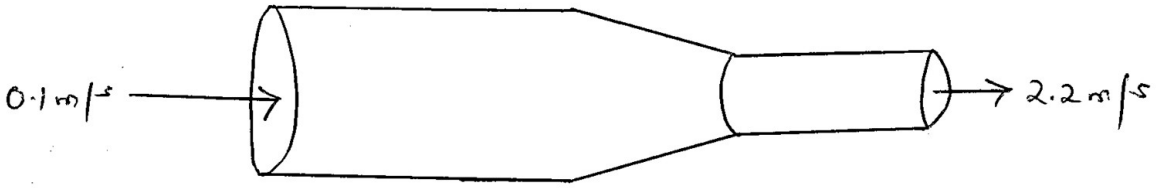
5 The figure below a uniform wooden plank of length 4m and weight 10N. The plank is held at equilibrium by a weight of 40N placed at one end as shown.

D



6 The figure shows a non-viscous fluid that is not compressible moving through a pipe of varied cross-sectional area.

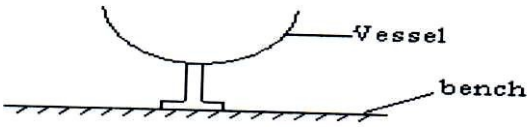
If



7 State the S.I unit of luminous intensity. (1mark)

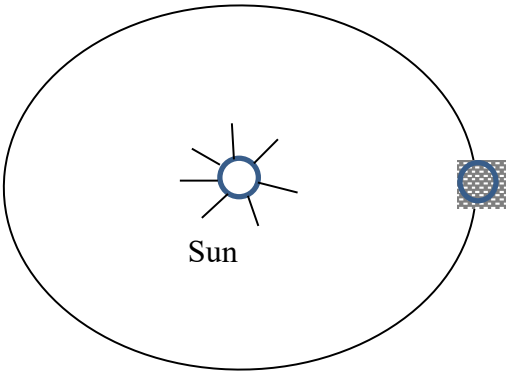
8 In terms of intermolecular forces, explain the difference between liquid and gaseous state. (2marks)

9 The figure shows a vessel resting on a horizontal bench.



State and explain the effect on the stability of the vessel when it is filled with water. (2marks)

10 The figure below shows a planet Venus orbiting the sun in a circular orbit at constant speed.

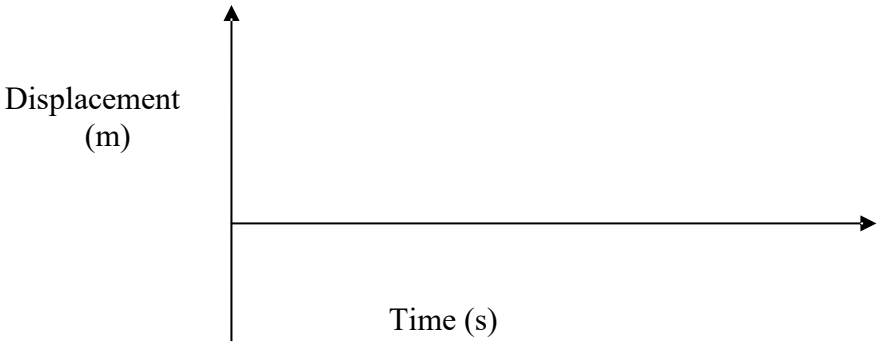


Venus

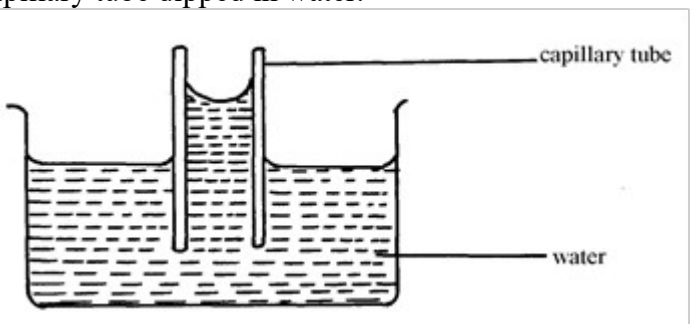
(i) State what provides the centripetal force. **(1 mark)**

(ii) Indicate the direction of centripetal force on the planet. **(1 mark)**

11 On the axes below, sketch displacement time graph for an accelerating body. (1mark)



12 The figure shows a capillary tube dipped in water.



State **two** differences that will be observed when water is replaced with mercury in the set up above. (2 marks)

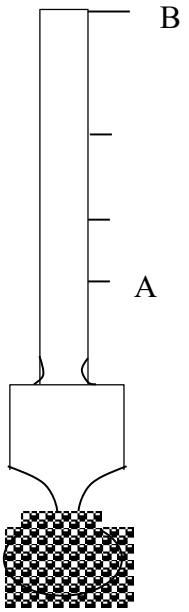
13 Water is known to boil at 100^0C. A student heated some water and noticed that it boiled at 101^0C. State two possible reasons for this observation. **(2 marks)**

SECTION B (55 marks)

*Answer **all** the questions in this section in the spaces provided.*

15 (a) State Archimedes' principle. (1mark)

(b) The figure shows a hydrometer.



(i) State the reason why lead shots are fixed at the bottom of hydrometer.
(1 mark)

(ii) State the letter in the figure which represents a greater density.
(1 mark)

(c) An ordinary hydrometer of mass 30g floats with 4cm of its stem out of the water. The area of the cross – section of the stem is 0.90 cm^2. Taking density of water= 1.0g/ cm^3.
Determine the:

(i) mass of the water displaced. (1mark)

(ii) Volume of water displaced. (1mark)

(iii) Volume of stem above water. (2marks)

(iv) Total volume of the hydrometer. (2marks)

(v) Length of stem above the surface when it floats in a liquid of relative density 1.5. (2marks)

(e) A balloon is filled with a gas which is lighter than air. It is observed to rise in air up to a certain height. State a reason why the balloon stops rising.

(1 mark)

(f) The figure shows a bucket of water.

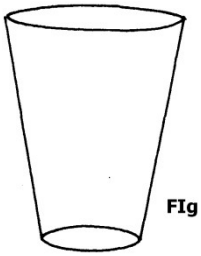


FIg 2

Explain why manufacturers prefer the shape shown above as a container for holding liquids such as water. (2marks)

16 (a) The figure shows a block hanging at rest from a ceiling by a piece of rope.

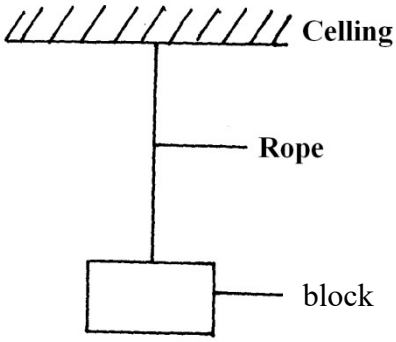


Fig. 9

Use the figure to answer question 16 (a) and (b)

(i) Both gravitational force and tensional force act on the system. State a reason for the presence of each force:

(I) Gravitational force. (1mark)

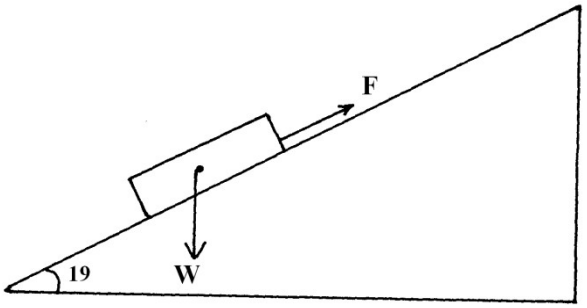
(II) Tensional force (1mark)

(ii) Air resistance and normal reaction are absent (do not act on the system). State a reason for each.

(I) Air resistance. (1 mark)

(II) Normal reaction (1mark)

(b) The figure shows a brick resting on an incline plane at an angle θ to the horizontal. The weight W and the frictional force, F_r are shown.

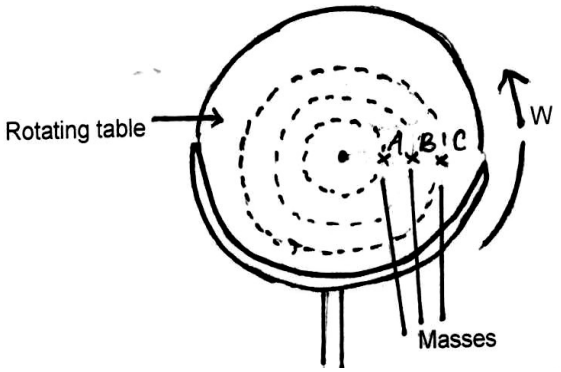


(i) On the same diagram show with an arrow one other force acting on the block and name the force. (1mark)

(ii) A runway for an airport is designed such that the lowest acceleration rate for the plane is $3m/s^2$. The take off speed for the plane is 65m/s. Determine the minimum length for the runway. (2 marks)

(c) A motor cyclist wears a helmet lined on the inside with sponge. Explain how this minimizes injuries to the motorists head when involved in an accident.
(2 marks)

17 (a) The figure below shows masses A, B and C placed at different points on a rotating table.



The angular velocity ω, of the table can be varied.

(i) State **<u>two</u>** factors that determine whether a particular mass slides off the table or not. (2marks)

(ii) It is found that the masses slide off at angular velocities ω_A,$\omega\omega_B$ and ω_C respectively. Arrange the values of ω_A, ω_B and ω_C in decreasing order. (1mark)

(b) A block of mass 200g is placed on a frictionless rotating table while fixed to the centre of the table by a thin thread. The distance from the centre of the table to the block is 15cm. If the maximum tension the thread can withstand is 5.6N, determine the maximum angular velocity the table can attain before the thread cuts. (4marks)

(c) State pressure law of an ideal gas. **(1 mark)**

(d) When the temperature of a gas in a closed container is raised, the pressure of the gas increases. Explain how the molecules of the gas cause the increase in pressure.
(2 marks)

(e) State **one** assumption for the experiments carried out to verify the gas laws.
(1 mark)

(f) A constant mass of hydrogen gas occupies a volume of 4.0 cm^3 at a pressure of $2.4 \times 10^5 Pa$ and temperature of 15^0C. Determine its volume at a pressure of $1.6 \times 10^5 Pa$ when the temperature is doubled. **(3 marks)**

18 (a) State what is meant by specific latent heat of vaporization. (1mark)

(b) In an experiment to determine the specific latent heat of vaporization of water, steam at 100 ^{0}C was passed into water contained in a well lagged copper calorimeter.
The following measurements were made:-

Mass of calorimeter	=	50g
Initial mass of water	=	70g
Initial temperature of water	=	5^0C
Final mass of water + Calorimeter + condensed steam	=	123g
Final temperature of mixture	=	30^0C
Specific heat capacity of water	=	4200JKg^{-1}k^{-1}
Specific heat capacity of copper	=	390 JKg^{-1}k^{-1}

(i) Determine the:-
(I) Mass of condensed steam (2marks)

(II) Heat gained by water and calorimeter. (2marks)

(ii) Given that L is the specific latent of heat of vaporization of steam:

(I) Write an expression for the heat given out by steam. (1mark)

(II) Determine the value of L. (2marks)

(c) The figure shows two similar containers with equal amounts of methylated spirit at room temperature. A draught is blown over container A and their temperatures taken after sometime.

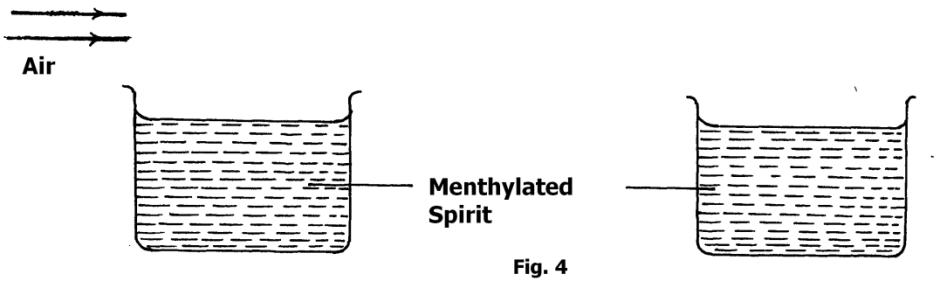


Fig. 4

State and explain one that will have a lower temperature. (2marks)

19 (a) Two gear-wheels have 80 teeth and 20 teeth and they lock with each other. They are fastened on axles of equal diameter such that equal weight of 150N attached to the string around the axle will just raise 450N on the other axles.

Determine:

(i) the mechanical advantage. (2marks)

(ii) the velocity ratio. (2marks)

(iii) The efficiency of this machine. (2marks)

(b) State any **one** possible way of increasing velocity ratio of wheel and axle. (1mark)

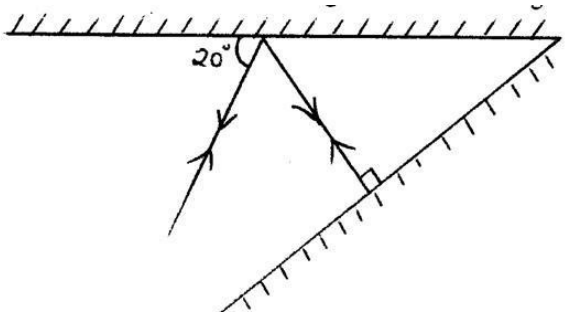
(c) A Loudspeaker is a transducer. Explain. (1mark)

PAPER 2

SECTION A (25 marks)

*Answer **all** the questions in this section in the spaces provided.*

1 The figure shows the path of light after striking two mirrors at an angle.

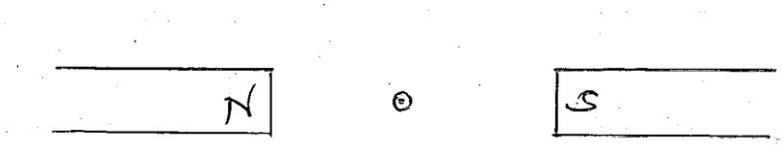


Dete.. (1 mark)

2 In a textile industry, the machines experience electrostatic forces at certain points. Suggest **one** method of reducing these forces. (1mark)

3 A positively charged rod is brought near the cap of a leaf electroscope. The cap is then earthed momentarily by touching with the finger. Finally, the rod is withdrawn. The electroscope is found to be negatively charged. Explain how this charge is acquired.
(2 marks)

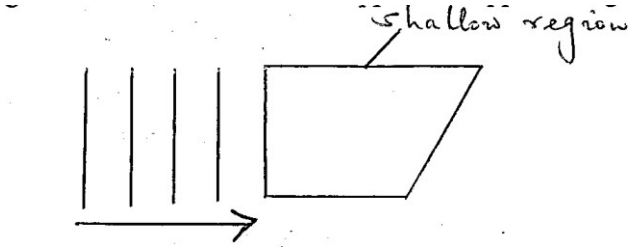
4 (a) The figure shows a conductor carrying current placed within the magnetic field of two magnets.



Comple :e F that acts on the conductor. (2 marks)

(b) State the reason why soft iron is used as a core of the coil of an electric bell.
(1 mark)

5 The figure shows wave fronts in a ripple tank approaching a shallow region in the tank.



Complete the diagram to show the wave fronts as they pass over the shallow region and after leaving the region. (2 marks)

6 State **one** advantage of a lead-acid accumulator over a nickel-iron accumulator. (1 mark)

7 Four bars of metal W, X, Y and Z are tested for magnetism. X attracts both W and Y but not Z. Z does not attract W, X or Y. W and Y sometimes attract one another and sometimes repel one another. State the conclusion you can draw about:

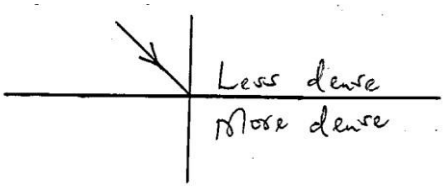
(a) Bar W (1 mark)

(b) Bar X (1 mark)

8 An observer watching a fireworks display sees the light from an explosion and hears the sound 4 seconds later. Determine how far the explosion was from the observer. (Speed of sound in air 330m/s). (3marks)

9 An object placed 15cm from a convex lens forms an upright image which is magnified two times. Determine the focal length of the lens. (2 marks)

10 (a) The figure shows light travelling from a less dense medium to a more dense medium.

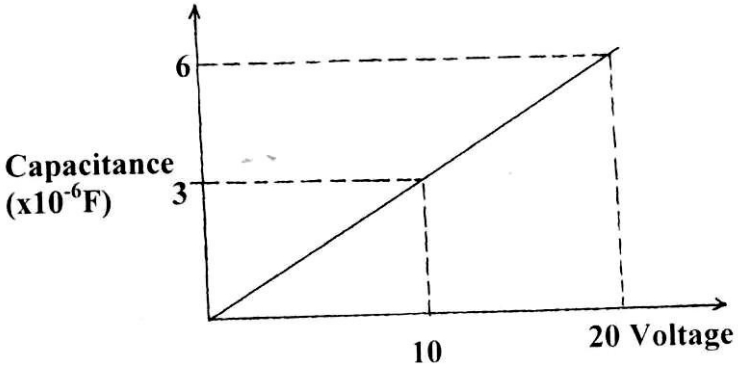


Show the direction of the refracted ray. (1 mark)

(b) State any **one** condition necessary for total internal reflection to take place. (1 mark)

11 An electric bulb rated, 40W is operating on 240V mains. Determine the resistance of its filament. (2 marks)

12 The graph shows the variation of capacitance of a capacitor with voltage supplied across it.



Use the graph to determine the quantity of charge stored in the capacitor. (3marks)

13 The box contains names of seven parts of electromagnetic spectrum.

Radio waves	Microwaves	Infra-red	Visible light	Ultra violet	X-rays	Gamma rays

State the order in which they have been written. (1mark)

SECTION B (55 marks)

*Answer **all** the questions in this section in the spaces provided.*

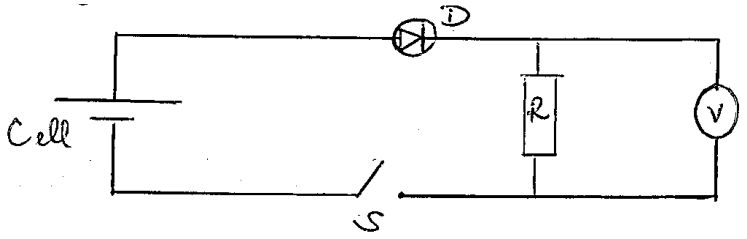
14 (a) P-type and n-type semiconductors are made from a pure semiconductor by a process known as "doping"

(i) State what is meant by doping. (1 mark)

(ii) Explain how the doping produces an n-type semiconductor. (2 marks)

(b) Sketch a circuit diagram that can be used to investigate p-n junction diode characteristics. (2marks)

(c) The figure below shows an electric circuit.



When the switch, S is closed, the voltmeter shows a reading. When the cell terminals are reversed, the voltmeter reading is zero. Explain these observations.
(2 marks)

(d) Study the figure and use it to answer questions that follow.

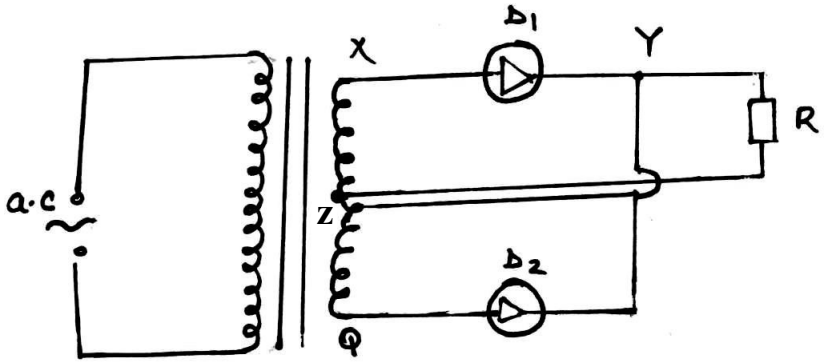


Fig. 7

(i) Briefly explain how the circuit works to produce a rectified alternating current.
(3marks)

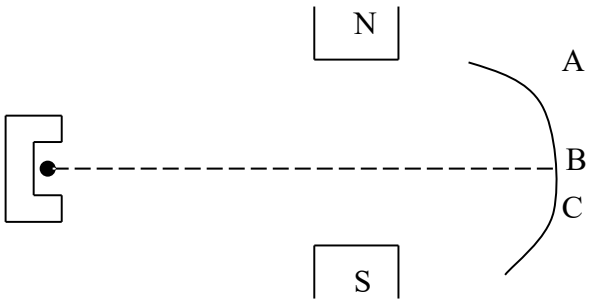
(ii) Draw on the diagram to show the position of the capacitor. (1mark)

(iii) State the function of the capacitor in the circuit. (1mark)

(iv) Sketch the graph of the output as seen on a CRO screen. (1mark)

15 (a) A radioactive isotope showed a count rate of 82 counts per second initially. After a time of 210 seconds, the count rate dropped to 19 counts per second. The average background count remained constant at 10 counts per second. Determine the half-life of the material.
(2 marks)

(b) The figure shows an experimental set up in a vacuum for investigating the effect of a magnetic field on the radiation emitted by a radio-active source.

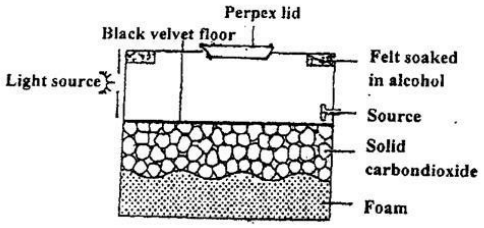


The background radiation at the place is 5 counts per minute. The detectors are placed a positions A, B and C respectively. Results obtained are shown in the table below.

Positions	A	B	C
Counts / min	480	5	400

Use the table to explain which of the three types of radiations are emitted from the source. (2marks)

(c) The figure shows a diffusion cloud chamber used for detecting radiations from a radioactive source.



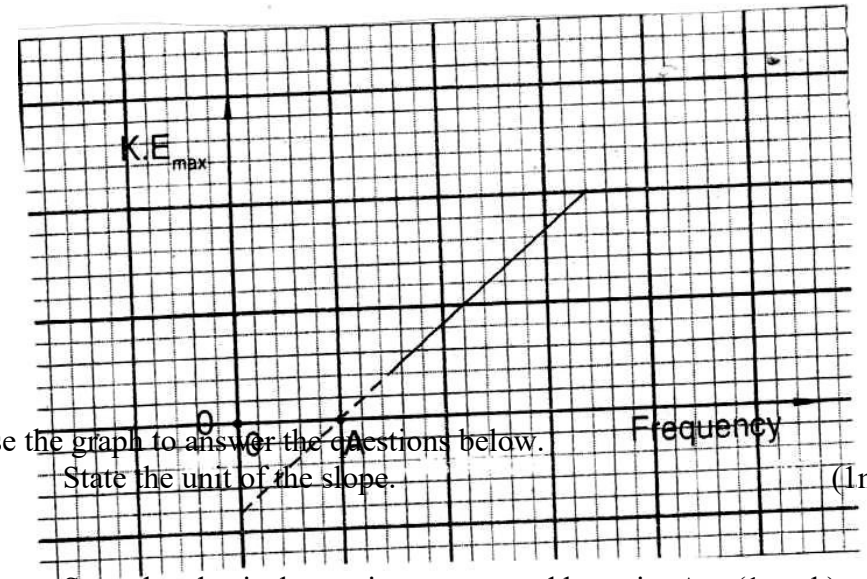
(i) Explain how the cl is introduced at the source. (2 marks)

(ii) State the purpose of solid carbon (IV) oxide. (1 mark)

(iii) State **one** advantage of the cloud chamber over a G.M tube as a detector of radioactive emissions. (1 mark)

(d) State **one** use of radio activity in medicine. (1mark)

16 (a) A photocell has a cathode made of caesium metal when a monochromatic radiation is shone on the cathode photoelectrons are emitted. A graph of kinetic energy against frequency is drawn as shown in the figure.



Use the graph to answer the questions below.

(i) State the unit of the slope. (1mark)

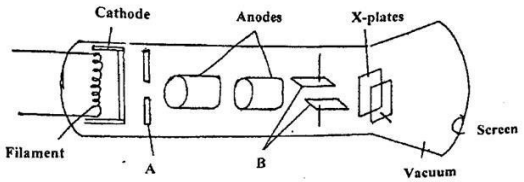
(ii) State the physical quantity represented by point A. (1mark)

(iii) Lithium metal has a higher work function than caesium. On the same axes, sketch the graph of lithium. (1mark)

(iv) State what the term monochromatic means. (1mark)

(b) The maximum Kinetic energy of the electrons emitted from a metallic surface is 1.6×10^{-19}J when the incident radiation is 7.5×10^{14}Hz. Determine the minimum frequency of radiation for which electrons will be emitted. (Planck's constant = 6.6×10^{-34}Js)
(3marks)

17 (a) The figure shows the features of a cathode ray oscilloscope.



(i) Name the parts A and B. State role played each of the parts A and B.
(2 marks)

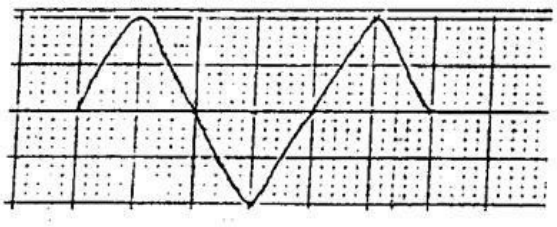
A

B

(ii) Explain how electrons are produced. (2 marks)

(iii) State one factor considered when choosing the material for the cathode.
(1 mark)

(b) The figure shows the trace on the screen of an a.c signal connected to the y-plates of a C.R.O with the time base on.

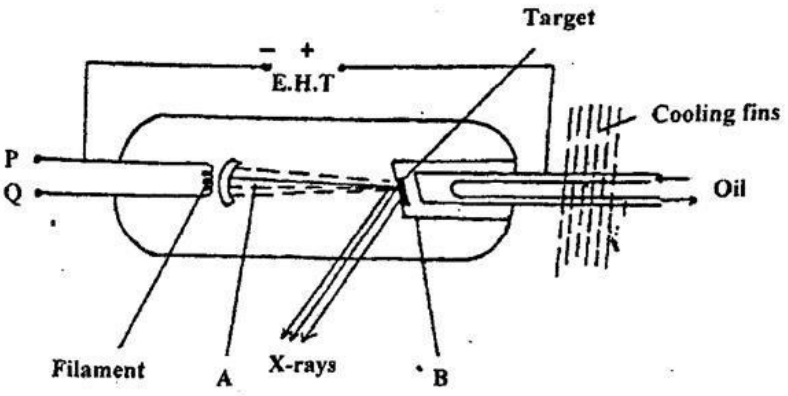


Given that the time base control is 100ms/div and the y-gain is at120V/division, determine:

(i) the frequency of the a.c signal (2 marks)

(ii) the peak voltage of the input signal (2 marks)

(c) The figure shows the features of an X-ray tube.



(i) Name the parts labelled A and B. (2 marks)

A

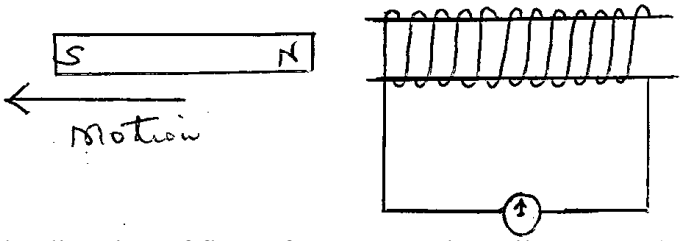
B

(ii) Explain how a change in the potential across PQ changes the intensity of the X-rays produced in the tube. (2 marks)

(iii) State the property of lead which makes it suitable for use as a shielding material. (1 mark)

18. (a) State Lenz's law of electromagnetic induction. (1 mark)

(b) The figure shows a coil and a magnet being removed from the coil.



Indicate the direction of flow of current on the coil. (1 mark)

(c) The primary coil of a transformer has 1200 turns and the secondary coil has 60 turns. The transformer is connected to a 240V a.c source. Determine:

(i) the output voltage (3 marks)

(ii) the output current when the primary coil has a current of 0.5A. (Assume there is no energy loses) (2 marks)

(d) One of the primary ways in which power is lost in transformers is through eddy currents. State how eddy currents can be minimized.(1 mark)

(e) Give a reason why appliances which draw current from a ring's main circuit have a third cable connected to the earth. (1mark)

(f) Determine the cost of using an electric iron rated 1500W, for a total of 30 hours given that the cost of electricity per kWh is Ksh 8. (3 marks)

PAPER 3
Question 1

PART A

You are provided with the following:

1. Metre rule.
2. Vernier Callipers.
3. 300g mass
4. Two knife edges.
5. Thread

Proceed as follows:

(a) Place the metre rule on the knife edges such that each is 5cm from the end.
Ensure the mm scale is facing upwards. Set the distance between the knife edges, L= 900mm.

(b) Place the vernier callipers vertically against the metre rule at 50cm mark with the depth gauge lowered to touch the bench.

(i) Record the height h_o of the upper edge of the metre rule at the 50cm mark

h_o = _____cm _____mm (1mark)

(ii) Using the thread provided hang the 300g mass at 50cm mark of the metre rule ensuring it does not touch the bench. Measure and record the height h of the upper edge of the metre rule from the bench at the 50cm mark.

h = _____cm _____mm (1mark)

(iii) With the 300g mass hanging at the 50cm mark, adjust the position of the knife edges so that the distance L is 600mm with the knife edges equidistant from the 50cm mark i.e. at 20cm from each end.
Measure and record the height h of the upper edge of the metre rule at 50cm mark.

h = _____cm _____mm (1mark)

Table

Length L(mm)	900	600
Height h(mm)		
Depression, d = (h_o-h) (mm)		
Log L		
Log d		

(3marks)

(c) Determine the value of $s = \frac{log\ 900 - log 600}{log d_{900} - log\ d_{600}}$ (2marks)

(d) Evaluate $y = \frac{1}{s}$ (1mark)

(e) Given that $G = \frac{log\ K}{y}$ $where\ G = 2.75$, determine the value of K. (1mark)

PART B

You are provided with the following:

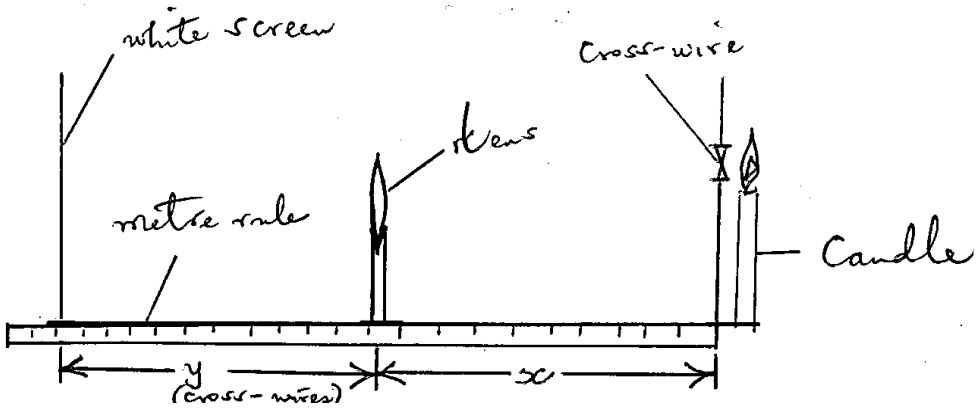
1. A white screen with crosswires
2. A Mounted lens
3. A White screen
4. A Candle
5. A Metre rule

Proceed as follows:

(f) Estimate the focal length of the lens by focusing the image of a distant object on the screen provided e.g. distant window.

f_o = _____cm (1mark)

(g) Arrange the apparatus as shown.



With the object (cross-wires) illuminated using a candle flame placed at $x = 15cm$, move the screen until a sharp magnified image of the object is formed on the screen.
Measure and record the corresponding value of y in the table.

(h) Repeat step (g) for the value of $x = 18\ cm$

Table (3 marks)

$x\ (cm)$	15	18
$y\ (cm)$		
$\frac{x+y}{xy}$ (cm^{-1})		

(i) Determine the average of $\frac{x+y}{xy}$ (2marks)

(j) Compare the average $\frac{x+y}{xy}$ and $\frac{1}{fo}$ (2marks)

(k) Given that $\frac{1}{fo} = \frac{y}{(\frac{y}{x})+1}$ $and\ x = 25\ cm.\ Determine\ the\ value\ of\ y.$ (2marks)

Question 2
PART A

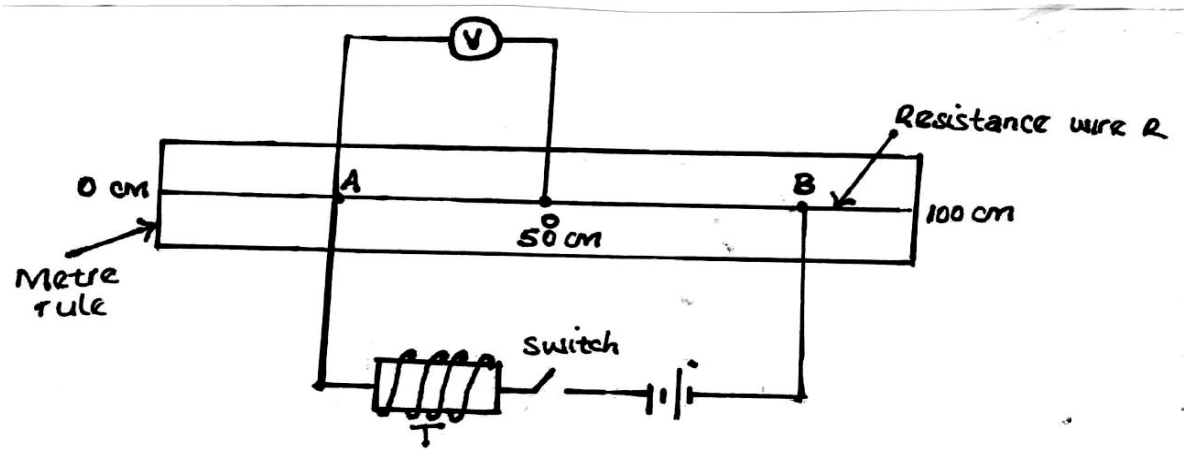
You are provided with the following:

1. A voltmeter
2. A resistance wire labelled R mounted on a metre rule.
3. A metre rule.
4. A resistance wire labelled T mounted on a small piece of carton.
5. Two dry cells and a cell holder.
6. Six connecting wires, each with a crocodile clip at one end.
7. A switch.

Proceed as follows:

⇨ Measure and record the e.m.f. E_0 of the cells connected in series, E_0 = ____ V.
(1mark)

⇨ Connect the circuit as shown below. Point O on the resistance wire R is at 50cm mark of the metre rule. A and B are points on resistance wire R such that AO = OB = x = 30cm.



(c) Close the switch. Read and record the potential difference V across AO
V = ……. Volts. (1mark)

(d) The relationship between V and x is given by:

$$\frac{1}{V} = \frac{35}{x} + \frac{1}{y}$$

Determine the value of y. (2marks)

(e) Use the e.m.f. E_0 to determine the constant k, given that:

$$k = \frac{8}{35E_0}$$ (1mark)

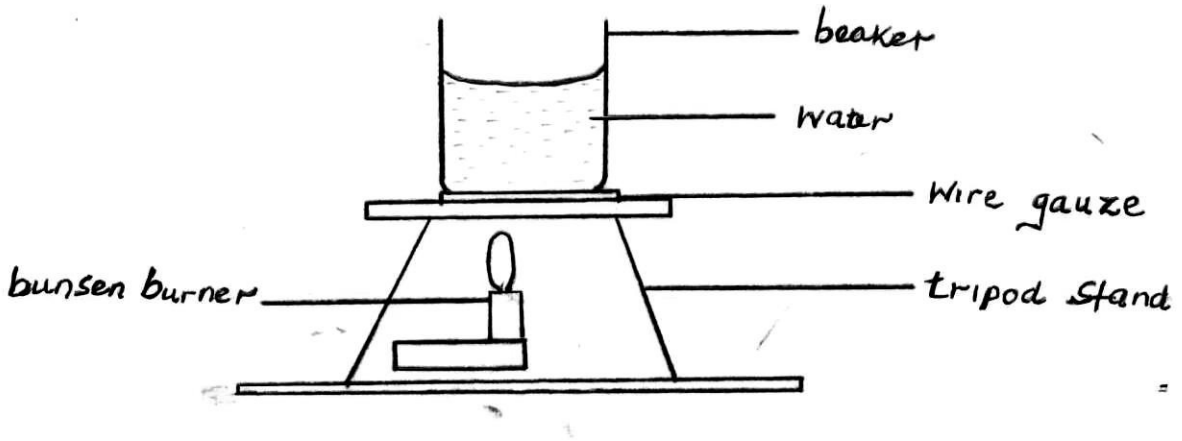
PART B

You are provided with the following:-

1. A glass beaker
2. A Bunsen burner
3. A Thermometer
4. A Stop watch
5. A Tripod stand and a Wire gauze
6. A measuring cylinder
7. Water in a container

Proceed as follows:

(f) Set the apparatus as shown in the figure.



(g) Measure 100cm^3 of water and pour it into the beaker. Take the initial temperature of the water.
T_0 = ……^{0}C (1mark)

(h) Now heat the water to a temperature of 80 ^{0}C. Switch off the gas tap and place a thermometer into the beaker and start the stop watch when the temperature is 65 ^{0}C. Take the temperature T (^{0}C) of water after every two minutes. Record your results in the table

Table (5marks)

Time, t(min)	2	4	6	8	10	12	14
Temperature , T (^{0}C)							
(T - T_0) (^{0}C)							
Log (T - T_0)							

(i) Plot a graph of Log (T - T_0) against Time (t). (5marks)

(j) Determine the value of P (log (T - T_0)) when t = 0. (1mark)

(k) Determine N, where N is the antilog of P. (1mark)

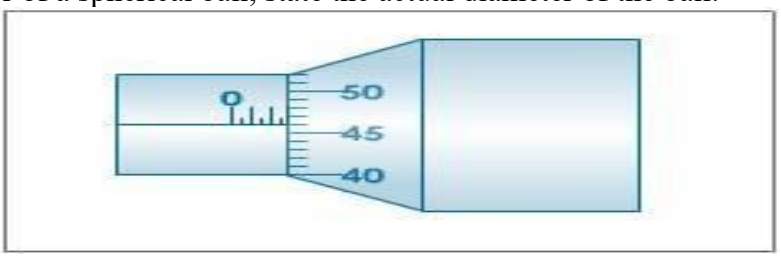
(l) Determine the temperature of the surrounding T_R using the expression
N = 65–T_R (2marks)

KCSE REPLICA 5

PAPER 1

SECTION A: (25 MARKS)

1. The figure below shows a section of a micrometer screw guage with a thimble scale of 50 divisions. When the spindle is in contact with the anvil, the device reads 0.25mm. If the screw guage is used to measure the diameter of a spherical ball, state the actual diameter of the ball. (2marks)

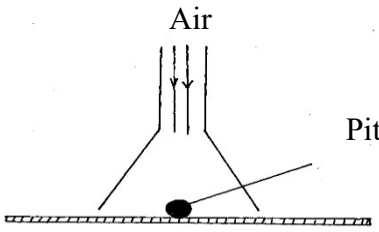


……
……

2. When washing clothes, it is easier to remove the dirt using soap in warm water than cold water. Explain. (1marks)

……
……

3. The diagram below shows a funnel inverted over a light pith ball on a table. Air is blown into the funnel as indicated on the diagram.



State and explain what is likely to be observed. (2 marks)

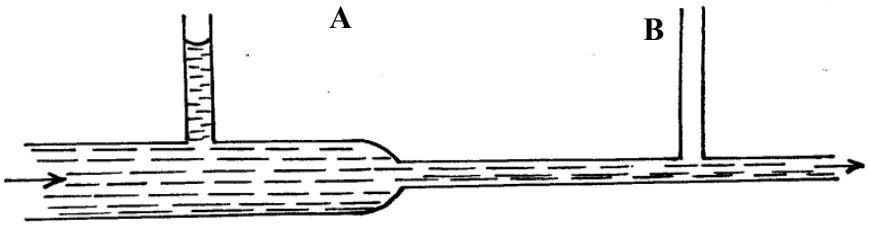
……
……
……

4. A car of mass 800 kg is initially moving at 25 m/s. Calculate the force needed to bring the car to the rest over a distance of 20 m. (3marks)

……

……

5. The figure below shows water flowing through two sections A and B of a pipe having x-sectional areas of $8cm^2$ and $2cm^2$, respectively.



i) Mark the appropriate level of water in the manometer **B**

(1mark)

ii) The velocity of water as it flows past the wider section of the pipe is $0.6ms^{-1}$. Calculate the velocity at the narrower section. (2marks)

……
……
……

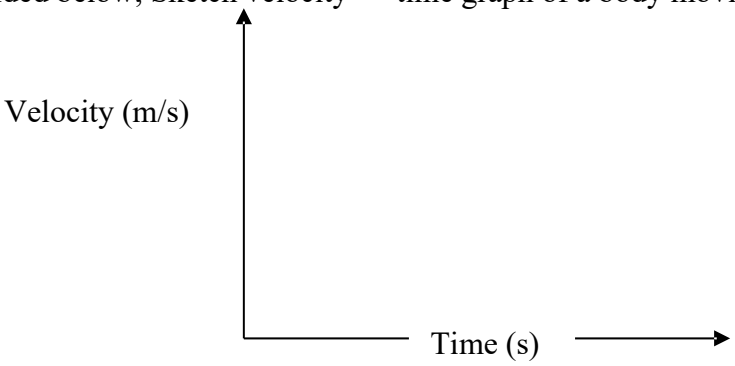
6. A piece of metal weighs 3N in air and 2N when totally immersed in water. Calculate the volume of the metal. (Density of water = $1000Kg/m^3$) (3marks)

……

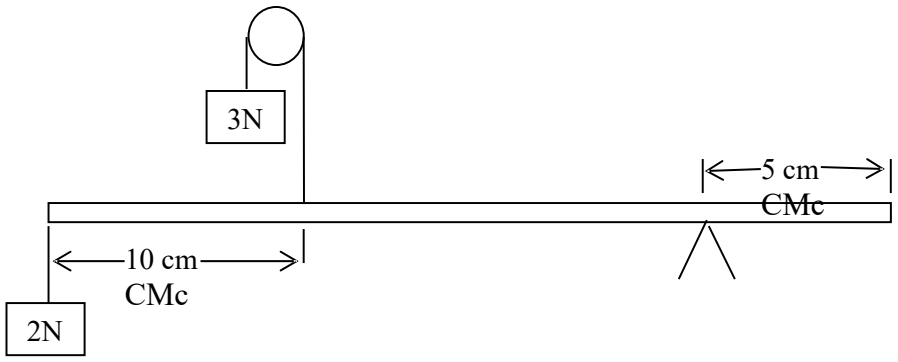
……

……

7. On the axis provided below, Sketch velocity — time graph of a body moving down a viscous fluid. (1marks)



8. A uniform half meter rule is supported by force of 3N and 2N as shown in the figure below.



Determine the weight of the half meter rule (3marks)

……

……

……

……

 for marking schemes inbox 0724351706

9. Explain why water in a pond may freeze on the surface only but not deep inside the pond. (1mark)

……

……

10. A ball is thrown upwards and returns to its starting point after 6 seconds. Calculate the maximum height reached ($g=10m/s^2$) (2marks)

……

……

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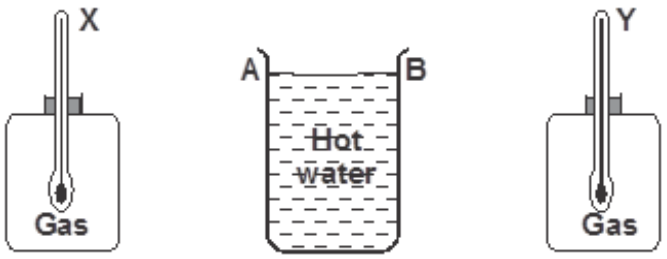
……

……

11.The figure below shows a cylindrical container having hot water at 95°C. End A is shiny while end B is dull black. At equal distances from the container is placed two identical gas jars fitted with thermometers X and Y.



(i) Compare the readings of the two thermometers after two minutes (1 mark)

……

(ii) Give a reason for your answer in **(i)** above (1 mark)

……

……

12. Two ships moving parallel close to each other are likely to collide. Explain (1mark)

13. State **one** physical property of a material medium which may be used to measure temperature. (1mark)

Section B (55 marks)

13. (a) Define the term heat capacity **(1mark)**

(b) You are provided with the apparatus shown in the figure below and stop watch

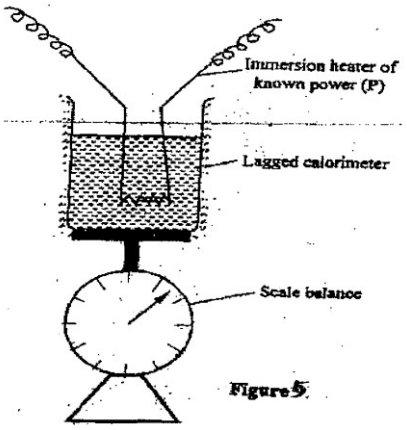


Figure 5

Describe an experiment to determine the specific latent heat of vaporization of water using the set up. In your answers clearly explain the measurements to be made and how these measurements would be used. **(4marks)**

(c) A block of metal of mass 150g at 100°C is dropped into a lagged calorimeter of heat capacity $40JK^{-1}$ containing 100g of water at 25°C. The temperature of the resulting mixture is 34°C. (Specific heat capacity of water=$4200JK^{-1}$)
Determine:
(i) Heat gained by calorimeter; (2marks)

(ii) Heat gained by water; (1mark)

(iii) Heat lost by the metal block; (1mark)

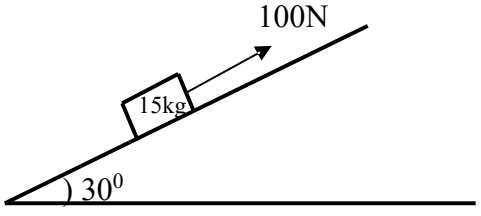
(iv) Specific heat capacity of the metal block (3marks)

14. (a) In a car, the engine drives an alternator which produces electricity that lights the headlights. List the energy changes involved. (2marks)

(b) What is the power output of a pump which can raise 60kg of water to a height of 10m every minute? (2marks)

(c) If the efficiency of the pump in 15(b) is 80%, how much power must be supplied? (2marks)

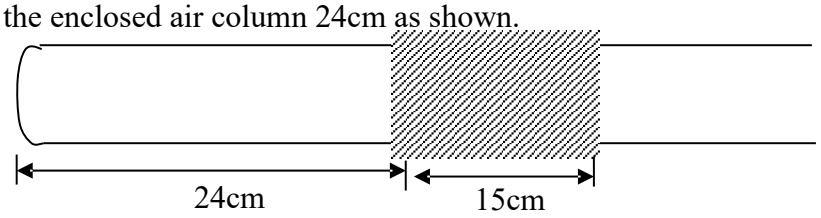
d) (i) The figure below shows an inclined plane and a load of mass 15kg pulled by an effort of 100N.



Find the efficiency of the machine (3marks)

(ii) a) Draw a single pulley arrangement with a velocity ratio of 2. (1mark)

15(a) A glass capillary contains enclosed air by a thread of mercury 15cm long when the tube is horizontal, the length of the enclosed air column 24cm as shown.



i) What is the length of the enclosed air column when the tube is vertical with the open end uppermost if the atmosphere pressure is 750mmHg? (2marks)

ii) Explain why the mercury does not run out when the tube is vertical with the closed end uppermost. (1mark)

b) Explain why an air bubble increase in volume as it rises from the bottom of a lake to the surface. (2 marks)

c) When an inflated balloon is placed in a refrigerator it is noted that its volume reduces, use the kinetic theory of gases to explain this observation. (2marks)

d) A certain mass of hydrogen gas occupies a volume of $1.6m^3$ at a pressure of 1.5×10^5 Pa and a temperature of 22^0c. Determine the volume when the temperature is 0^0c at a pressure of 0.8×10^5 Pa. (3marks)

16 a) State Archimedes principle. (1 mark)

b) A block of wood measuring 0.8m by 0.5m by 2m floats in water. 1.2m of the block is submerged.(density of water is $1gcm^3$)

(i) Determine the weight of the water displaced. (2 marks)

(ii) Find the force required to just make the block fully submerged. (3 marks)

e) A balloon weighs 10N and has a gas capacity of $2m^3$. The gas in the balloon has a density of $0.1kg/m^3$. If density of air is $1.3kgm^{-3}$, calculate the resultant force of the balloon when it is floating in air.
(3 marks)

17.(a) The moon goes round the earth at constant speed. Explain why it is true to say that the moon is accelerating. (1 mark)

(b) A string of negligible mass has a bucket tied at the end. The string is 60cm long and the bucket has a mass of 45g. The bucket is swung horizontally making 6 revolutions per second. Calculate:

(i) The angular velocity. (1 mark)

(ii) The centripetal acceleration. (2 marks)

(iii) The tension on the string. (2 marks)

(iv) The linear velocity. (1 mark)

(c) A ball of mass 100g is dropped from a height of 1.25m above the ground surface. It rebounds to a height of 1.1m. Calculate

(i) Velocity of the ball before impact. (3 marks)

(ii) Force of impact if the ball is in contact with the surface for 0.2S (g = 10N/kg). (3marks)

PAPER 2
SECTION A: (25MARKS)

1. What is observed when the hole of a pinhole camera is enlarged? (1mk)
2. State one use of a charged electroscope (1mk)
3. The chart below shows an arrangement of a section of the electromagnetic spectrum

P	Q	R	UV Light	S	Gamma rays

Name the radiation represented by letter Q (1mk)

4. Draw a circuit diagram to show P-N junction diode in the forward biased mode. (2mks)
5. Explain why the walls of studio are padded with woolen materials (1mk)

6. (a) Define half- life as used in radioactivity (1mk)

(b)The initial mass of a radioactive substance is 20g.The substance has half-life of 5yrs.Detemine the mass remaining after 20yrs. (2mks)

7. Give a reason why it is necessary to leave the caps of the cells open when charging lead-acid accumulator (1mk)

8. (a) State one property of soft iron that makes it suitable for use as a transformer core. (1mk)

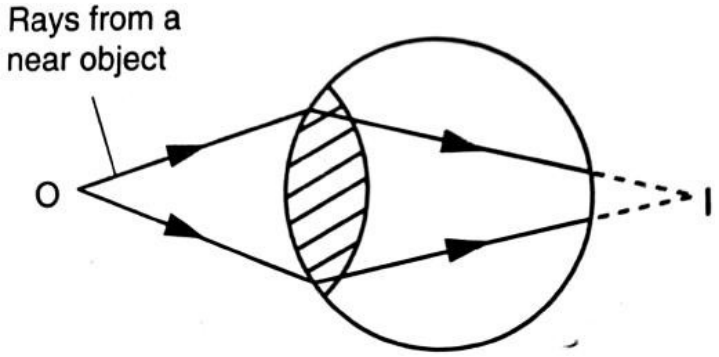
(b)The primary coil of a transformer has 1200 turns and the secondary coil has 60 turns. The transformer is connected to a 240V a.c source. Determine the output voltage. (3mks)

9. State two ways of minimizing electrical power losses during transmission (2mks)

10. A convex mirror is preferred to a plane mirror for use as a driving mirror. Explain why. (1mk)

11. An electric bulb is rated 60W, 240V. Determine the current that flows through it when it is connected to a 240v supply (2mks

12. The figure below shows a defect of vision



(i) Name the defect. (1mk)

……
……

(ii) List two possible causes of the defect. (2mks)

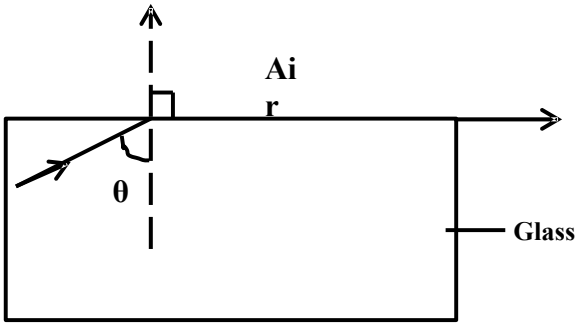
……
……
……
……

13. A broadcasting station produces radio waves of wavelength 600m. Determine their frequency in MHz (speed of air is $3X10^8$m/s) (3mks)

SECTION B (55MARKS)

14. (a) Define the refractive index of a medium (1mk)

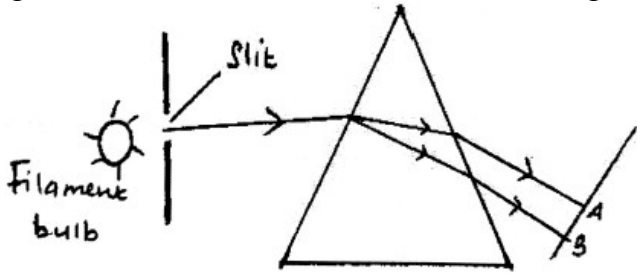
(b) The figure below shows a ray of light incident on a glass-air interface



Given that the refractive index of the glass is 1.5, determine angle θ (3mks)

(c) State one condition for total internal reflection to occur (1mk)

(d) The diagram below shows a narrow beam of white light shone onto a glass prism



(i) What is the phenomena represented in the diagram? (1mk)

(ii) Name the colours at A and at B (2mks)

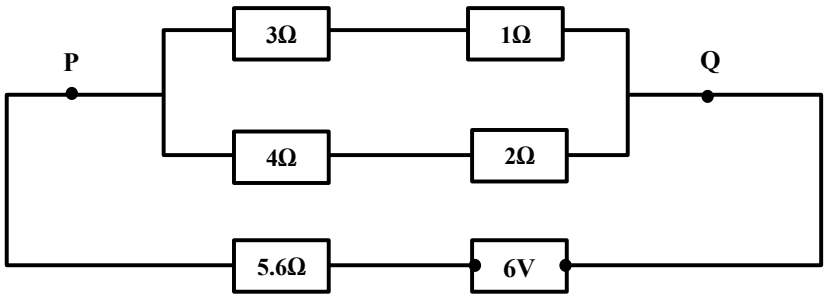
(iii) Explain the reason for your suggestion of the colours named above. (1mk)

(iv) What is the purpose of the slit. (1mk)

15. (a) State one factor that affect the resistance of a metallic conductor (1mk)

……
……

(b) The figure below shows resistors in a circuit. The internal resistance of the battery is negligible



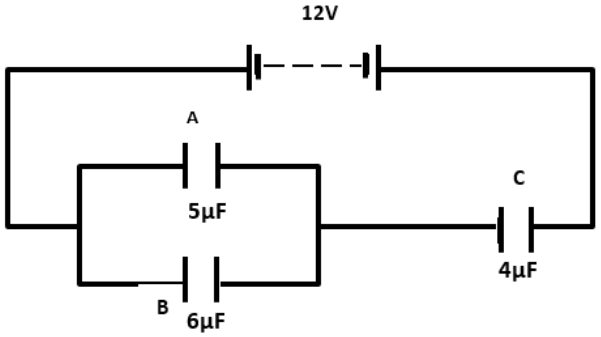
(i) Calculate the effective resistance of the circuit (2mks)

(ii) Find the total current in the circuit (2mks)

(iii) Find the P.d between P and Q (2mks)

(c) What is the effect of decreasing the distance between the plates of a parallel plate capacitor on the capacitance (1mk)

(d) The figure below shows electrical circuit with three capacitors A, B and C of capacitance 5μF, 6μF and 4μF respectively connected to a 12V battery



Determine

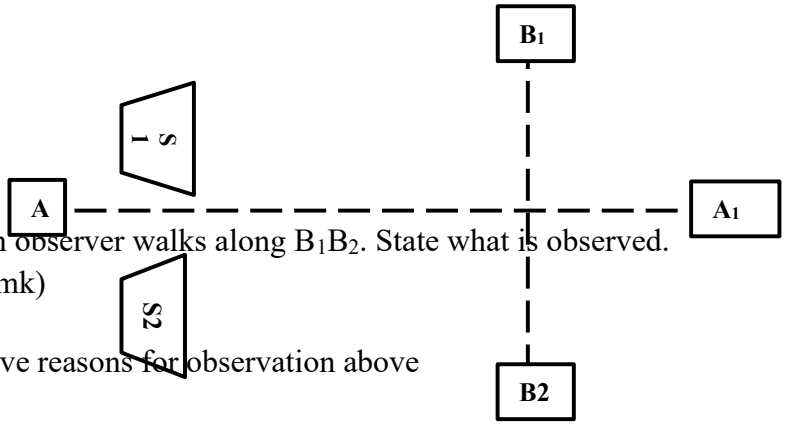
(i) The combined capacit :e of the three capacitors (2mks)

(ii) The potential difference across the capacitor B (3mks)

……

16. (a) Name two factors which determine the frequency of sound from a stretched wire at room temperature (2mks)

(b) The figure below shows two loud speakers S_1 and S_2 connected to a signal generator

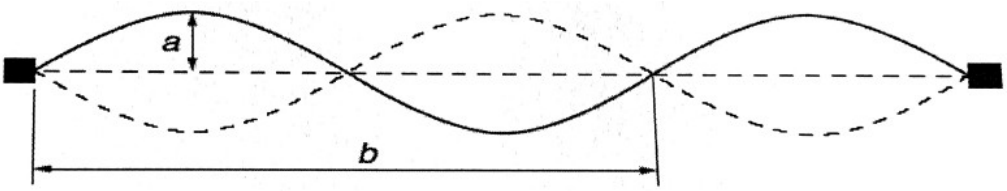


(i) An observer walks along B_1B_2. State what is observed. (1mk)

(ii) Give reasons for observation above (2mks)

(iii) Another observer walks along AA_1, state and explain what he observed (2mks)

(c) A stretched string is vibrating between two fixed ends. The figure shows how the string is vibrating



(i) State the name of: (2mks)

[I] Distance a:

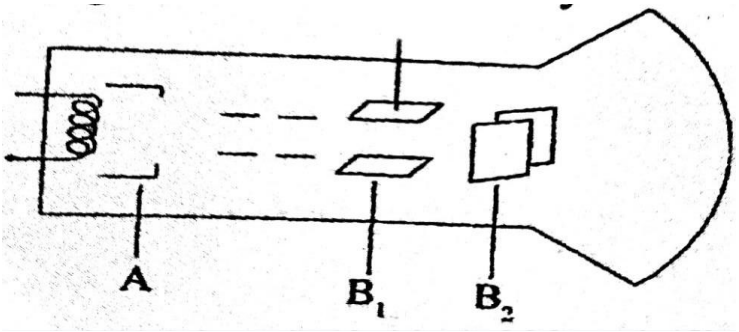
.

[I] Distance b:

…

(ii) On the diagram, label the node and the antinode (2mks)

17. The figure below shows a block diagram of a cathode ray oscilloscope(CRO)



(a)(i)State the names of the parts labelled B_1 and B_2 (2mks)

(ii)State and explain the function of the part marked A (2mks)

(ii)Why is the tube highly evacuated? (1mk)

(b)Give a reason why the target in an X-ray tube is made of tungsten or molebdnum (1mk)

(c) X-rays are used for detecting cracks inside metal beams.State with a reason which type of X- rays is used. (2mks)

(d) In a certain X-ray tube the electrons are accelerated by a p.d of 12kV.Assuming all the energy goes to produce X-rays, determine the frequency of the X-rays produced .(Planks constant $h=6.62\times10^{-34}$ Js and charge of an electron $=1.6\times10^{-19}$C) (2mks)

18.(a) state two factors that affect photoelectric emission (2mks)

(b)Light of wavelength 4.0×10^{-7} m is incident on two different metal surfaces ,nickel and potassium (Take speed of light as 3.0×10^{8} m/s and planks constant $h=6.63\times10^{-34}$Js)

(i)Determine the energy of the incident radiation (3mks)

(ii)If the work function of nickel is 8.0×10^{-19} J and that of potassium metal is 3.68×10^{-19}J,state with a reason which of the two metals given light will eject electrons (2mks)

(iii)Determine the velocity of the emitted electrons from the metal surface in b(ii).(Take mass of an electron as 9.1×10^{-31} kg) (3mks)

PAPER 3

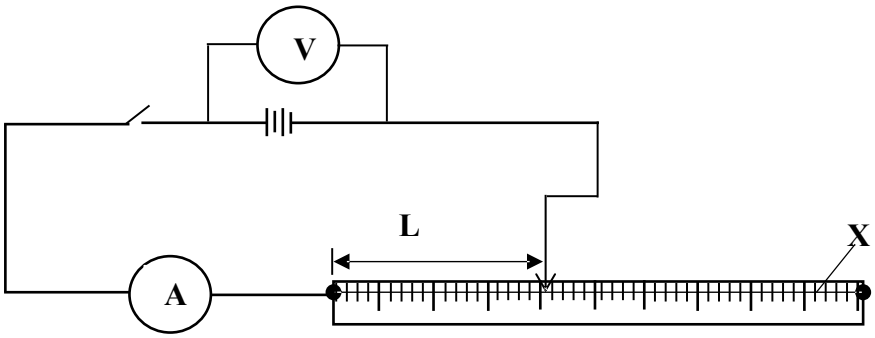
You are provided with the following:

- 2 new dry cells size D.
- A cell holder.
- A switch.
- An ammeter (0 – 1A)

- A voltmeter (0 – 5V)
- 6 connecting wires, 3 with crocodile clips.
- Nichrome wire mounted on the metre rule labelled X.
- A micrometer screw gauge (to be shared).

Proceed as follows:

(a) Connect the circuit as shown in the figure below.



(b) Measure the voltage, E before closing the switch.

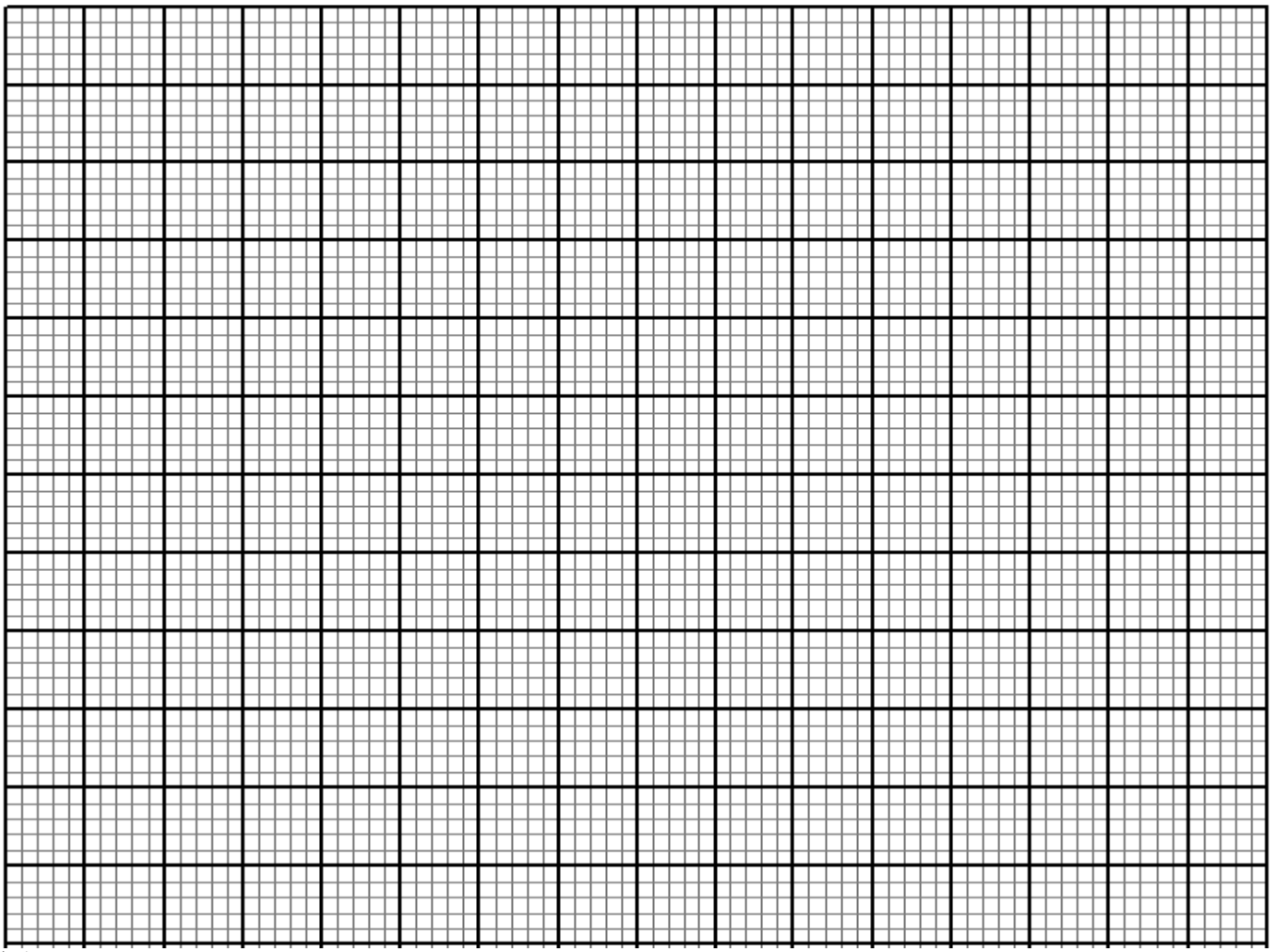
E = …… (1mk)

(c) Adjust the length L of the wire 0.2m, close the switch S and read the value of current and record in the table below.

(d) Repeat the procedure in (c) above for the value of length, **L** and fill the table for $\frac{1}{I}$.
(5mks)

Length (m)	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**
Current I(A)						
$\frac{1}{I}(A^{-1})$						

(e) On the grid provided plot a graph of $\frac{1}{I}$ (y axis) against L.



(5mks)

(f) Determine the gradient of the graph. (3mks)

(g) (i) Measure the diameter of the wire in three points using micrometer screw gauge. (1mk)

d_1 = …… d_2 = …… d_3 = ……..…

Averaged **d** = ……..….. (1mk)

(ii) Determine the cross-section area, A of the wire. (1mk)

(h) From the equation $\frac{1}{I} = \frac{KL}{AE} + \frac{Q}{E}$ determine;

(i) the value of K.
(2mks)

(ii) the value of Q. (1mk)

QUESTION 2

PART A

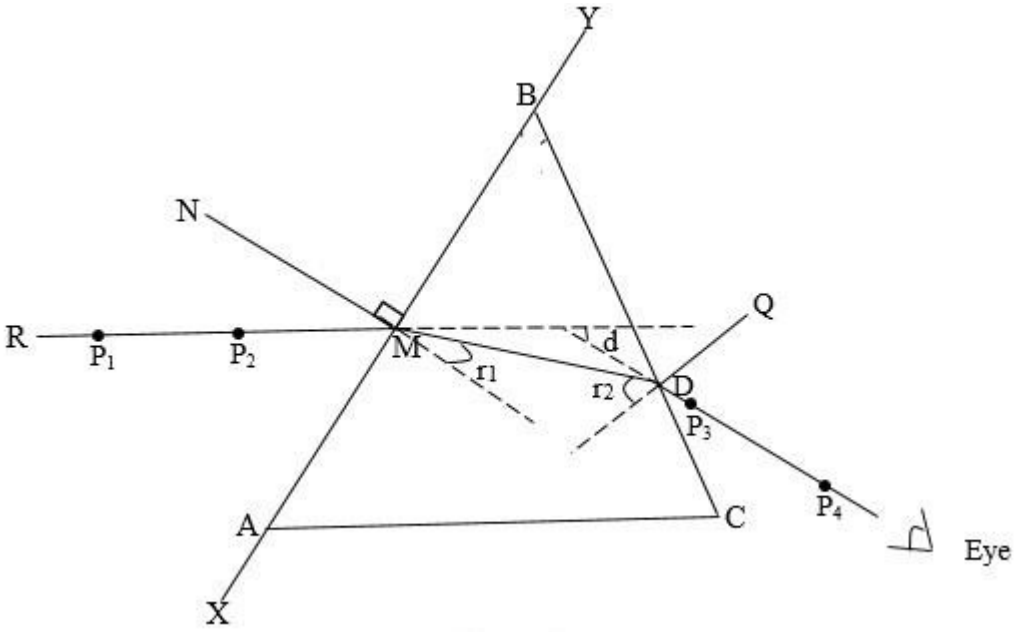
a) ***You are provided with the following:***
Triangular glass prism
Four optical pins Thermometer

250 ml beaker	Plain paper
Soft board	Stopwatch
source of boiling water	Four office pins

Proceed as follows

a) Fix the plain paper on the soft board using the office pins.

b) On the plain paper, draw line XY. Mark a point M on its midpoint. Draw a normal N at M to XY. Draw line RM such that angle RMN = 50°.
(This paper will be collected at the end of the experiment) (1mk)



c) Place the glass prism such that one edge AB of the prism is in line with XY. Accurately draw the outline ABC of the prism

d) Place optical pins **P_1** and **P_2** on the line RM

c) Through edge BC observe the images of **P_1** and **P_2**. Fix **P_3** and **P_4** so that **P_1**, **P_2**, **P_3** and **P_4** lie on straight line.

d) Remove the pins; construct straight line from **P_4** through **P_3** to meet side BC at D, join M to D.

i) Measure angle **r_1**. (1mk)

r_1 = ……..

ii) Produce **P_4P_3** to meet RM produced. Measure angle **d**. (1mk)

d……..

iii) Draw the normal at D and measure the angle **r_2**. (1mk)

r_2 ……

e) Given that R= $\mathbf{r_1}$+ $\mathbf{r_2}$. Calculate **R** (1mk)

f) Given that $\mathbf{n = \frac{\sin(\frac{R+d}{2})}{\sin(\frac{R}{2})}}$, find the value of n. (3mks)

g) Given that $\boldsymbol{n \sin k = 1}$, find the value of **k** (2mks)

h) What Physical property does **n** represent? (1mk)

PART B

(Read all the instruction before starting this part)

i) (I) Using the thermometer, measure and record the temperature of the room, $\boldsymbol{\theta}$.

$\boldsymbol{\theta}$……℃. (1mk)

(II) Using the 250 ml beaker, collect 200 ml of hot water from the boiling source. Place the thermometer into the hot water and wait until it cools to **80** ℃ the start the stopwatch and record time $\mathbf{t_1}$ it takes to cool to **75** ℃.

$\mathbf{t_1}$ .....seconds. (1mk)

(III) Wait until the water cools to **70** ℃ and then start the stopwatch and record the time $\mathbf{t_2}$ it takes the water to cool to **65** ℃

$\mathbf{t_2}$ …….. seconds. (1mk)

j) Determine the rate of temperature change $\boldsymbol{\rho}$ and $\boldsymbol{\beta}$ in the two intervals.

(i) $\boldsymbol{\rho = \frac{77.5-\theta}{t_1}}$ **(2mks)**

(ii) $\boldsymbol{\beta = \frac{67.5-\theta}{t_2}}$ **(2mks)**

k) State with reason how the rate of change of temperature between **50** ℃ and **45** ℃ compares with $\boldsymbol{\rho}$

(2mks)

KCSE REPLICA 6

PAPER 1

SECTION A (25 marks)
Answer ALL the questions in the spaces provided.

1. A rectangular container measures 2cm by 3cm by 5cm. What is the weight of mercury that will fill the container to the brim. (Take g = 10N/kg and density of mercury = 13600 kg/m³). (3 marks)

2. A vernier calliper has a zero error of -0.02cm. Draw the section of the calliper scale when used to take an actual measurement of 4.85cm. (2 marks)

3. Figure one below shows a beaker placed on a bench. A block of ice is placed in a beaker as shown below.

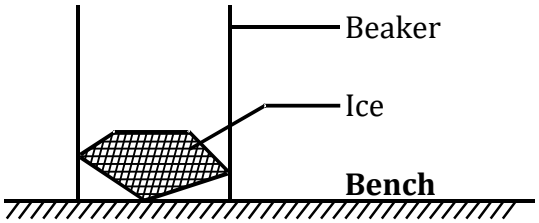


Fig 1

State and explain the change in the stability of a beaker when ice melts. (2 marks)

4. Figure 2 below shows horizontal copper wire tightly fixed on two stands. A mass P is suspended from the wire using a string that can freely slide.

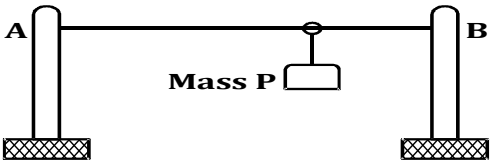


Fig 2

The copper wire is then heated for sometime. State and explain what happens to mass P.(2 marks)

5. Water flows through a pipe with different cross-section areas at a rate of 7.7×10^2 m³ / s. If the pipe has a diameter of 7mm, determine the velocity of water through the pipe at that particular section. (3 marks)

6. Apart from friction, name another factor that reduces efficiency in machine. (1 mark)

7. Two forces act on a trolley as shown below;

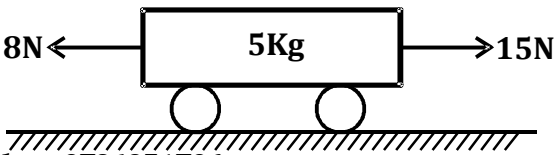
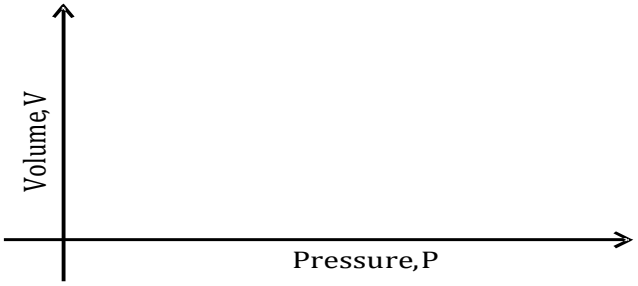


Fig 3

Find: the acceleration of the trolley. (3 marks)

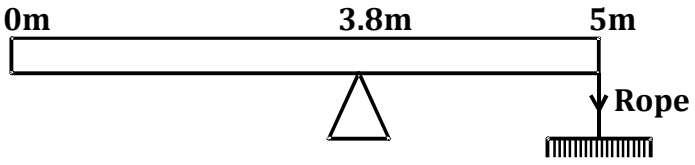
8. State the factors that affect the rate of flow of heat through a metal conductor. (2 marks)

9. Sketch a graph of volume of a fixed mass of a gas against pressure on the axes below. (1 mark)



10. A form three student heats 5kg of water to a temperature of 80°C. When he added X kg of water at 15°C, the mixture attains a temperature of 40°C. Determine the value of X. (3marks)

11. A uniform rod of length of 5m and a mass of 6kg is pivoted at 3.8m mark. The rod is held horizontally by a vertical rope at 5m mark as shown in figure 3 below.



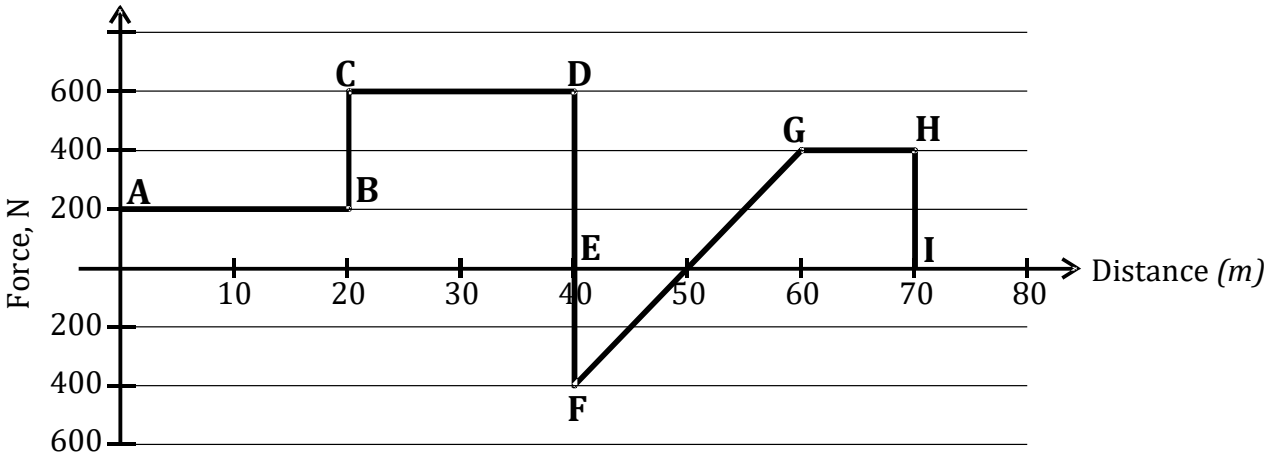
Calculate tension on the rope. (3 marks)

SECTION B: 55 marks)

12. a) i) State the law of conservation of energy. (1 mark)

ii) Explain why it is easier to use a thick screw driver than a thin one. (1 mark)

b) The figure below shows a force-distance graph for a car being towed on a horizontal ground.



i) Calculate the total work done. (3 marks)

ii) If the velocity just before reaching point D is 0.6m/s, calculate the power developed by the source providing the force at this point. (1 mark)

c) An electric pump can raise water from a low level reservoir to a high level reservoir at a rate of 3.6×10^6 kg/h. The vertical height that water is raised is 400m. If the rate of energy loss in form of heat is 200kw, calculate the efficiency of the pump. (3 marks

13. a) State Newton's second law of motion. (1 mark)

b) Why is it easier to stop a saloon car than a bus moving at the same velocity. (2 marks)

c) A bullet of mass 20g moving at $200ms^{-1}$ hits and gets embedded in a wooden block of mass 450g that is suspended freely on a light inextensible string at a height of 5m above the ground. If the string breaks on impact, calculate:

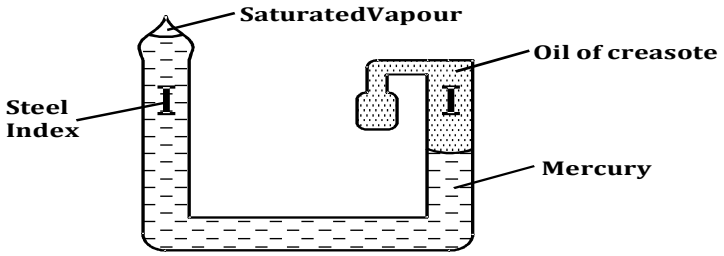
i) the velocity of the block immediately after impact. (2marks)

ii) the time taken by the block to strike the ground. (2 marks)

iii) the horizontal range of the block. (2 marks)

14. a) State two properties of mercury that makes it a suitable thermometric liquid. (2 marks)

b) Figure below shows a six's maximum and minimum thermometer.



i) What is the thermometric liquid in the thermometer (1 mark)

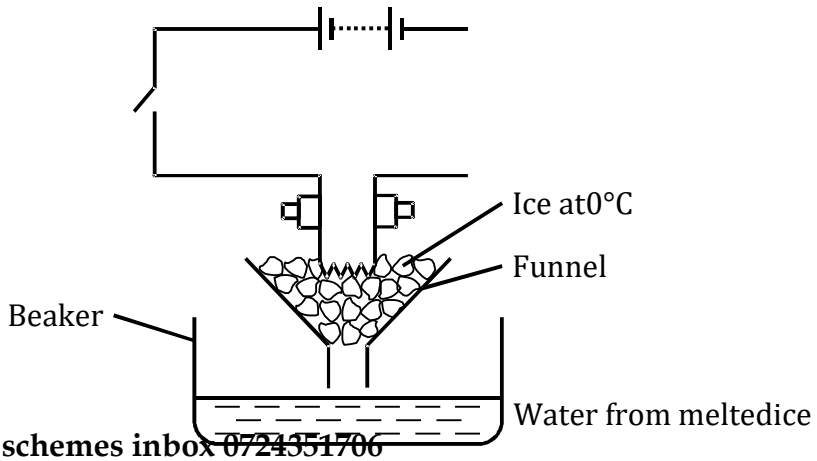
ii) Give a reason why vapour in bulb B is saturated. (1 mark)

iii) Describe how the thermometer above works. (3 marks)

iv) At what points is reading of temperature taken from the thermometer. (1 mark)

15. a) State one factor that affects freezing point of distilled water. (1 mark)

b) Figure below illustrates an experiment in which electrical energy is used to determine specific latent heat of fusion of ice.



i) Complete the circuit to show connection of essential circuit components. (3 marks)

ii) In the above experiment the following readings were obtained when heater was switched on for 10 minutes.
Voltage - 8.0V
Current - 2.25A
Temperature rise - 10°C
At the end of the experiment 400g of water at 0°C was collected in the beaker. Determine latent heat of fusing of ice. (3 marks

iii) State any assumption made in (ii) above. (1 mark)

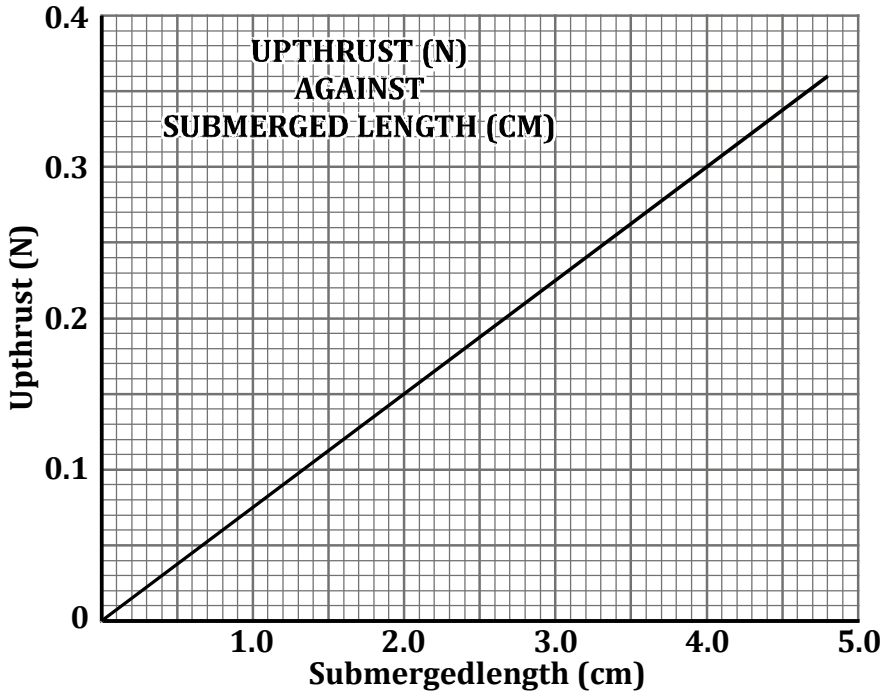
16. a)i) What is the importance of banking a road in corners? (1 mark

ii) Explain why wet clothes put in a drum which has holes at the bottom get dried faster when the drum of drying machine is rotated at high speed. (2 marks)

b) A turntable of a record player makes 60 revolutions per minute. Calculate.
i) Angular velocity in rads/second. (2 marks)

ii) The linear acceleration at a point 0.18M from the centre. (3 marks)

17.a) In an experiment to determine the density of a liquid, uniform metal cylinder of cross-section area 6.0cm² and length of 4.2cm was hang from a spring balance and lowered gradually into liquid. The graph below shows upthrust plotted against, lengths submerged.



From the graph, determine:
i) Value of upthrust when the cylinder is fully submerged. (1 mark)

ii) The density of the liquid in SI units. (5 marks)

b) A solid displaces 5.0cm³ of paraffin when floating and 20cm³ when fully immersed in it. Given that the density of paraffin is 0.8g/cm³, calculate the density of the solid. (3 marks)

PAPER 2

Section I (25 marks)

1. Figure 1 shows a pencil lying in front of a plane mirror. The pencil is moved 2cm towards the mirror in the same orientation.

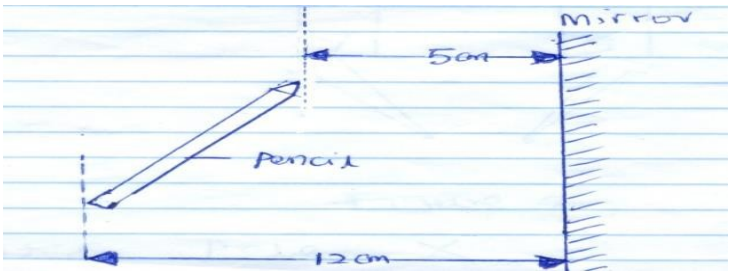
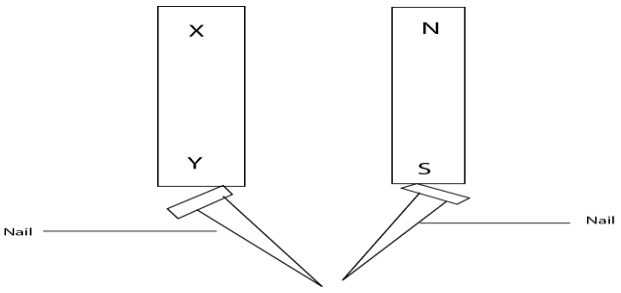


Figure 1

Determine the distance between the new position of the tip of the pencil and its image. (2mks)

2. a) State the basic law of magnetism. (1mks)

b) Figure 2 shows two bar magnets, one whose poles are labelled and a second one whose poles are labelled X and Y. Iron nails are attracted to the lower ends of the magnets as shown.



(1mk)

Figure 2
Identify pole **X**

3. State the reason why convex mirror is preferred over a plane mirror for use as driving mirrors in cars. (1mk)

4. Figure 3 shows the displacement-time graph for a certain wave.

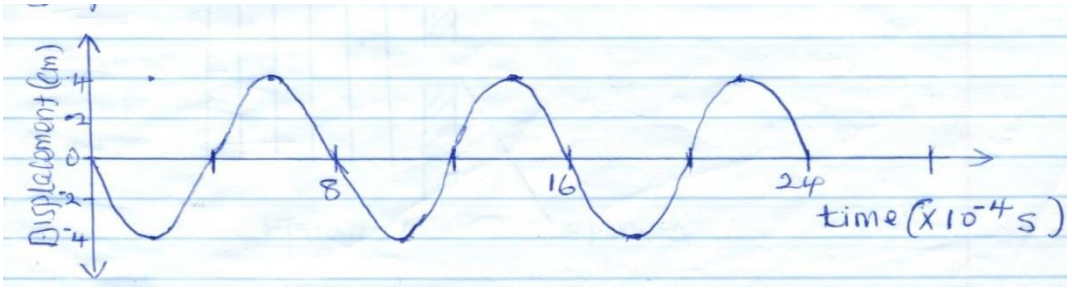


Figure 3

a) Determine the frequency of the wave. (2mks)

b) On the same diagram, draw a wave with half the amplitude and twice the frequency of the one shown. (1mk)

5. a) State the main difference between primary chemical cells and secondary chemical cells. (1mk)

b) State how the design of a dry Lechlanche cell reduces polarization. (1mk)

6. Figure 4 shows a wave incident on a narrow opening.

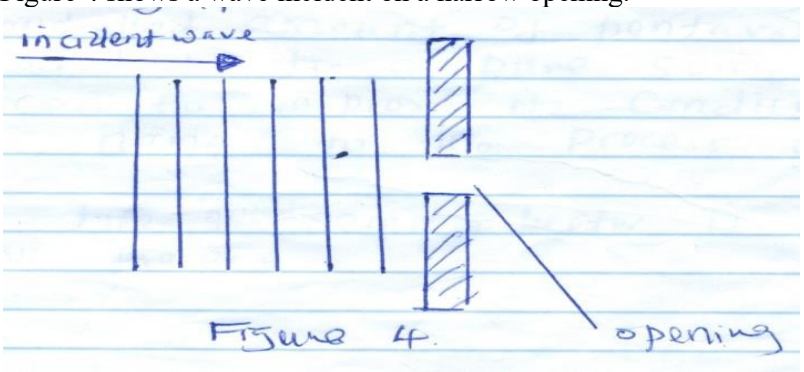


Figure 4

Draw the appearance of the wave after passing through the opening. (1mk)

7. A student stands between two classroom walls and claps. After 0.6 seconds, she hears the first echo and hears the second echo after 0.8 seconds. Determine the distance from the student to the further wall. Take speed of sound in air = 320m/s. (3mks)

8. The list below is some radiations in the electro-magnetic spectrum. Red light, Gamma rays, Ultra violet radiations and Blue light. Arrange the radiations in order of increasing wavelength. (1mk)

9. A controlled amount of pentavalent (donor) impurity atoms added in to a pure semi conductor such as silicon to improve its conductivity.

a) Give name to the process above. (1mk)

b) What type of semiconductor is obtained in the above process? (1mk)

10. Figure 5 shows the cross-section of two bar magnets and a current carrying conductor held between them. The direction of current is into the paper.

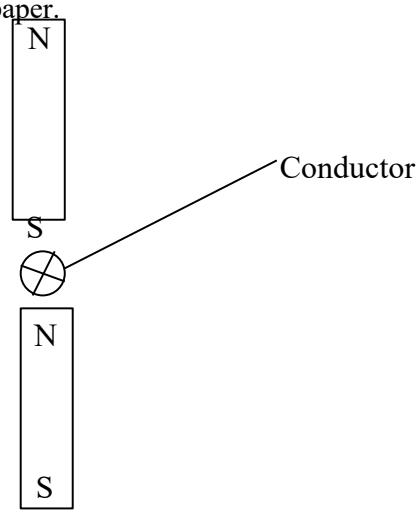


Figure 5

a) indicate with an arrow the direction of force experienced by the conductor. (1mk)

b) State one way in which the force on the conductor above can be reduced. (1mk)

11. a) State the reason why electrical power is transmitted over long distances at very high voltage and low current. (1mk)

b) An electric bulb is labelled 100W 20V. Determine the resistance of its filament at its operating temperature. (2mks)

12. a) State Ohm's law. (1mk)

b) Figure 6 shows an electrical circuit.

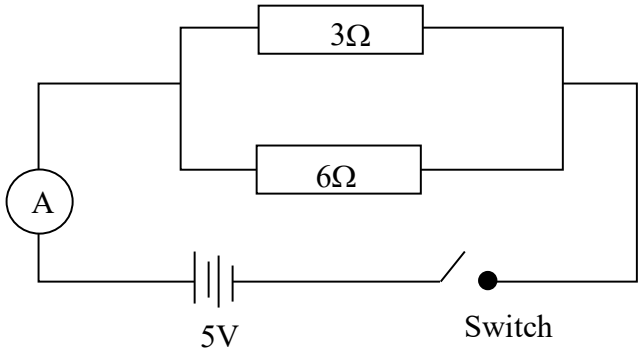


Figure 6

Determine the Ammeter reading in a closed circuit. (2mks)

SECTION B (55 Marks)

13. a) State Lenz's law of electromagnetic induction. (1mk)

b) Figure 7 shows stationary magnet and a solenoid being moved as shown.

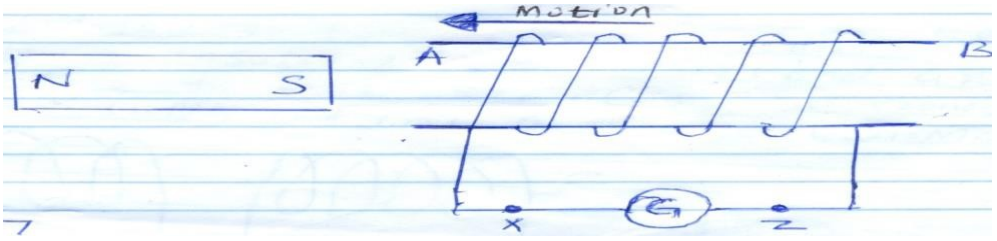


Figure 7

i) State with a reason the direction of deflection of the galvanometer. (2mks)

\

ii) State one way through which the size of deflection of the galvanometer can be decreased. (1mk)

c) State how energy losses in a transformer through eddy currents is minimized in its design.(1mk)

d) Figure 8 shows two identical coils C and D made of insulated copper wires and are placed close to each other. Coil C is connected to DC power supply and Coil D to a galvanometer.

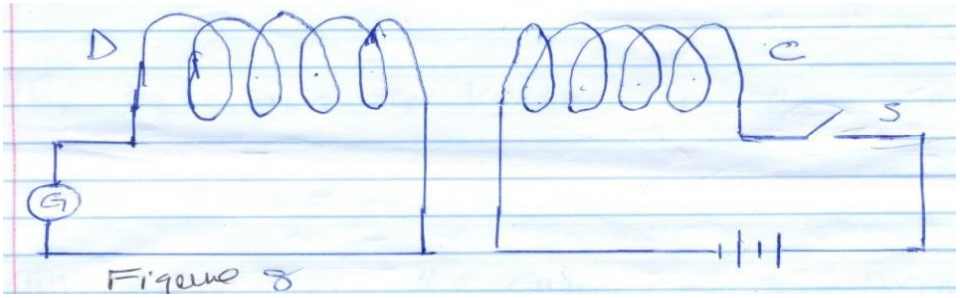


Figure 8

(i) State and explain what would be observed on the galvanometer immediately switch S is closed and then opened. (2mks)

ii) How would the observation made in d(i) differ if the number of turns in coil C were doubled but those in D remain unchanged? (1mk)

e) The primary coil of a transformer has 250 turns and the secondary coil has 50 turns. The primary coil is connected to a 120V AC supply.

i) State with a reason the type of transformer described above. (1mk)

ii) Determine the voltage in the secondary coils. (1mks)

iii) Given that the current in the primary coil is 0.50A and in the secondary coil is 2.0A. Determine the efficiency of the transformer. (2mks)

14. a) State the law of electrostatic charges. (1mk)

b) Figure 9 shows a highly positively charged glass rod being brought slowly near the cap of a negative charged gold leaf electroscope. It is observed that the leaf initially falls and then rises.

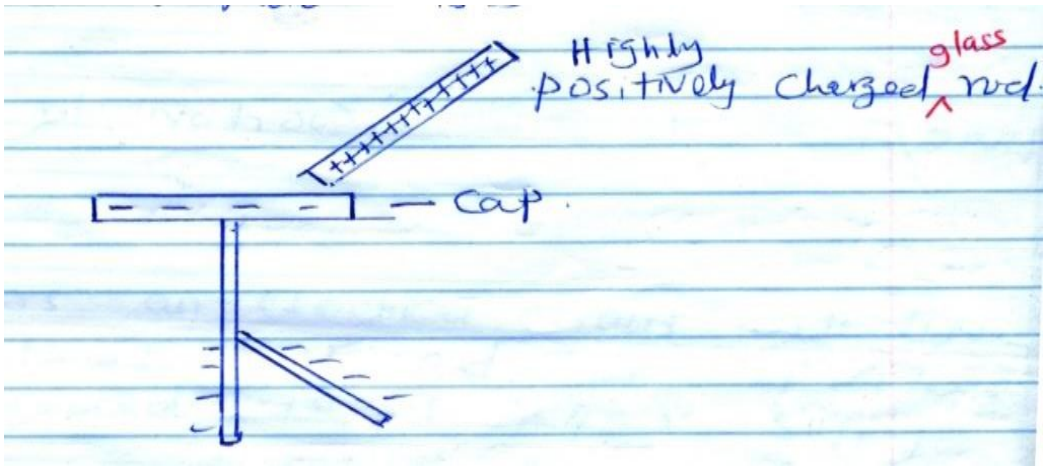


Figure 9

Explain this observation. (1mks)

c) Figure 10 shows an electric circuit used to charge a capacitor C. When switch is closed, it is observed that, the millimeter records some current which gradually reduces to zero with time.

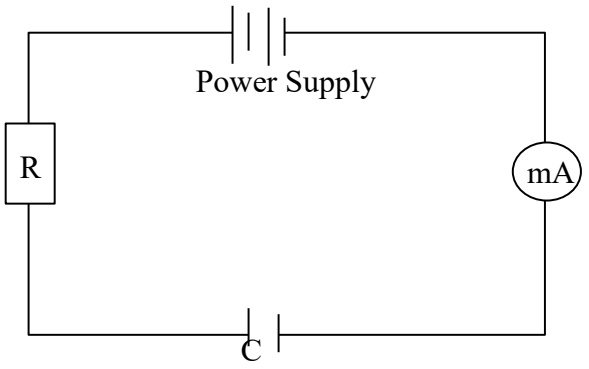


Figure 10

Explain the observation (1mks)

d) Figure 11 shows an electrical circuit with three capacitors of 10μF, 2μF and 3μF capacitance connected to a 240V supply.

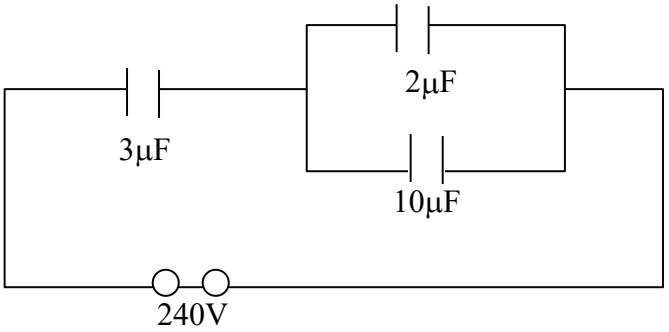


Figure 11

Determine

i) The effective capacitance of the capacitor combination. (2mks)

ii) The charged stored in the circuit. (2mks)

iii) The potential difference across the 2μF capacitor (2mks)

15. a) State one condition necessary for total internal reflection to occur. (1mk)

b) Figure 12 (a) shows a ray of light travelling in an optically denser medium to an optically rarer medium. The angle of incidence ***i*** and angle of refraction **r** are also shown.

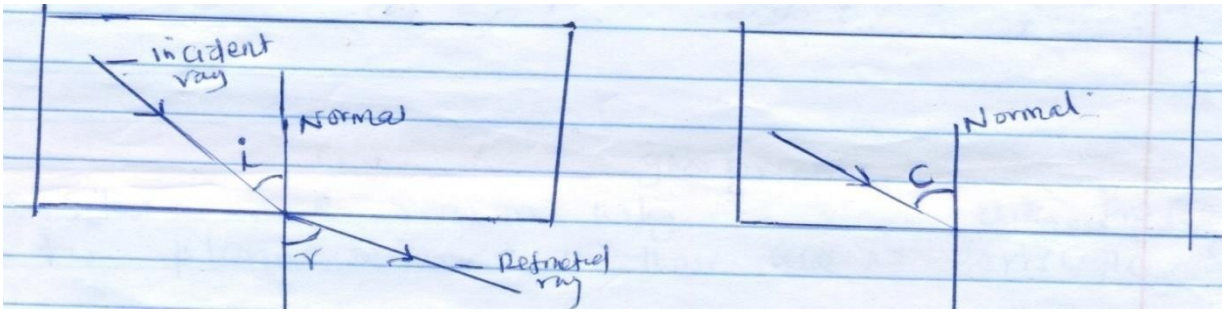


Figure 12 (a) **Figure 12 (b)**

Complete Figure 12 (b) to show the path of refraction ray when the angle of incidence is increased to reach critical angle. (1mk)

c) An optical pin placed at the bottom of a glass measuring cylinder filled with a liquid and appears to be 11.4cm below the surface of the liquid. If the refractive index of the liquid is 1.48. Determine The height of the column of the liquid in the measuring cylinder. (2mks)

d) i) State one reason why glass prisms are preferred to plane mirrors in their use in periscope. (1mk)

ii) Figure 13 shows two right angled glass prism arranged to be used in a periscope.
An object is placed besides one prism as shown.

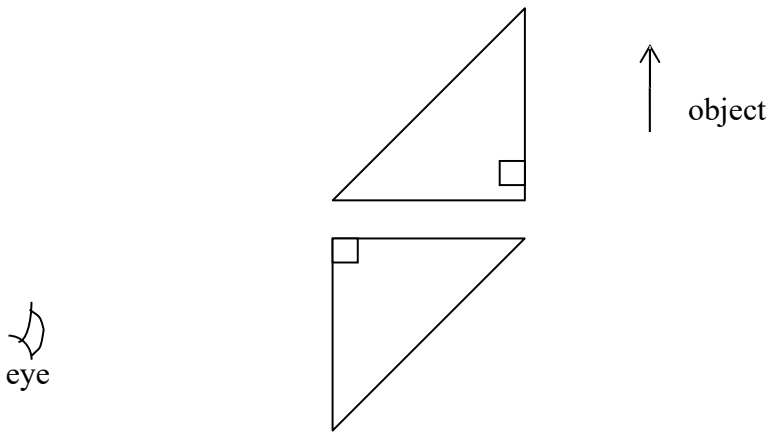


Figure 13

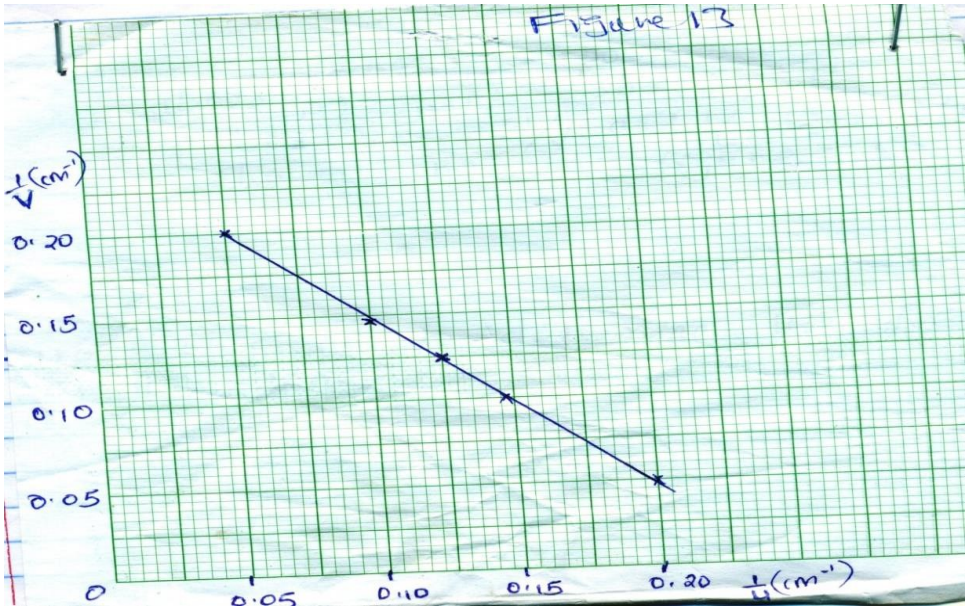
Complete the diagram by showing the path of rays of light from the object until they reach the eye.(1mk)

e) In an experiment to determine the focal length of a lens, you are provided with the following apparatus.

- A converging lens and a lens holder
- A lit candle
- A metre rule
- A white screen

i) State one measurements that you would take in the experiment. (1mk)

ii) In another experiment similar to the above, a graph showing the relationship between $\frac{1}{V}$ and $\frac{1}{u}$ was plotted as shown in figure 13.



- Use the graph to determine the focal length, f of the lens. (2mks)

e) Figure 14 shows a defeat of the eye

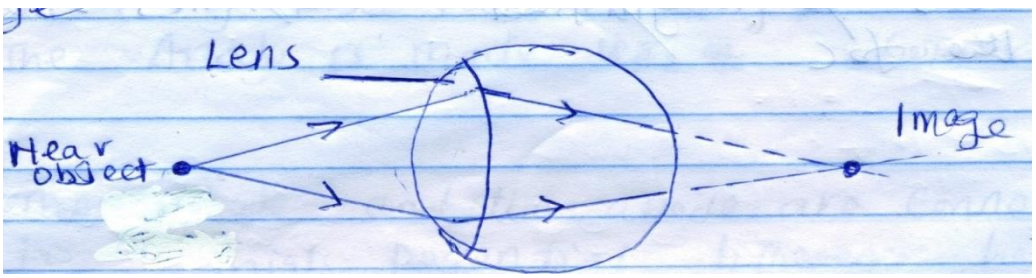


Figure 14

i) State two possible causes of the defect. (2mks)

ii) Explain how the defect is corrected. (1mk)

16. a) i) In an X-ray tube explain why

I. The anode is made up of copper. (1mk)

II. The cathode and the anode are connected to a high potential difference between them. (1mk)

ii) State the adjustments made in an X-ray tube in order to decrease the intensity of X-ray. (1mk)

iii) State the property of X-rays that makes it used in detecting foreign objects in human bodies. (1mk)

b) i) Explain the meaning of the term photoelectric effect. (1mk)

ii) A monochromatic light frequency 6.25×10^{14} Hz is incident on a metal surface. The minimum frequency that can cause photo emmission on the metal surface is 5.5×10^{14}Hz. Given that Planck's constant, h is 6.63×10^{-34} Js.

Determine

I. The energy of the source light. (2mks)

II. The work function of the metal surface. (2mks)

III. The average kinetic energy of the photo electrons. (2mks)

17. a) Figure 15 shows some features of a cathode ray tube.

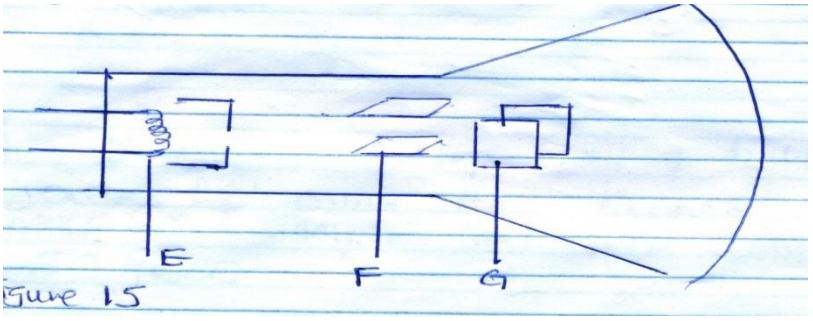


Figure 15

i) Name parts E & F (2mks)

ii) The process through which electrons are produced. (1mk)

b) i) Alpha (α) particles cause more ionization in a gas compared to Beta (β) particles. Give one reason for this. (1mk)

ii) The following is part of radioactive decay series. The symbols do not represent the actual symbols of the nuclides.

$$^{234}_{83}X \xrightarrow{\beta} {}^{a}_{84}Y \xrightarrow{\alpha} {}^{230}_{b}Z$$

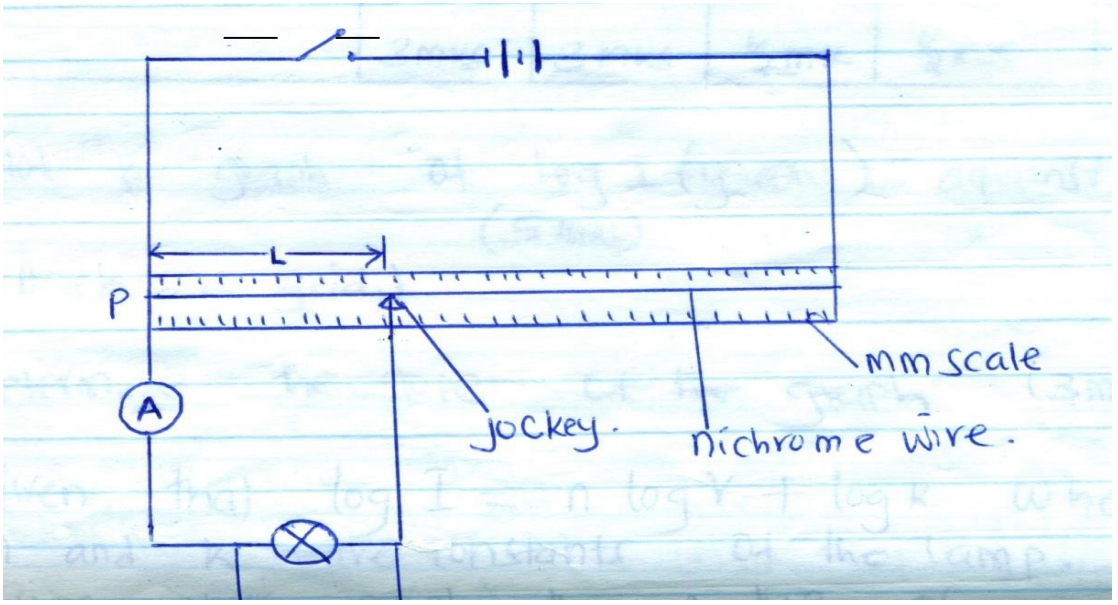
Determine the values of a and b (2mks)

iii) A radioactive Isotope has a halflife of 5.25 years. Determine the fraction of the original mass in a sample that will remain after 42 years (2mks)

PAPER 3
Question 1

1. You are provided with the following apparatus:
   - 2 size D dry cells
   - 100cm nichrome wire on a mm scale, labelled P at one end.
   - A bulb (2.5V) and a bulb holder.
   - 8 connecting wires (at least 4 with crocodile clips)
   - Cell holder
   - A voltmeter (0-5V)
   - An ammeter (0-1A)
   - A jockey

   a) Connect the apparatus provided as shown in the diagram.



b) Place the jockey at L = 20cm from P, then close the switch.
Record the ammeter reading and the voltmeter reading in the table below.

c) Repeat the experiment by placing the jockey at L = 30, 40, 50, 60 and 80cm from P.
Record your readings and complete the table below.

Length *l* (cm)	I (A)	Pd, V(V)	I(mA)	Pd, v(MV)	log I	log V
20						
30						
40						
50						
60						
80						
	3mks	3mks	-½ mk	-½ mk	-½ mk	-½ mk

d) Plot a graph of log I (y-axis) against log V (5mks)

e) Determine the slope of the graph. (3mks)

f) Give that log I = nlog V + log K where n and k are constants of the lamp. Determine using your graph the value of:

i) K (2mks)

ii) n (2mks)

Question 2

Part A

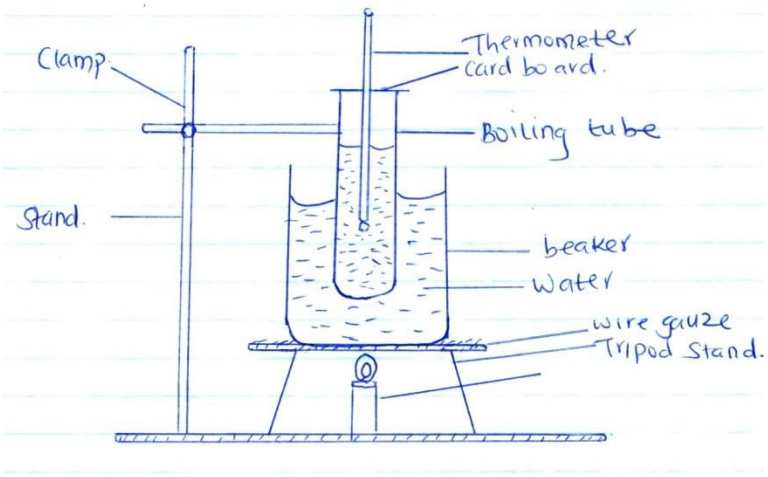
You are provided with the following:

- A retort stand, boss and clamp.
- 2 boiling tubes
- A thermometer
- Some distilled water in a beaker labelled W
- Some liquid in a beaker, labelled L
- A 250ml beaker containing some water.
- A measuring cylinder
- A stop watch

- A tripod stand and wire gauze
- A card board with a hole in the middle
- A burner.

Proceed as follows

a) Clamp one boiling tube on the retort stand. Measure and pour 45ml, of the distilled water, W into a boiling tube. Set up the apparatus as shown in the figure below.



b) Heat the water in the large beaker (250ml) until the temperature of the distilled water reached 85°C. Remove the boiling tube from the hot water by lifting up the retort stand and placing it away from the burner.

c) Stir the water in the boiling tube using the thermometer. Record in the table below the temperature of the distilled water at intervals of 30 seconds starting at 80°C until it drops to 60°C (stir the distilled water before taking any reading).

Time in minutes	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Temperature of W(°C)										
Temperature of L(°C)										

Time in minutes	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
Temperature of W(°C)										
Temperature of L(°C)										

(4mks)

d) Using the second boiling tube, repeat the procedure in b and c using 45ml of liquid L instead of distilled water. Record your results in the same table.

e) Using the same axis on the grid provided, plot a graph of temperature (y-axis) against time for
i) Distilled water, W
ii) Liquid L

(Label the graphs of L and W. (7mks)

f) From the graph, determine:
i) the time, t taken for the distilled water to cool from 75°C to 65°C.

t_w = _____ minutes (1mk)

ii) the time, t taken for liquid L, to cool from 75^0C to 65^0C

t_L= _____ minutes (1mk)

g) Determine the constant r given that $r = \frac{4.2t_l}{dt_w}$ where d, density of liquid, L = 0.8g/cm^3. (2mks)

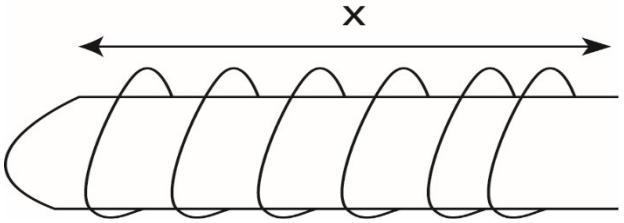
PART B

You are provided with the following:

- Copper wire of length 130cm.
- Test tube of diameter 1.5cm (ordinary)
- Metre rule.

Procedure

By using the wire provided, make 20 closely packed turns around the said ordinary test tube as shown.



h) Measure the length x = _____ cm (1mk)

i) Use the result "X" to determine the thickness of the wire, d = _____ cm. (1mk)

j) Given that the volume of the wire $V = \frac{1}{4}\pi d^2L$, determine the volume, V of the wire if L = 120cm. (3mks)

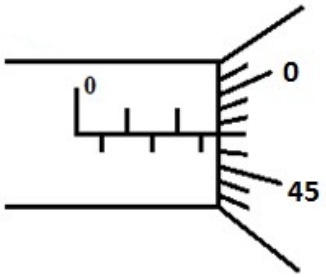
KCSE REPLICA 7
PAPER 1

INSTRUCTIONS TO CANDIDATES.

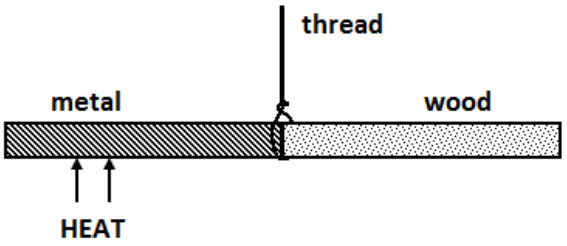
Constant: g=10N/kg or 10m/s²

SECTION A: 25 MARKS

1. The figure below shows a part of micrometer screw gauge with a zero error of -0.04mm. Write down the exact length measured. (2 marks)



2. The following figure shows a rod made of wood on one end and metal on the other end suspended freely with a piece of thread so that it is in equilibrium.



The side made of metal is now heated with a Bunsen flame. State and explain the observation that will be made after some time. (2marks)

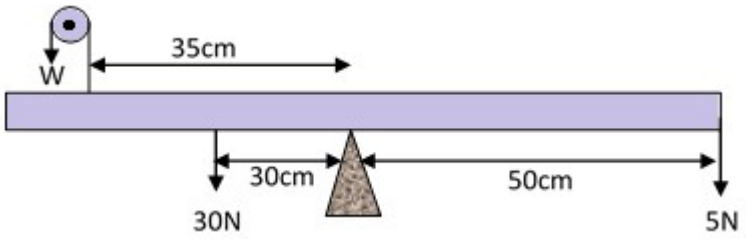
3. Estimate the size of an oil molecule if a drop of oil of volume 6.0×10^{-10} m^3 forms a patch of diameter 32 cm on a water surface. (2marks)

4. An immersion heater rated at 180W is placed in a liquid of mass 2kg. When the heater is switched on for 7.5 minutes the temperature of the liquid rises by 40°C. Determine the specific heat capacity of the liquid. (3marks)

5. Other than increase in temperature state one other way of lowering the surface tension of a liquid.

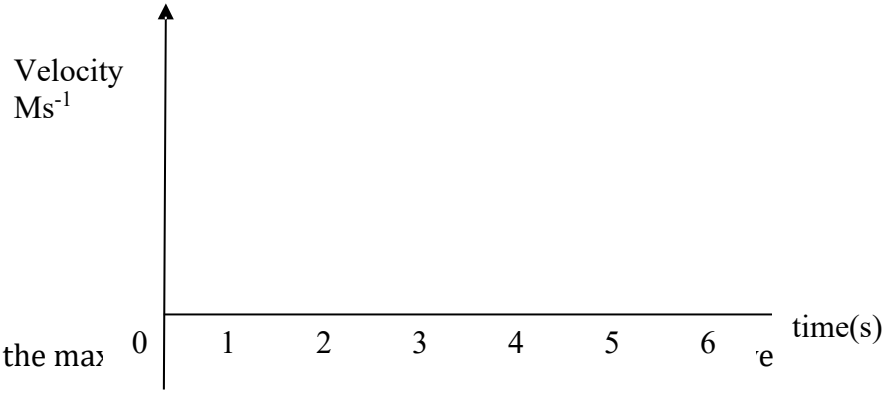
(1mark)

6. The figure below shows a uniform bar pivoted at its centre and is at equilibrium.



Determine the value of W. (3marks)

7.(i) Sketch a velocity – time graph on the axes provided for an object thrown vertically upwards with initial velocity 20 ms^{-1} and takes 2 seconds to reach maximum height.(1 mark)



(ii) Calculate the max e (2 marks)

8. Inan experiment to demonstrate Brownian motion, smokewas placed in asmoke celland observed under amicroscope. State and explain the observation. (2marks)

9. Stateareasonwhyaburn from steam at 100^0C is moreseverethan aburn from boilingwater at the same temperature (1 mark)

10. Explain why therate of heatflowin a conductorincreases with increaseincross-section area.
(1 mark)

11.A piece of paper is held in front of the mouth and air blown horizontally over the paper, it is observed that the paper get lifted up. Give reason for the observation. (1mark)

12. In the study of free fall, it is assumed that the gravitational force F acting on a given body of mass, m is given by F = mg. State two other forces that act on the same body. (2marks)

13.A girl in a school in Nakuru plans to make a barometer using a liquid of density $1.25gcm^{-3}$. If the atmospheric pressure in the school is $93750Nm^{-2}$. Determine the minimum length of the tube that she will require? (2 marks)

SECTION B (55MARKS)

ANSWER ALL QUESTIONS IN THIS SECTION

14 a) (i) State Archimedes' Principle. (1mk)

(ii) A metal block weighs 1.04N in air, 0.64N when fully immersed in water and 0.72N when fully immersed in a liquid. If the density of water is 1000 kg m^{-3}, find:

I) the density of the liquid. (2mks)

II) Thedensity of the metal block. (2mks)

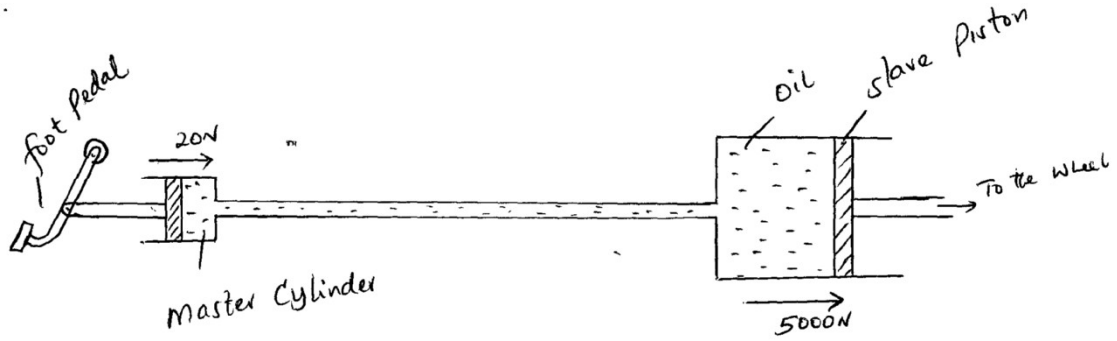
b) A crane lifts a load of 2000Kg through a vertical distance of 3.0m in 6 seconds.
Determine the;

i) Work done by the crane. (2mks)

ii) Power developed by the crane. (2mks)

iii) Efficiency of the crane given that it is operated by an electric motor rated 12.5kW. (2mks)

15. (A) The figure below shows a hydraulic brake system.



A force of 20 N is applied on the foot pedal connected to a master cylinder piston of area 500cm^2. This causes a stopping force of 5,000N on one wheel. Calculate.

i) Pressure on the master cylinder (2 marks)

ii) Area of the slave cylinder piston. (2 marks)

iii) Velocity ratio of the system. (2 marks)

B) I) State the reason why a body in uniform circular motion is said to be accelerating.(1 mark)

II) A particle moving along a circular path of radius 5cm describes an arc of length 2cm every second. Determine:

(i) Its angular velocity. (1mark)

(ii) Its periodic time. (2marks)

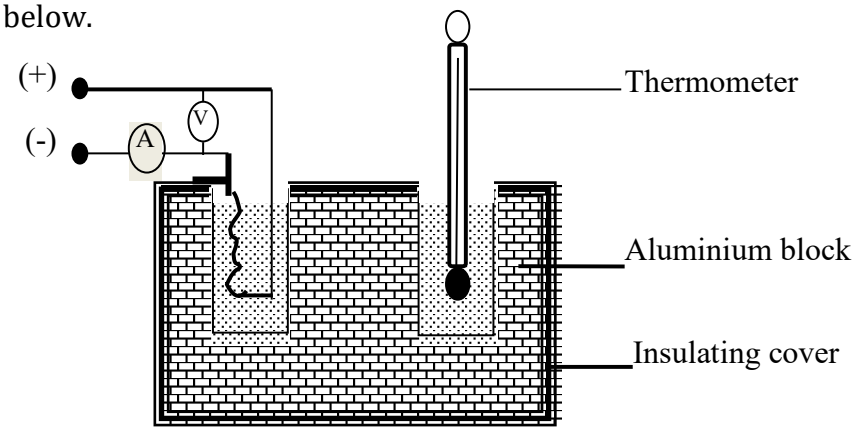
c) A stone of mass 150g is tied to the end of a string 80cm long and whirled in a vertical circle at 2rev/s. Determine the maximum tension in the string. (3marks)

 for marking schemes inbox 0724351706

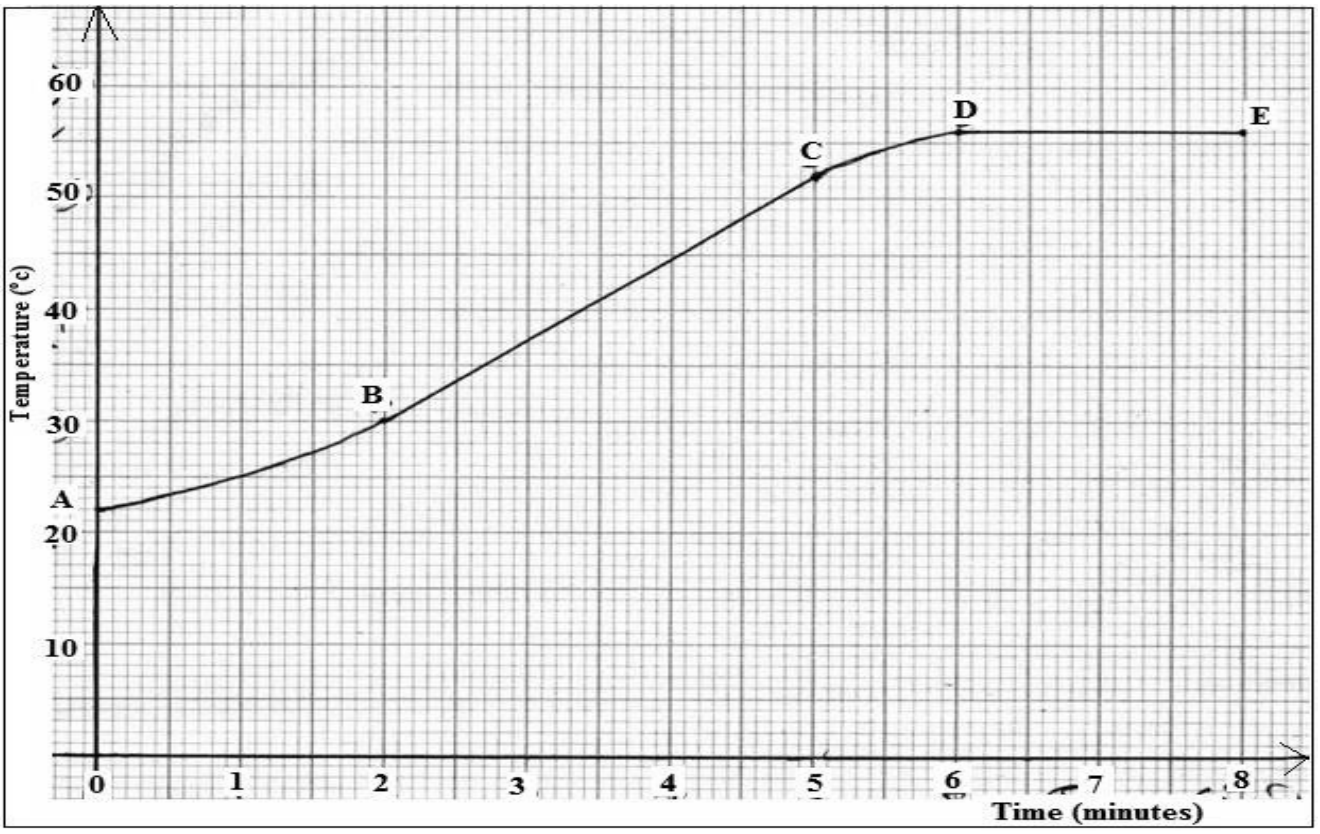
(d) State **one** factor affecting centripetal force (1mark)

16 a) Define "specific heat capacity" of a substance (1mark)

b) In an experiment, an aluminum block of mass 2kg was heated using an immersion heater as shown in figure below.



The temperature of the block was recorded every minute for exactly five minutes and then the heater was switched off. A graph of temperature in ^{o}C against time in minutes for the experiment is shown below.



Using the graph, Suggest why;

i) The reading in the thermometer rose relatively slowly between point A and B. (1mark)

ii) The temperature continued to rise after the heater was switched off (1mark)

iii) Use the straight portion of the graph (B to C)to calculate the specific heat capacity of the aluminum given that the voltmeter reads 22.0 V and ammeter 10.0 A throughout the experiment. (3 marks)

c) Giving a reason explain why the value calculated in b) (iii) will not be accurate. (1 mark)

d) A faulty thermometer reads 40^0Cwhen dipped in pure melting ice and 240^0Cwhen in contact with steam above pure boiling water. What would the same thermometer read when put in water at 50^0C? (2 marks)

17 (a) A stone is thrown horizontally with a velocity of 45m/s from the top of a vertical tower 50mhigh. Determine:

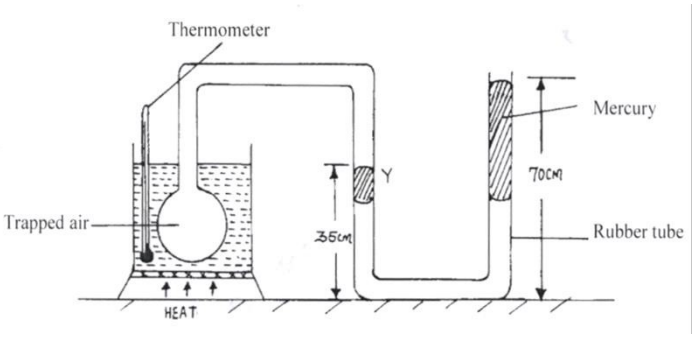
i. The time taken by the bullet to reach the bottom of the ground (2 marks)

ii. The maximum horizontal distance covered by the bullet (2marks)

b) i) Distinguish between elastic and inelastic collision. (1mark)

ii) A car of mass 800 kg collides heads on with a truck of mass 5000kg travelling at 40 m/s. The car is thrown to the bonnet of the truck which continues to move after impact at 10 m/s in the original direction. How fast was the car moving? (3marks)

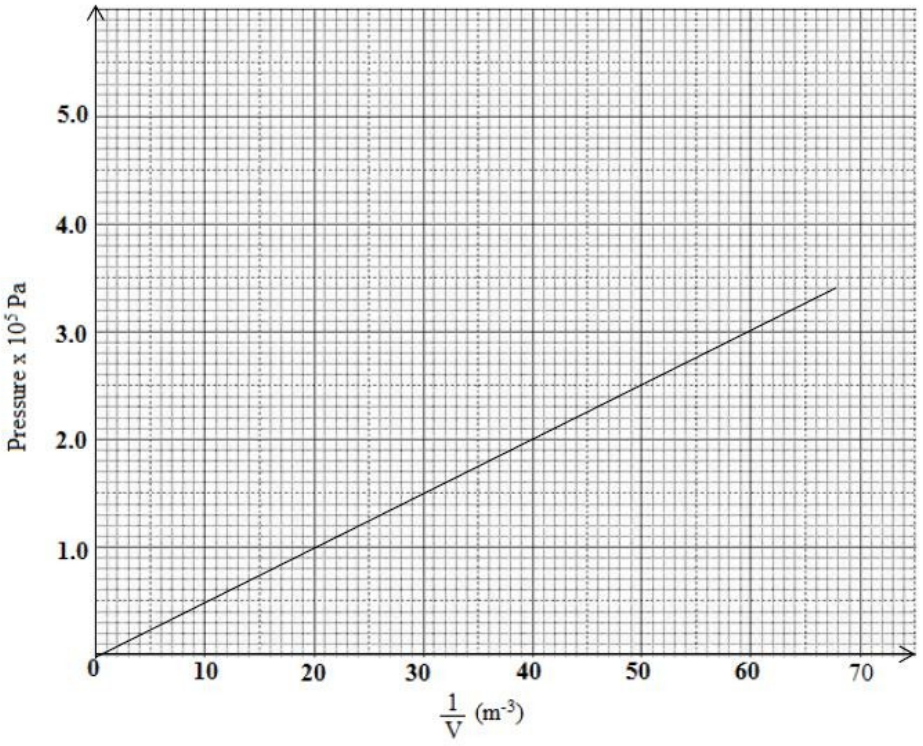
18. Figure below shows the apparatus that a student used to investigate the relationship between temperature and pressure of a fixed mass of a gas at constant volume.



a) i) Describe how the student should ensure that all air trapped has the same temperature as indicated by the thermometer. (2 marks)

ii) Give a reason why it is necessary to ensure that before taking any reading on pressure, the liquid level should reach the level marked Y. (1 mark)

(b) The pressure P of a fixed mass of a gas at a constant temperature of T = 200K isvaried continuously and values of corresponding volume recorded. A graph P against $\frac{1}{V}$ is shown on grid below.



(i) determine the volume of the gas when the pressure reads 2.8 x 10^5pa (2 marks)

(ii) find the value of R given that the pressure P and volume V of the gas are related by the equation $T = \frac{PV}{2R}$, where R is a constant (4 marks)

(c) The pressure of the air inside a car tyre increases if the car stands out in the sun for some time on a hot day. Explain the pressure increase in terms of the kinetic theory of gases. (2 marks)

(d) A gas is put into a container of fixed volume at a pressure of 3.6 x 10^5 Nm^{-2} and temperature 27°C. The gas is then heated to a temperature of 177°C. Determine the new pressure (3 marks)

PAPER 2

SECTION A 25MARKS.
Answer all questions in the space provided

1. What is meant by virtual image? (1mk)

……

2. i) Arrange the following electromagnetic waves in order of their increasing wavelength *visible light, X-rays, Microwaves, infrared radiation.* (1 mk).

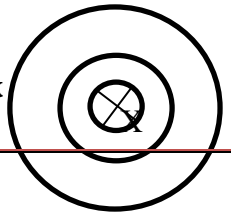
……

……

ii) Name one device that can be used to detect infrared radiation. (1mk)

……

3. Indicate the direction of the magnetic field in the conductor carrying current shown below. (1mk)

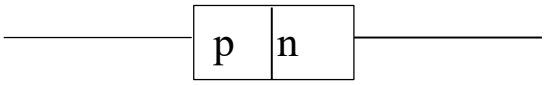


4. i) Define the term 'doping'. (1mk)

.....

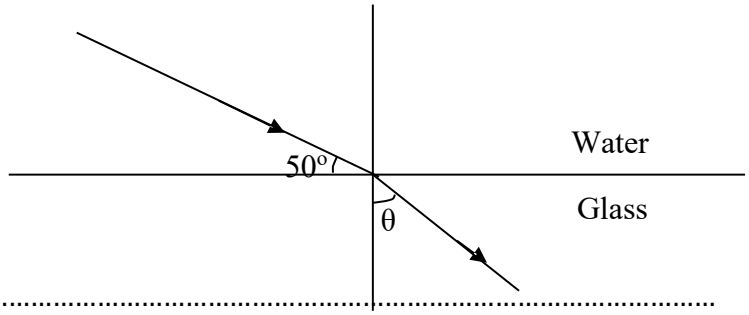
.....

ii) The diagram below shows a p – n junction diode.



Complete the diagram above to show how the diode can be connected in reverse bias mode. (1mk)

5. Given that the refractive index of glass is 3/2 and that of water is 4/3. Determine the value of angle in the figure below. (3mks)



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6. State two factors that determine how far X- rays penetrate a given material. (2mks)

.....

.....

7. i) Uranium $^{238}_{92}U$ emits an alpha particle to become another element X as shown in the equation below.

$$^{238}_{92}U \quad ^{a}_{b}X + \text{alpha particle} \longrightarrow$$

Determine the values of a and b. (2mks)

……

……

ii) State two sources of background radiation. (2mks)

……

……

8. i) Explain why Nichrome wire is used as a heating element rather than copper. (1mk)

……

……

ii) An electric bulb is rated 240V, 100W. Calculate the amount of current through its filament. (2mks)

……

……

……

iii) If ten such bulbs were used in a house for lighting, determine the most suitable fuse value. (1mk)

……

……

9. State two conditions for the formation of a stationary wave. (2mks)

……

……

10. A gun is fired and an echo heard at the same place 0.6s later. How far is the barrier which reflected the sound from the gun? (Speed of sound in air = 330m/s). (3mks)

……

……

……

……

11. State how polarization is reduced in a dry cell. (1mk)

……

12. A negatively charged rod is brought near the cap of lightly charged electroscope. The leaf divergence first reduces but as the rod comes nearer, it diverges more. State the charge of the electroscope. (1 mk)

……

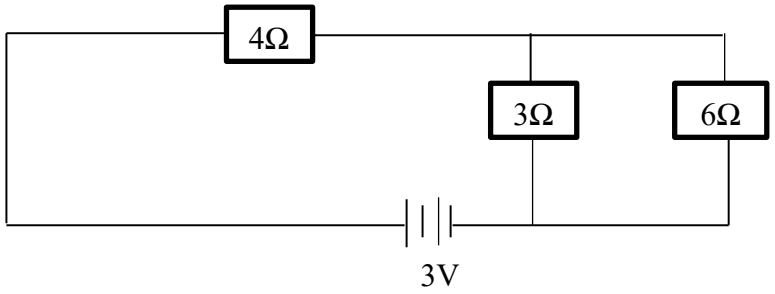
SECTION B (55 MARKS).
Answer all the questions in the spaces provided

13. a) State one condition under which ohm's law is obeyed in a metal conductor. (1mk)

……

b) You are provided with three resistors R_1, R_2 and R_3 connected in parallel. If the p.d across them is V, show that an expression for the effective resistance of the three resistors is given by. $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ (3mks)

c) The diagram below shows the resistors connected in a circuit.



Calculate:

i) The total resistance in the circuit. (2mks)

……

……

……

ii) Total current flowing in the circuit. (2mks)

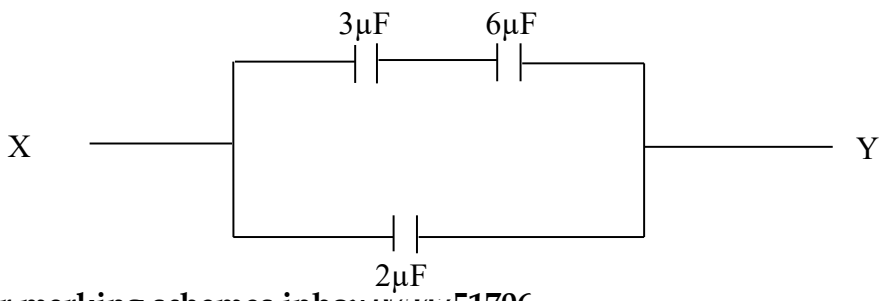
……

……

d. i) State one way of increasing the capacitance of a parallel plate capacitor. (1mk)

……

ii) The diagram below shows a simple network of capacitor.



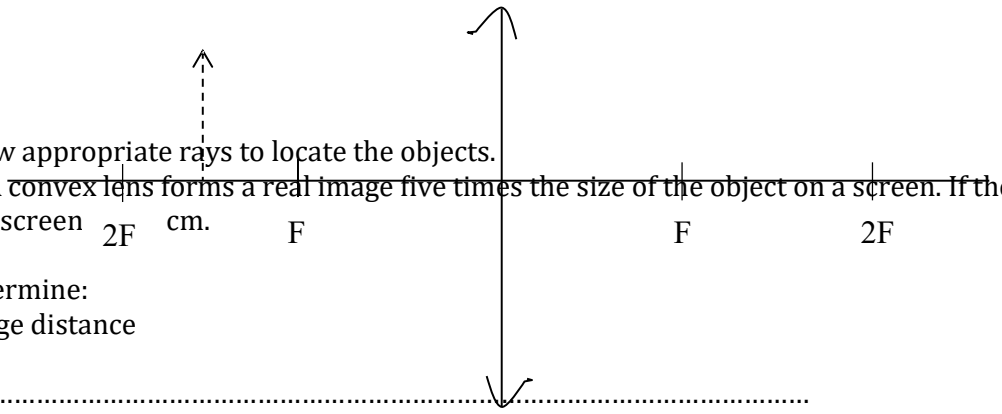
If the potential difference between X and Y is 12V, calculate the total charge stored bythe capacitors. (3mks)

14. a) Define Principal focus of a biconcave lens

……

……

b)The diagram below shows a virtual image of an object placed in front of a biconvex lens



Draw appropriate rays to locate the objects. (3mks)

c). A convex lens forms a real image five times the size of the object on a screen. If the distance between the object and screen cm.

Determine:

i. Image distance (1mk)

……

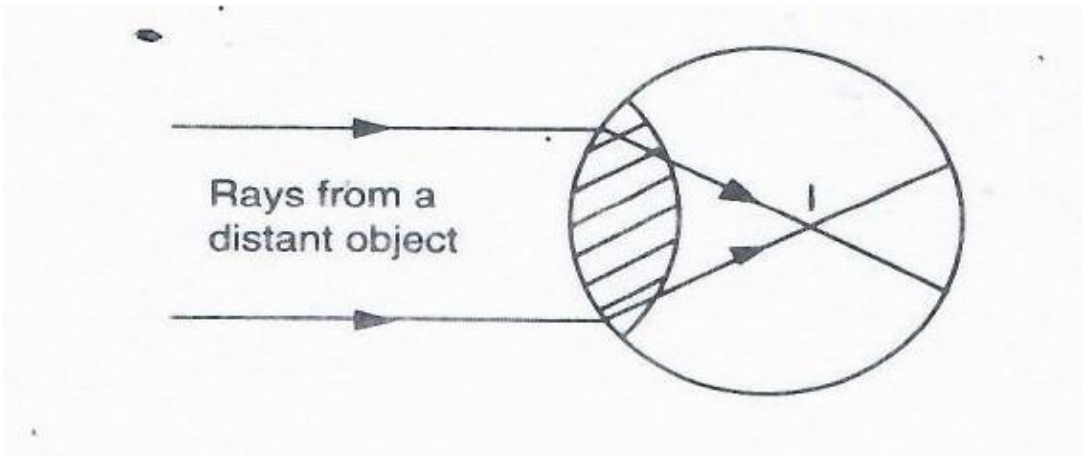
……

ii. Focal length. (2mks)

……

……

d) The diagram below shows a defect in human eye.



(i) Name the defect. (1mk)

……

ii) State one cause of the defect. (1mk)

……

iii) How can the defect be corrected? (1mk)

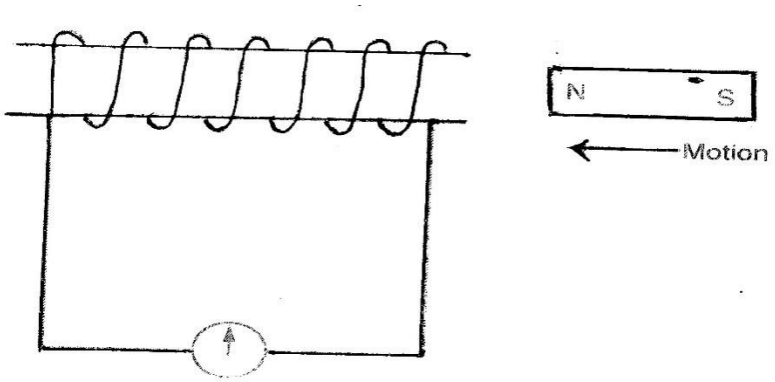
……..

15. a) State Lenz's law of electromagnetic induction. (1mk)

……

……

b) The figure below shows a bar magnet being moved into a coil connected to a galvanometer in the direction indicated.



State the observation made on the galvanometer when:

i. The magnet is moved into the coil at a steady speed. (1mk)

……

ii. The magnet is held stationary inside the coil. (1mk)

……

c) How is a transformer designed to minimize energy losses through flux leakage? (1mk)

……

……

d) The primary coil of a transformer has 2000 turns and is connected to a 240V a.c supply. The secondary coil has 400 turns.

i. State with a reason the type of the transformer. (1mk)

……

……

ii. Determine the voltage in the secondary coil. (2mks)

……

……

……

iii. If the current flowing in the primary coil is 0.5A and in the secondary coil is 2.0 A determine the efficiency of the transformer. (2mks)

……

……

……

e) Electrical energy is transmitted at very high voltage and low current.

i. State how the high voltages are attained. (1mk)

……

ii. State two reasons why aluminum wires are preferred to copper wires for transmission over long distances. (2mks)

……

……

16. a) What is thermionic emission? (1mk)

……

……

b) Explain why a cathode ray tube is evacuated. (1mk)

……

……

c) Heated cathodes are coated with oxides of such metal as barium, Strontium or thorium. Explain. (1mk)

……

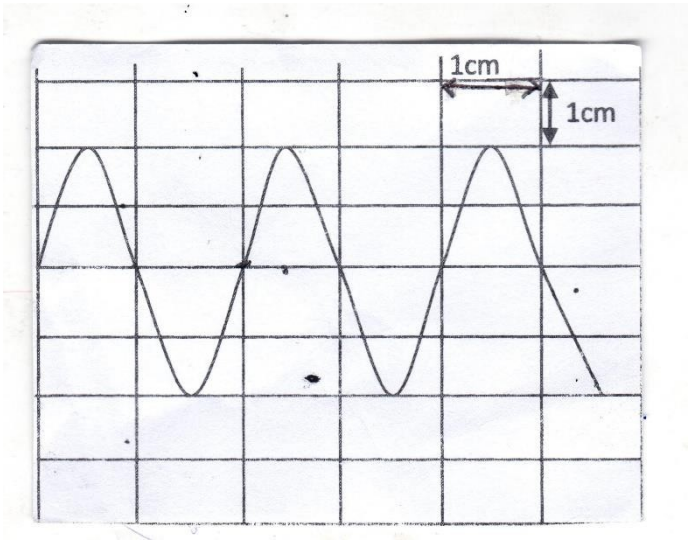
……

d) State one property of cathode rays. (1mk)

……

……

e) The figure below shows the waveform displayed on C.R.O screen when an alternating voltage is applied on the Y – input. The time – base is at 1ms/cm and the Y- gain at 10v/cm.



Calculate :

i. The pick voltage of the input signal. (2mks)

……

……

ii. The frequency of the a.c signal. (2mks)

f) In a certain X- ray tube, the electrons are accelerated by p.d of 12kv. Assuming that all the energy goes to produce X-rays, determine the frequency of the X rays produced.
(takeplanck'sconstant h = 6.62 x10 $^{-34}$ Js, and the charge of an electron e = 1.6 x 10 $^{-19}$ C) (3mks)

……

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17. a) It is observed that when ultra – violet radiation is directed onto a clean Zinc plate connected to the cap of a negatively charged leaf electroscope, the leaf falls.

i. Explain this observation. (1mk)

……

……

ii. Explain why the leaf of the electroscope does not fall when infrared radiation is directed onto the zinc plate. (1mk)

……

……

b) State the effect on the electrons emitted by the photoelectric effect when the intensity of incident radiation is increased. (1mk)

……

……

c) The maximum wavelength required to cause photoelectric emission on a metal surface is 8.0 x 10^{-7} m. The metal surface is irradiated with light of frequency 8.5 x 10^{14} Hz.
(Take lev = 1.6 x 10^{-19}J ,c = 3.0 x 10^{8} m/s , h= 6.63 x 10^{-34}Js)

Determine:

i). The threshold frequency. (2mks)

……

……

……..

work function of the metals in electron volts. (2mks)

……

……

……

iii) .The maximum Kinetic energy of the electrons. (3mks)

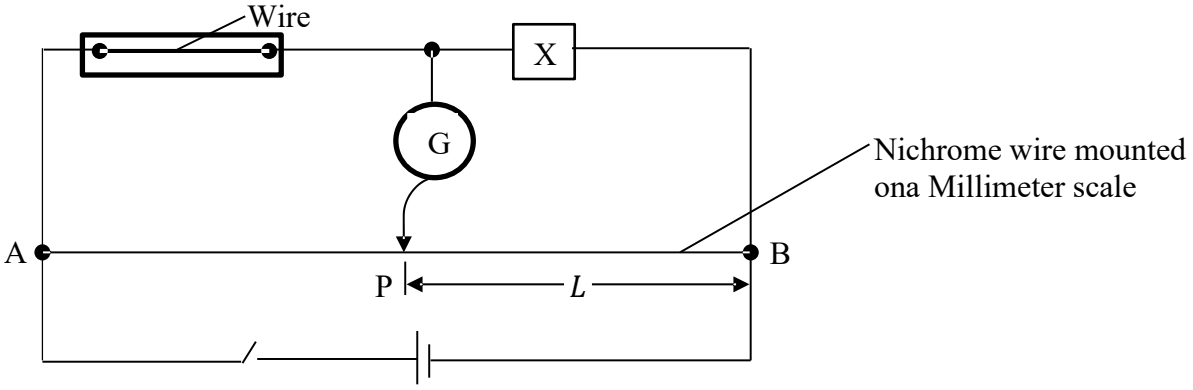
PAPER 3

QUESTION 1 (20 marks)

1. You are provided with the following;
   - A galvanometer
   - A dry cell and a cell holder
   - A switch
   - A wire labelled Y mounted on a piece of wood.
   - Eight connecting wires each with a crocodile clip at one end.
   - A resistance wire labelled AB mounted on a millimeter scale.
   - Six 10Ohm carbon resistors
   - A jockey or crocodile clip
   - Micrometer screw gauge (to be shared)

Proceed as follows:

(a) Set up the circuit as shown in figure below, with Xbeing one of the 10 ohms carbon resistors.



(b) Close the switch. Tap the jockey at various points on the wire AB and locate point P at which the galvanometer shows zero deflection, measure and record in table below the length, l where l = PB.

(c) Repeat the procedure in (b) using X as two 10Ω resistors, three resistors, four resistors, five resistors and six resistors. **X is the effective resistance for the parallel combination i.e.** $\mathbf{X = \frac{10}{n}}$ where **n** is the number of resistors in parallel.

(d) Record your readings in table below. (6mks)

TABLE

Number of **10Ω** Carbon resistor	**One**	**Two**	**Three**	**Four**	**Five**	**Six**
X (Ω)						
L (cm)						
$\frac{1}{X}(\Omega^{-1})$						
$\frac{1}{L}(cm^{-1})$						

(e) Plot a graph of $\frac{1}{L}$ (y-axis) against $\frac{1}{X}$. (5mks)

(f) Determine the slope m of the graph. (2mks)

(g) Given that $\mathbf{\frac{1}{L} = \frac{R}{KX} + \frac{1}{K}}$ where K = 100cm. Use the graph to determine R. (2mks)

(h) Measure the diameter d and the length l of wire Y. (2mks)

l =……m

d = ……m

(i) Determine its cross-sectional area A of the wire Y. (1mk)

A =…… m^2

(j) Determine the resistivity $\boldsymbol{\rho}$ of the wire Y given that its Resistance, $\mathbf{R = \rho \frac{l}{A}}$. (2mks

QUESTION 2 (20 marks)

PART A

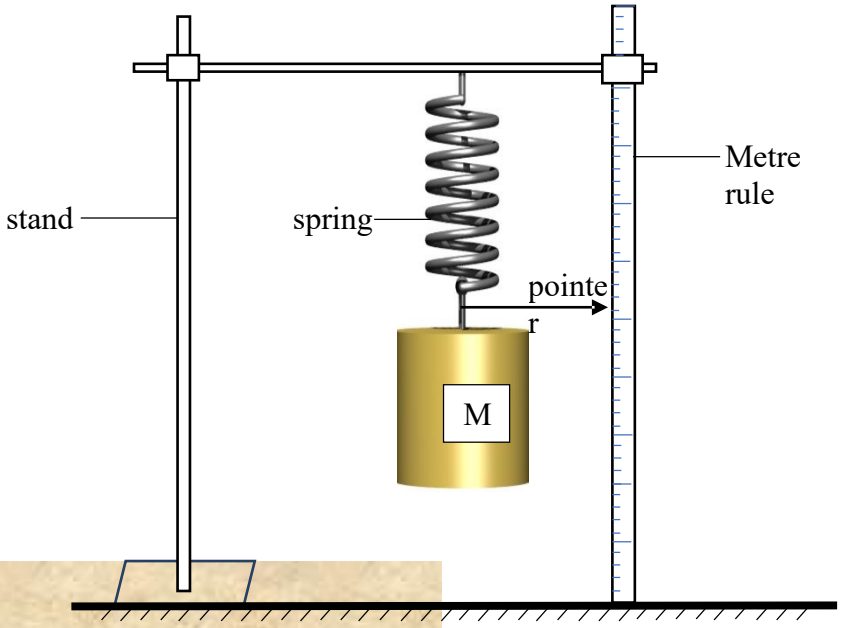
You are provided with the following;

- Meter rule

- Retort stand, clamp and boss
- A spring and with a pointer
- Three masses (a 100 g and two 50g masses)
- Stop watch

Proceed as follows

a) Set the apparatus as shown below.



ecord the pointer readings

.....m. (1mk)

ermine the extension of the spring, e_1.

e_1.....m. (1mk)

(ii) Displace the 150 g mass slightly downwards and release it to oscillate vertically. Time 20 oscillations and obtain time t_1.

t_1..... (1mk)

(iii) Find periodic time T_1

T_1..... (1mk)

(iv) Use the equation $T = 2\pi\sqrt{\frac{e}{p}}$ to find the value of P_1. (2mks)

d) (i) Load a mass of 200 g and determine the extension of the spring, e_2.

e_2.....m. (1mk)

(ii) Displace the 200 g mass slightly downwards and release it to oscillate vertically. Time 20 oscillations and obtain time t_2.

t_2..... (1mk)

(iii) Find periodic time T_1

T_2..... (1mk)

(iv) Use the equation $T = 2\pi\sqrt{\frac{e}{p}}$ to find the value of P_2. (2mks)

e) Find the average of P

$P_{av} = \frac{P2+p1}{2}$ (2mks)

PART B

Apparatus

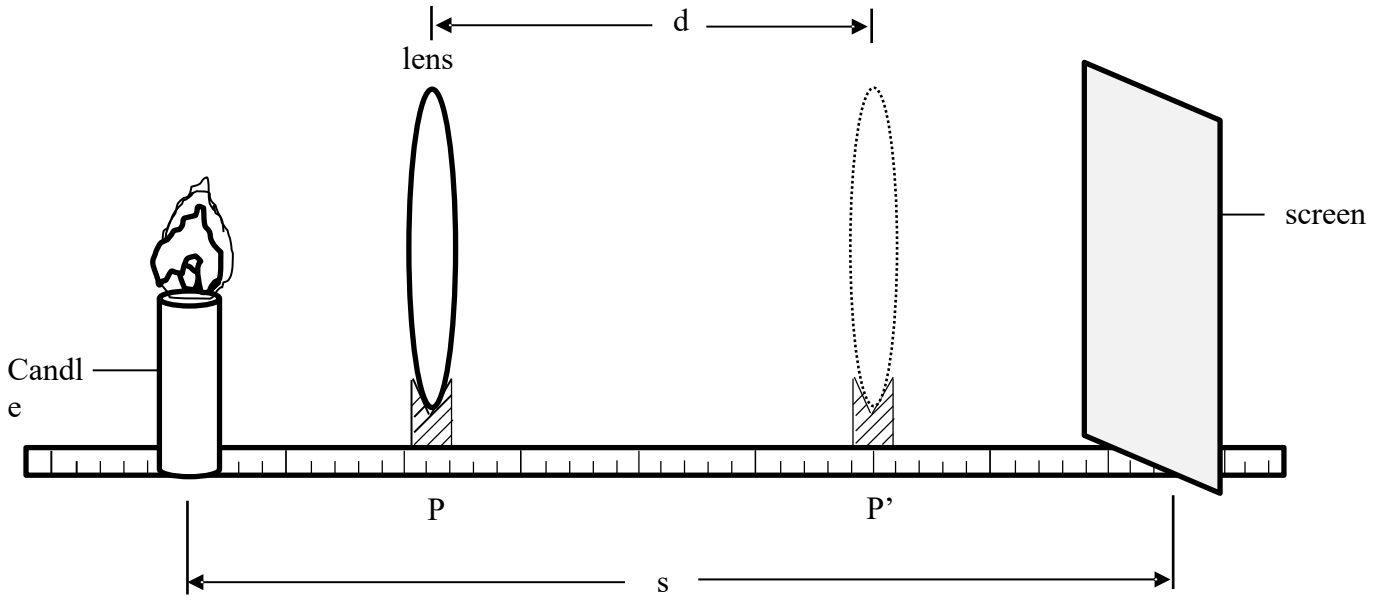
- Lens and a lens holder.
- A candle
- Screen
- A metre rule.

Procedure

f) Focus a distant object and estimate the focal length, **f** of the lens

f ..... mm. (1mk)

g) Set up the apparatus as shown below.



h) Set the distance **s= 60 cm.**

i) Adjust the position of the lens to position **p** where a magnified sharp image is formed on the screen**.** Recordposition P.

P =..... cm. (1mk)

ii) Maintaining distance **s,** adjust the lens to position **P'**where a diminished sharp image is formed on the screen. Record position, **P'.**

P' = ... cm. (1mk)

iii) Find distance **d,** betweentheoriginalposition and final position of lens

d = ... cm (1mk)

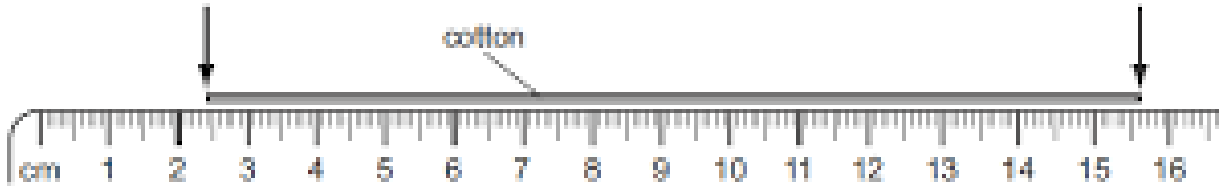
i) Using the formula $s^2 - d^2 = 4qs$. Find the value of **q.** (2mks)

j) What physical quantity do **q** represent (1mk)

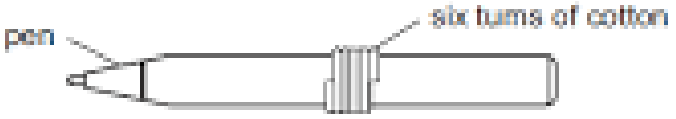
KCSE REPLICA 8
PAPER 1

SECTION A (25 MARKS)

1. A piece of cotton is used to measured between two points on a ruler as shown



When the length of cotton is wound closely around a pen, it goes round six times.



Calculate the circumference of pen (3 marks)

2. Koome heats 5kg of water to a temperature of 80°C. When she adds m kg of water at 15°C the mixture attains a temperature of 40°C. Determine the value of m (3mks)
……
……
……

3. 100 drops of oil, of density 800kg/m^3 are found to have a total mass of 2 x 10-^{4} kg. One of the drops is placed on a large clean water surface and it spreads to form a uniform film of diameter 50 cm^2. Determine; the diameter of the oil molecule. (3 mks)
……
……
……

4. The figure below shows a uniform plank AB of length 10m weighing 500N. Two masses measuring 25kg and 60kg are loaded on its ends.

Determine the distance from point A where a support should be placed for the plank to balance horizontally. (3mks)
……
……
……

5. An aircraft 300m from the ground, travelling horizontally at 400 m/s releases a parcel. Calculate the horizontal distance covered by the parcel from the point of release. (Ignore air resistance) (2mks)

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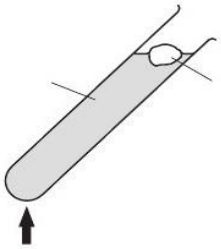
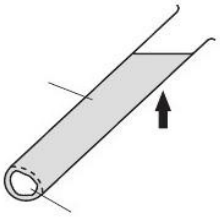
……
……

6. The figure below the figure below shows two experiments to investigate energy transfer in water.





gentle heating

gentle heating

apped by small piece of wire gauze

gentle heating

Name the process by which thermal (heat) energy travels through the glass. (1 mk)

……..

7. In the above experiment give a reason who the ice had to be wrapped on metal (1 mark)

……
……
……

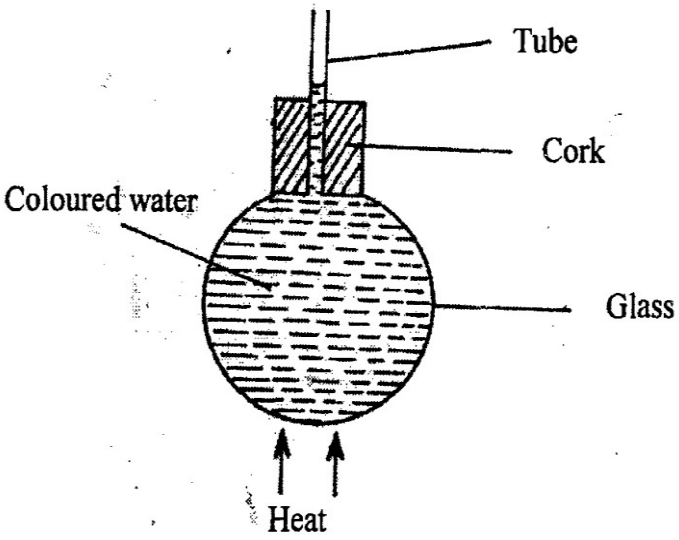
9. Distinguish between speed and velocity. (1mark)

……
……
……

10. In the study of free fall, it is assumed that the force F acting on a given body of mass, m, is gravitational, given by F = mg. State two other forces that act on the same body. (2marks)

……
……
……

11. In the set up shown below, it is observed that the level of the water initially drops before starting to rise. Explain this observation. (2marks)



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12. A wise cyclist will carry a load on the bicycle's carrier and not in a rack sack on his back. Explain (2mks)

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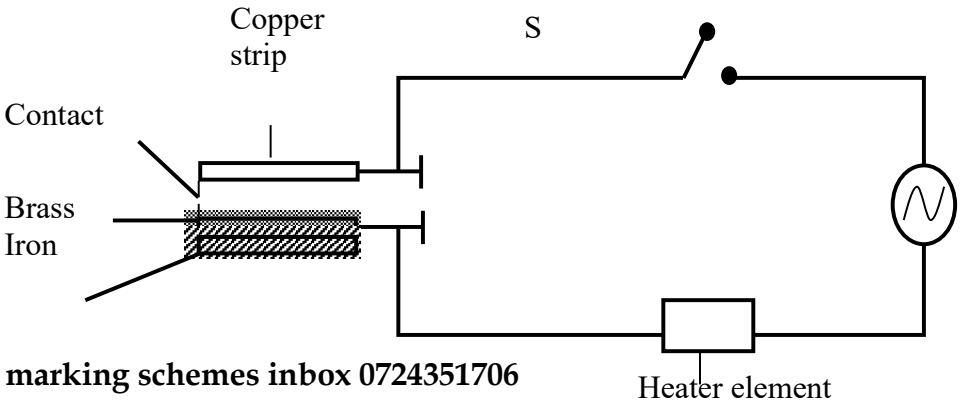
Section B (55 Marks)

13.. (a) The figure below shows a circuit diagram for a device for controlling the temperature in a room.



(i) State the purpose of the bimetallic strip. (2mks)

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……
……

(ii) Describe how the circuit controls the temperature when the switch S is closed. (3 Marks)

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……
……

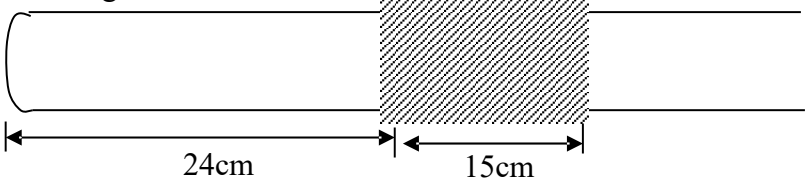
(b) (i) Differentiate between the term heat capacity and specific heat capacity of a substance (2mks)

……
……
……

(ii) An electric kettle rated 2.5kW is used to raise the temperature of 3.0kg of water through 50^0C. Calculate the time required to effect this (Specific heat capacity of water is 4200j/kgK) (3 Marks)

……
……
……

14.(a) A glass capillary contains enclosed air by a thread of mercury 15cm long when the tube is horizontal, the length of the enclosed air column 24cm as shown.



iii) What is the length of the enclosed air column when the tube is vertical with the open end uppermost if the atmosphere pressure is 750mmHg? (2mks)

……
……
……

iv) Explain why the mercury does not run out when the tube is vertical with the closed end uppermost. (1mk)

……
……
……

b) Explain why an air bubble increase in volume as it rises from the bottom of a lake to the surface. (1mk)

……
……
……

c) When an inflated balloon is placed in a refrigerator it is noted that its volume reduces, use the kinetic theory of gases to explain this observation. (2mks)

……
……
……

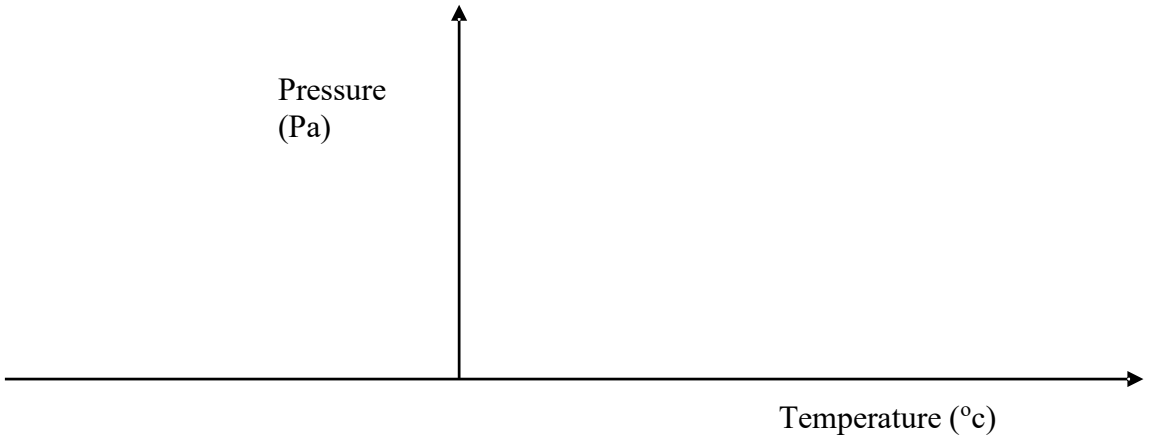
d) A certain mass of hydrogen gas occupies a volume of $1.6m^3$ at a pressure of 1.5×10^5 Pa and a temperature of 22^0c. Determine the volume when the temperature is 0^0c at a pressure of 0.8×10^5 Pa. (3mks)

……
……
……

e) i)State the pressure law (1mk)

……
……
……

ii)On the axis provided, sketch a graph of pressure against temperature on the celcius scale. On the same axis sketch another graph for a gas of a larger volume. (2mks)



15. a) A machine is a device that enables work to be done more easily and conveniently. State **two** ways in which a machine ensures this. (2 marks)

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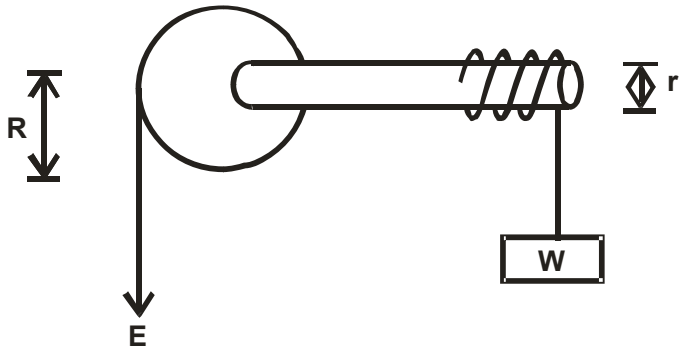
……
……

b) The figure below shows a simple machine being used to raise a load W by applying an effort E.



i) Name the machine. (1 mark)

……..

ii) Show that the velocity ratio (V.R) of the machine is given by R/r. (2marks)

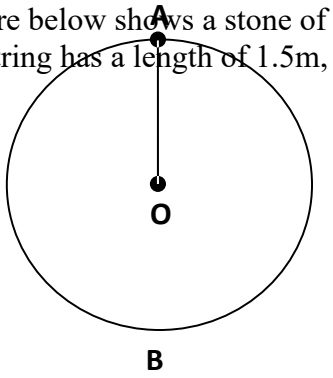
iii) Given that r =11cm and R = 99cm, determine the effort E required to raise a load of 2800N if the efficiency (η) of the machine is 95%. (4 marks)

c) Explain why as the load increases the value of mechanical advantage of a machine approaches the value of the velocity of the machine. (1 mark)

……

……

16.(a) The figure below shows a stone of mass 450g rotated in a vertical circle at 3 revolutions per second. If the string has a length of 1.5m, determine:



(i) The linear velocity (3mks)

……
……
……
……
……
……

(ii) The tension of the string at position **A** (3mks)

……
……
……
……..

b) On the same diagram indicate the path that the stone will follow if the string snaps at point B (1 Mk)

(c) A stone is whirled with uniform speed in horizontal circle having radius of 10cm. It takes the stone 10 seconds to describe an arc of length 4cm. Determine:

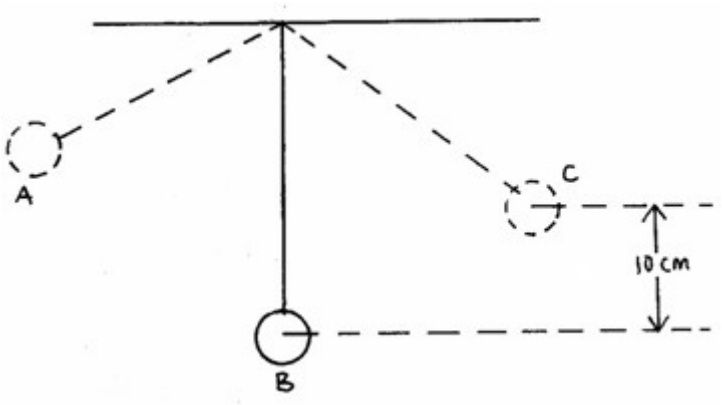
(i) The angular velocity **ω** (3mks)

……
……
……

(ii) The period **T** (3mks)

……
……
……

17. The diagram below shows a pendulum bob swinging freely to and fro.



(a) (i) State the position where the pendulum bob has maximum kinetic energy. (1mk)

……
……

(ii) Determine the velocity of the bob at the position identified in (a)i above if the maximum vertical displacement of the bob is 10cm. (3mks)

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……
……

(b) A bullet of mass 20g moving with a velocity of 1000m/s hits a stationery wooden block of mass 12kg. The bullet imbeds and the two move in one direction. Calculate its final velocity. (3mks)

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……
……

(c) A block of mass 200g rests on a rough horizontal table. A force of 0.6N pulls the block so that it moves with a constant acceleration of 1m/s². Calculate

(i) the time it takes to travel a distance of 200m. (2mks)

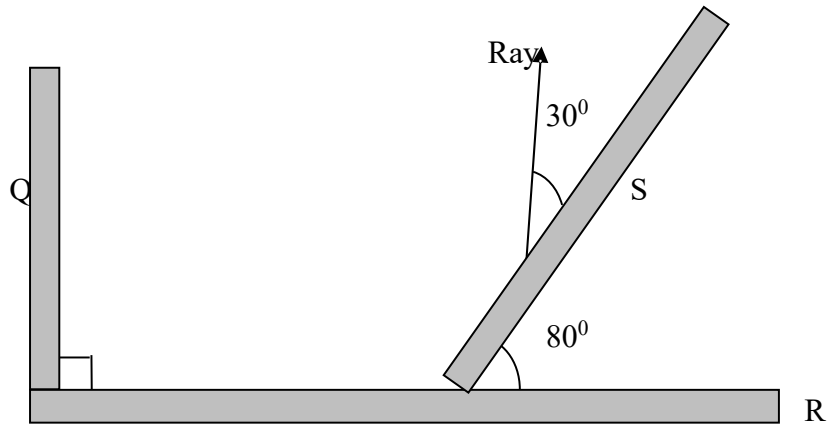
……
……
……

(ii) the friction force between the block and the table. (2mks)

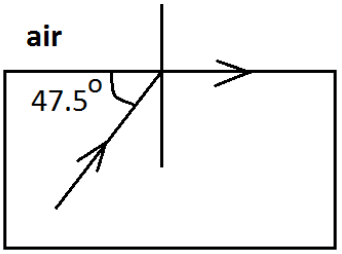
PAPER 2

SECTION A (25 MARKS)

1. A ray immerges from a mirror S at an angle of 30^0 to the mirror as shown in the figure below. On the same diagram complete the ray path to show its incident path to mirror Q and state the angle of incidence. (2 marks)



2. The figure below shows the path of light passing through a rectangular block of perpex, placed in air.



Calculate the refractive index of the Perspex. (3 marks)

……
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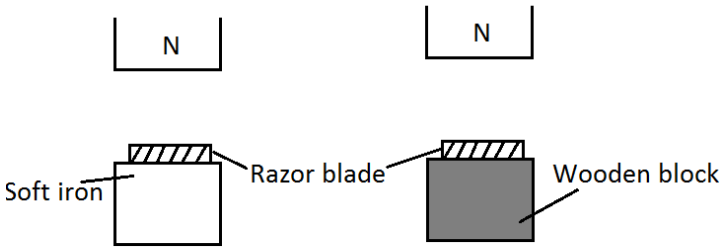
3. Two similar razor blades are placed one on a wooden block and the other on a soft iron block as shown in the figure below



It was observed that the razor blade on the wooden block was attracted to the magnet while the other on the soft iron block was not. Explain. (2 marks

……
……
……
……

4. A man driving a car in rain discovers that the moment he alights from it, while touching its body he gets an electrical shock. Why was he not getting the shock while inside even if he touches metallic parts?

(1 mk)

……
……
……

5. State and explain why TV tube has a wider screen than cathode Rays oscilloscope (C.R.O) tube (2mks)

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……
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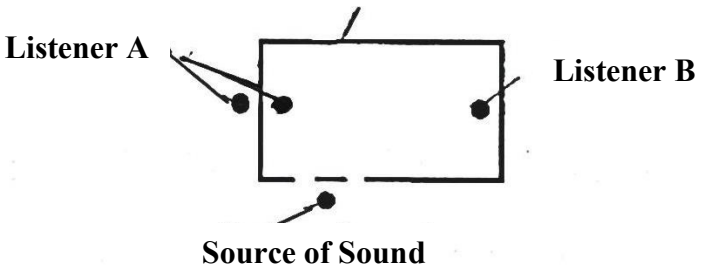
……

6 The source of sound and two listeners are positioned close to a tall building as shown in the figure below.



i) State the property of sound by which Listener A is able to hear the sound produced. (1 mark)

……

ii) Listener **B** is moving directly towards Listener **A** and has a problem hearing the sound produced. Explain. (2 marks)

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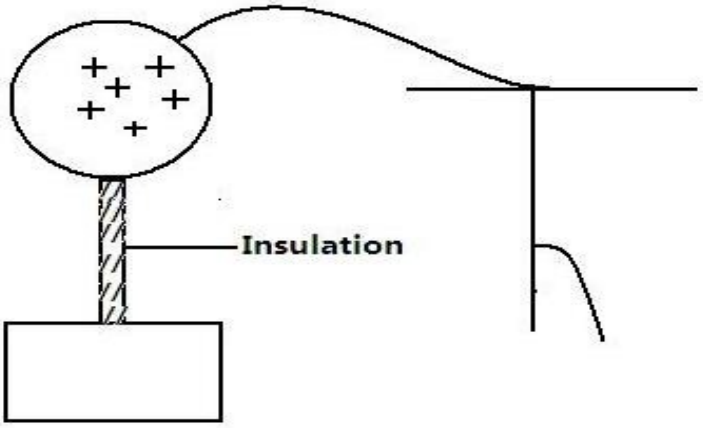
……

7. A charged metal sphere is connected to an uncharged electroscope as shown in the figure below. **State and explain** the observations made (2mks)



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8. The ammeter in the circuit in figure 3 has negligible internal resistance. The cell has an internal resistance of 0.5Ω and an electromotive force of 3.0V.

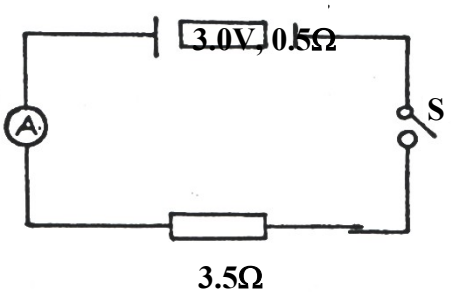

Figure 3

Determine the value of current the ammeter registers when switch S is closed. (2 marks)

9. . A thick sheet of plastic, n = 1.5, is used as the side of an aquarium tank. Light reflected from a fish in the water has an angle of incidence of 35^0. At what angle does the light enter the air. (3 mks)

……

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……

10. State any **one** condition under which a pinhole camera may form an image on its screen which has the same size as the object. (1 mark)

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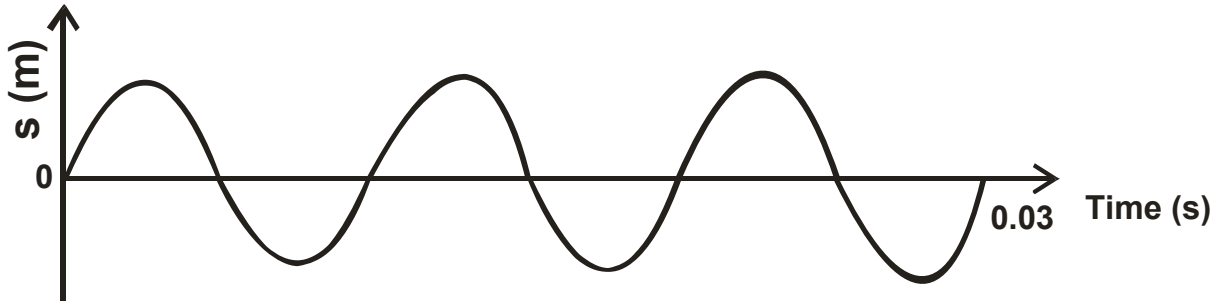
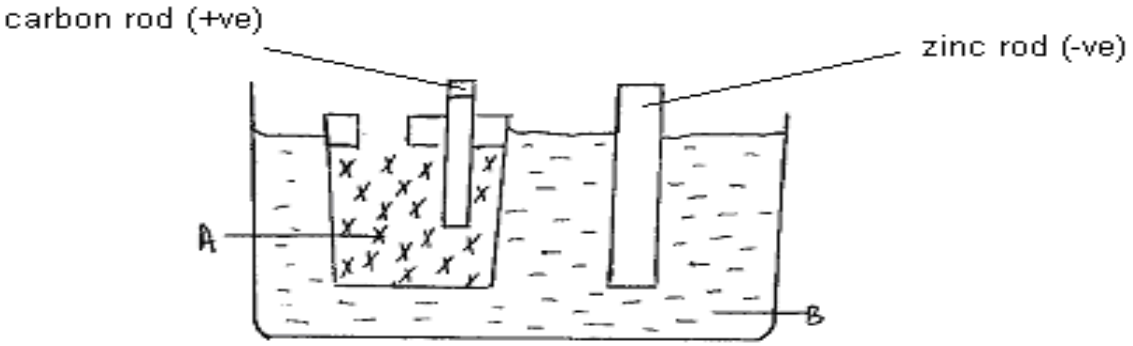
.....

11. The sketch shown below is a displacement-time graph of a wave traveling at $320ms^{-1}$



Find the wavelength of the wave. (2 marks)

12. The figure below shows a laclanche cell.



Name the chemical substances in the parts labeled. (2mks)

A.....

B.....

Section B 55 Marks

13.. (a) With the aid of a well labeled diagram, explain how lunar eclipse occurs. (4mk)

(b) Explain why large convex mirrors are placed at certain points in supermarket (2mks)

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(c) An object 2.5 m tall is at a point 8m from a pinhole camera. If the distance of the screen is 8.16m from the object, calculate the size of the image (3mks)

(d) (i) Draw a diagram to show how prisms are used in a periscope (2mks)

(ii) Calculate the critical angle of a ray of light passing from glass to water, if their refractive indices are $^{2}/_{3}$ and $^{4}/_{3}$ respectively. (3mks)

14. a) Define capacitance and state its SI units (1 mark)

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b) Figure 12 shows three capacitors of capacitance 3μF, 2μF, 6μF and 12V supply connected in a circuit.

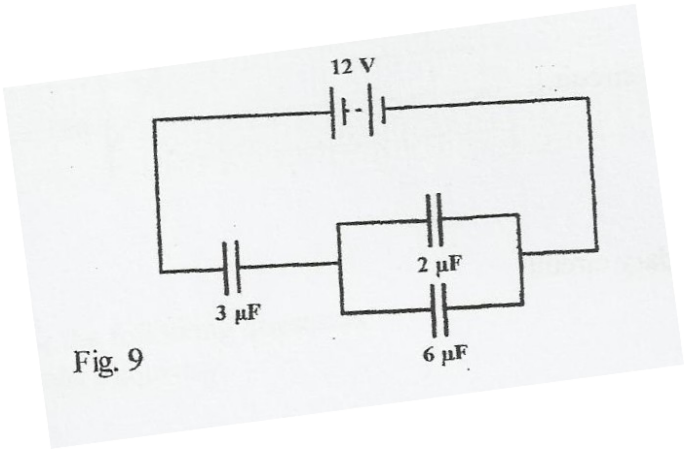

Fig. 9

Calculate

i) The total capacitance of the circuit. (2 marks)

ii) The charge stored in the circuit. (2 marks)

iii) The potential difference across the 2 µF capacitor. (2 marks)

c i) State Ohm's law. (1 mark)

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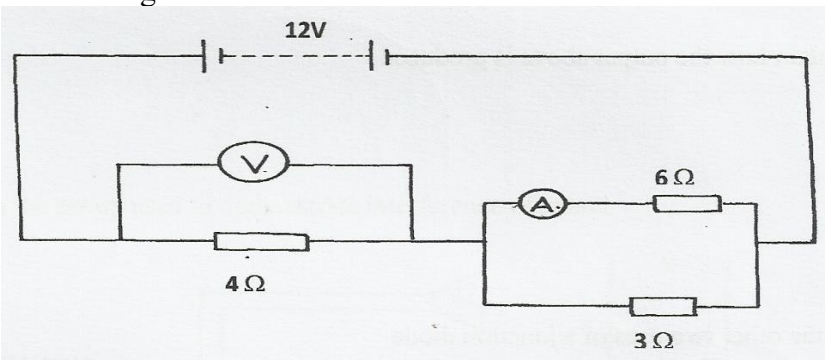
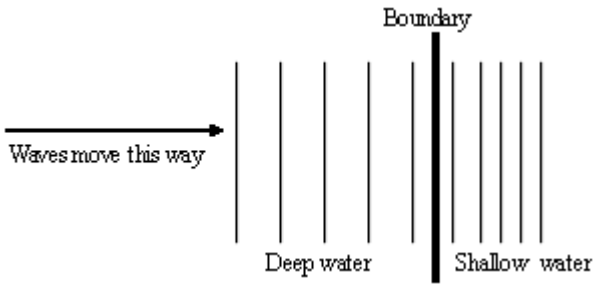
Study the circuit diagram shown below.



(ii) Determine the reading of the voltmeter V. (2 marks)

(iii) Determine the reading of the ammeter A. (2 marks)

15. Some plane water waves were produced in a ripple tank. They pass from a region of deep water into a region of shallow water. The figure shows what the waves look like from above.



(a) State what happens at the boundary to.

(i) The frequency of the waves. (1 mark)

(ii) The speed of the waves. (1 mark)

(iii) The wavelength of the waves. (1 mark)

(b) The waves have a speed of 0.12 m/s in the deep water. Wave crests are 0.08 apart to the deep water. Calculate the

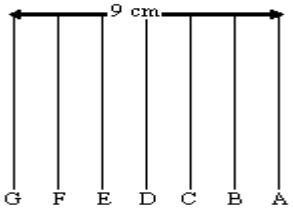
frequency of the source producing the waves. (2 marks)

(c) Arrange the following electromagnetic waves in order of their increasing wavelengths.X-rays, Gamma rays, Ultraviolet,

Visible light, Microwaves, Infra red. (2 marks)

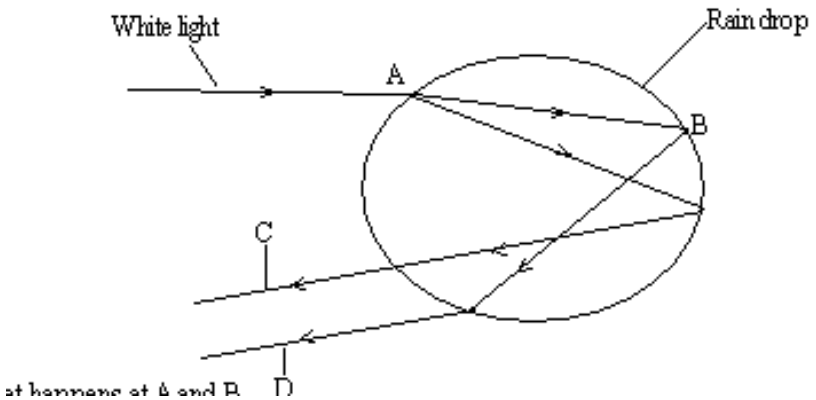
(d) State **two** differences between a stationary wave and a progressive wave. (2 marks)

(e) The figure below represents crests of straight wave produced in a ripple tank.



Determine the wavelength of the waves. (2 marks)

16. a) The figure below shows white light incident on a rain drop.



(i) State what happens at A and B. (2 mark)

……
……
……
……

(ii) State the colour of rays C and D. (2 marks)

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……
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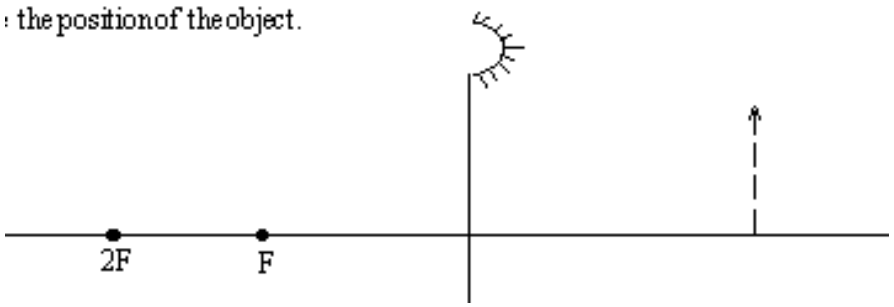
(b) The figure below shows an image formed by concave mirror. Complete by drawing rays and locate the position of the object. (3 marks)



17. The current in a wire varied with voltage as shown in the following table.

Voltages(V)	1.05	1.40	1.80	2.20	2.60
Current (mA)	150	200	250	300	350

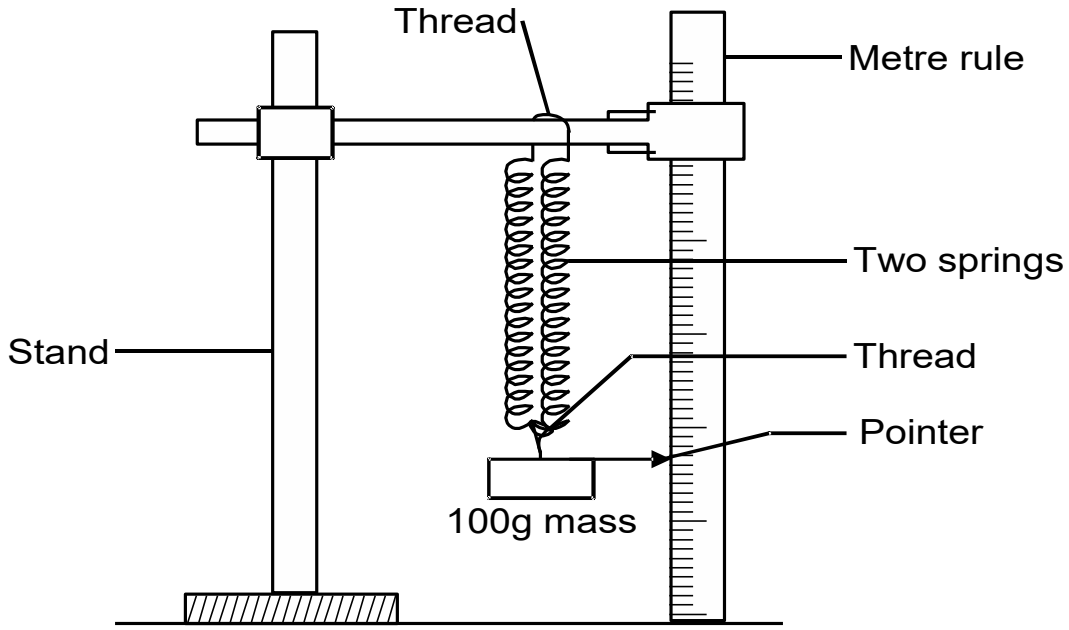
(a) Plot a graph of V against current. (5mks)

(b) From your graph, determine the resistance of the wire. (3mks)

PAPER 3

1. You are provided with the following :
- One stand
- One boss
- One clamp
- Two pieces of thread
- One stopwatch
- One metre rule or half metre rule
- Two springs.
- Six 100g masses
- A piece of cellotape.

a)



a) i) Hang the springs from rod of a clamp as shown in the figure above.
ii) Tie together the upper end and the lower ends to springs with pieces of thread as shown in the figure.
iii) Hang a 100g mass from the lower ends of he springs so that the mass is supported by both springs.
iv) Clamp the rule vertically with zero centimetre mark uppermost.
v) Use cellotape to fix the optical pin on the top of the 100g mass so that it acts as a pointer.
vi) Adjust the rule so that the pointer is at 40.0cm mark from the top of the rule.

b) i) Add a 100g mass to the first mass. Record the new position of the pointer and the extension, e, in the table below.
ii) Add another 100g mass and record the new position of the pointer and the extension in the table.
iii) Repeat b(ii) until the total mass supported by the spring is 600g.

c) i) Remove the rule. Displace the 600g mass slightly downwards and release it to oscillate vertically.
ii) Time 20 oscillations. Record in the table the time, t_1 for 20 oscillations. Repeat this to obtain the average time, t, and the
period of oscillation T.
iii) Repeat (c) (i) and (ii) for 500g, 400g 300g and 200g masses.
iv) Find T^2 and complete the table.

Mass (g)	100	200	300	400	500	600
Position of point (cm)	40.0					
Extension, e, cm	0.0					
Time of t, (s)						
20 oscillations t2(S)						
Average time, t(s)						
Periodic time, T(s)						
$T^2(S^2)$						

d) i) On the grid provided plot a graph of T^2(vertical axis) against the extension, e. (5 marks)

d) ii Determine the gradient of the graph. (2 marks)

……

……..

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……..

iii) The equation of the graph is given by

$$T^2 = \frac{4\pi^2}{b}e + c$$

Where b and c are constants.

Determine the value of b. (1 mark)

……

……..

What does the value of b represent? (1 mark)

……

……..

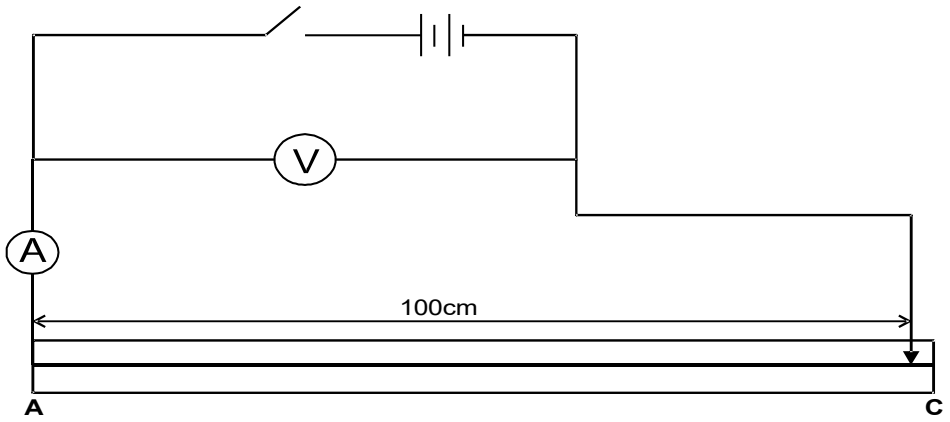
2. PART A

You are provided with the following apparatus.

- Two dry cells.
- Nichrome wire mounted on a mm scale.
- An ammeter.
- Cell holder.
- Voltmeter
- 8 connecting wires.
- Metre rule
- Switch.

Proceed

a) Connect the circuit as shown in the diagram below.



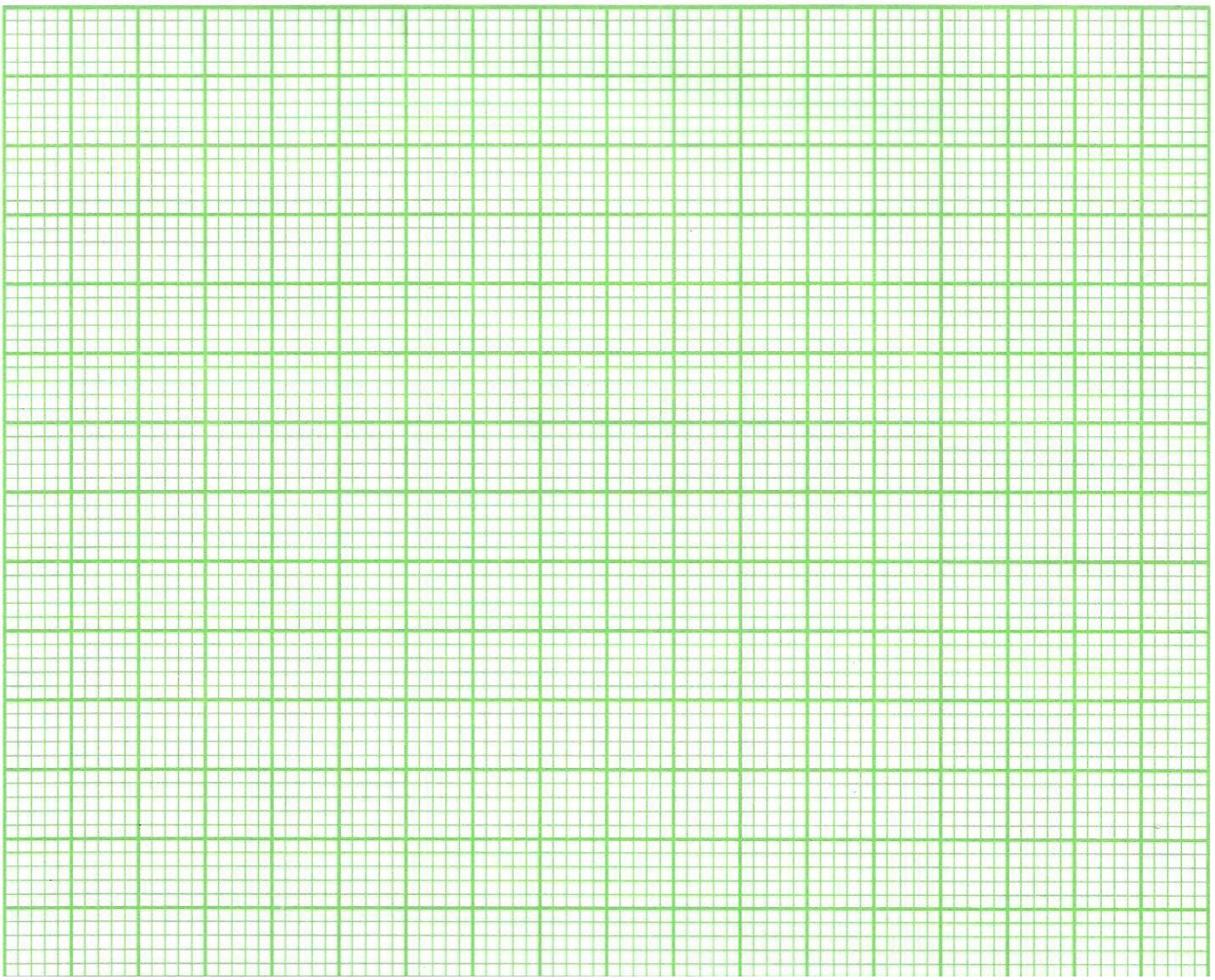
b) Connect the end A and C where AC is 100cm across the terminals as shown. Close the switch and measure both current I and p.d. across the wire AC.
Current = I ..... (½ mark)
P.d V = ... (½ mark)

c) Measure the emf of the cells E = ... (½ mark)

d) Reduce the length AC. In each case record the current I and the corresponding V. Complete the table below.

Length L(cm)	**100**	**70**	**60**	**50**	**40**	**20**
Current I (A)						
P.d. (V)						
E - V (v)						

e) Plot a graph of (E - V) against I (A) (5 marks)



f) Determine the slope of the graph. (2 marks)

……

……..

g) Given that E = V + 1r determine r from your graph. (1½ marks)

……

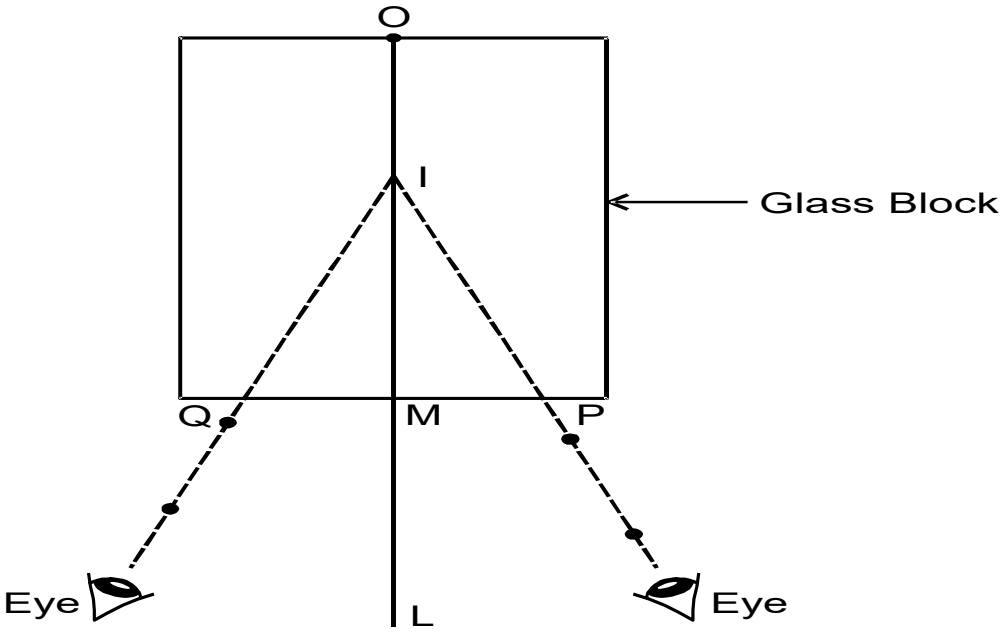
……..

Que 2 PART B

You are provided with the following apparatus.

- Rectangular glass block
- 3 optical pins
- A soft board.
- A plane paper
- 4 paper pins.

Place the rectangular glass block in the middle of the plane paper and trace its outline. Using a pencil remove the block.



Construct a perpendicular line LMO bisecting the shorter sides of M and O.
Mark points P and Q such that PM = MQ = 5cm.

a) Measure (1 mark)

OM.....

- Place the plane paper on the soft board and carefully replace the glass block so that it fit the outline.
- Press the object pin on O such that it is upright and touching glass block and the second pin on P also upright and touching the block.
- Press the third pin P_1 a short distance form the block such that P_1, P and I lie on a straight line when viewed through the block with one eye. I is the image of the object pin O.
- Repeat the experiment with now on Q. Press the third pin P_2 a short distance from the block such that when viewed P_2, Q and I lie in a straight line.

b) Remove the pins and glass block; draw the lines P_1PI (PI dotted) and P_2 QI (QI) doted meeting OM at I.
IM = ...cm (1 mark)

c) Using the above information calculate the refractive index of the glass block by real and apparent depth method. (2 marks)

……

……..

d) NB - Hand in your work on the plane paper. (1 mark)

KCSE REPLICA 9
PAPER 1

SECTION A (25 MARKS)

1. A spherical ball bearing of mass 0.0024 kg is held between the anvil and spindle of a micrometer screw gauge. The reading on the gauge when the jaws are closed without anything in between is 0.11mm. Use this information and the position of the scale in the **figure 1** below to answer the questions **(a)** and **(b)** below:

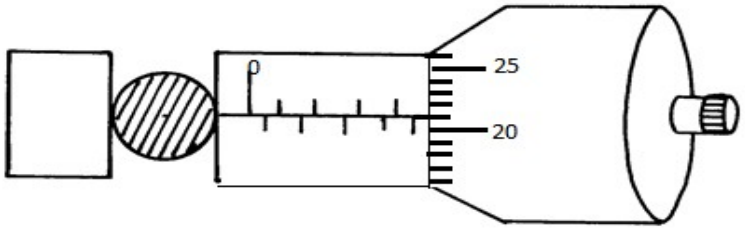


fig 1

a) What is the diameter of the ball bearing? (1 mk)

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……
……

b) Find the density of the ball bearing correct to 3 significant figures (2 mks)

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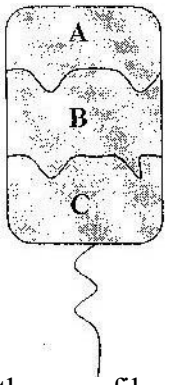
2. The diagram below shows a wire loop with two threads tied across it. The loop is dipped into a soap solution such that the soap film covers it as shown in **fig 2**

Fig 2



Region B is punctured such that the soap film in that section is broken. On the space alongside the diagram sketch the resulting shape of the wire loop. Give a reason for the shape. (2 mks)

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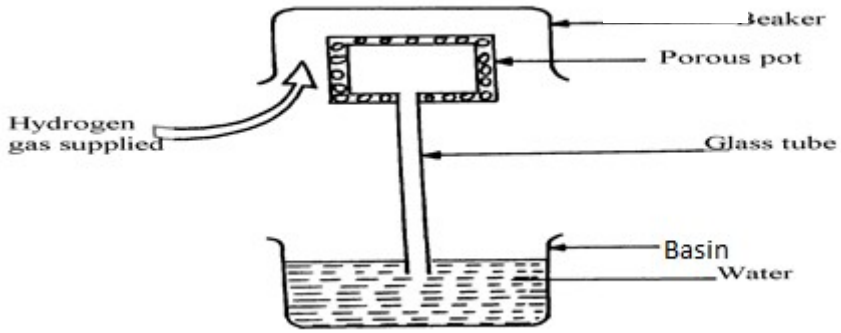
……
……

3. The **figure 3** below shows an arrangement to demonstrate diffusion through solids:-



The hydrogen gas is supplied for sometimes then stopped and the beaker removed. State and explain what is likely to be observed when the hydrogen gas supply is stopped (3 mks)

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4. Figure 4 shows two identical thermometers. Thermometer **A** has a blackened bulb while thermometer **B** has a silvery bulb. A candle is placed equidistant between the two thermometers

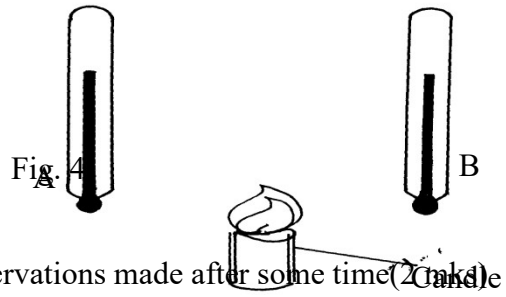

Fig. 4

State with a reason the observations made after some time (2 mks)

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5. A car being driven on a horizontal straight road accelerates uniformly from O to 20m/s. In the first 10s. It continues at that speed for the next 40s and then decelerates to a stop in 5s. Sketch the velocity time graph for its motion. (2 marks)

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……

6. A uniform metre rule is balanced at its centre. It is balanced by the 30N, 5N and the magnetic force between **P** and **Q**. **P** is fixed and **Q** has a weight of 5N

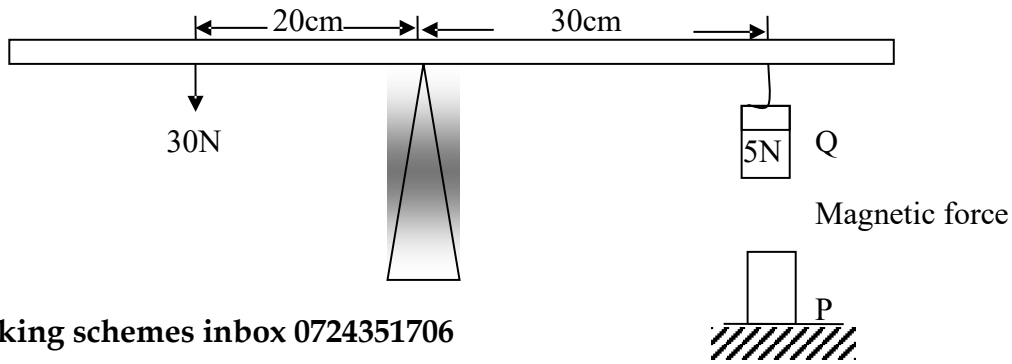

Fig 5

a) Ignoring the weight of the metre rule, calculate the value of the magnetic force between Q and P (2 mks)

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b) Given that the lower end of Q is North pole, state polarity of the end of P facing Q.
(1 mk)

……

7. (a) Give a reason why water is not suitable as a barometric liquid. (1 mk)

……
……

(b)Explain why a lift pump is unable to raise water from a borehole where the level of water is 20m below the ground level. (1 mks)

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……

8. The diagram below shows a mass of 12g hanged on a set of 6 identical springs. When a mass of 12g was hanged on spring A alone, its extension was 5cm. Find the extension of the combination shown if each spring and each rod has negligible mass (2 mks)

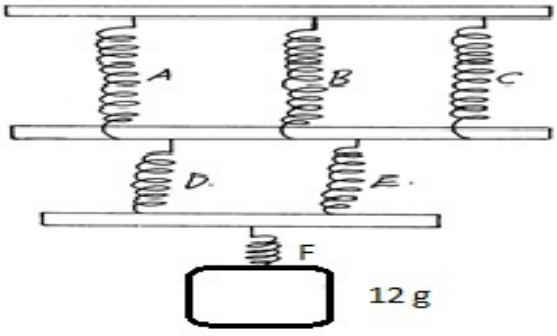

fig 6

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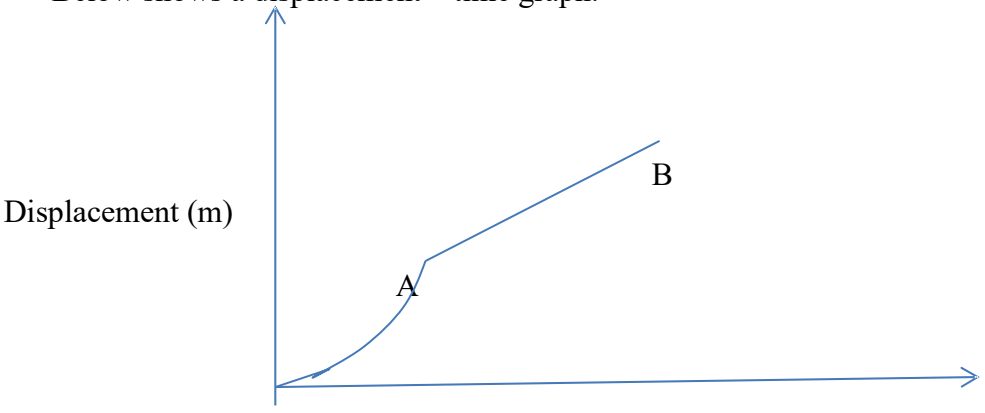
9. Sea water of density **1.04g/cm^3** is being pumped into a tank through a pipe of uniform cross-sectional area of 3.142cm^2. If the speed of water in the pipe is 5m/s, determine the mass flux in S.I unit. (2 mks)

……

Below shows a displacement – time graph.



O Time (s)

Describe the motion of the body between points:

OA…… (1 mk)

AB……..(1 mk)

10. A quantity of air occupied 500cm^3 at 15^{0}C when the pressure was 76 cmHg. At what temperature would it occupy 460cm^3 if the pressure was 85cmHg? (2 mks)

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SECTION B (55 MARKS)

12.a) State the pressure law for an ideal gas.(1 mark)

c) The set up shows an arrangement to determine the relationship between temperature and pressure of a gas at constant volume.

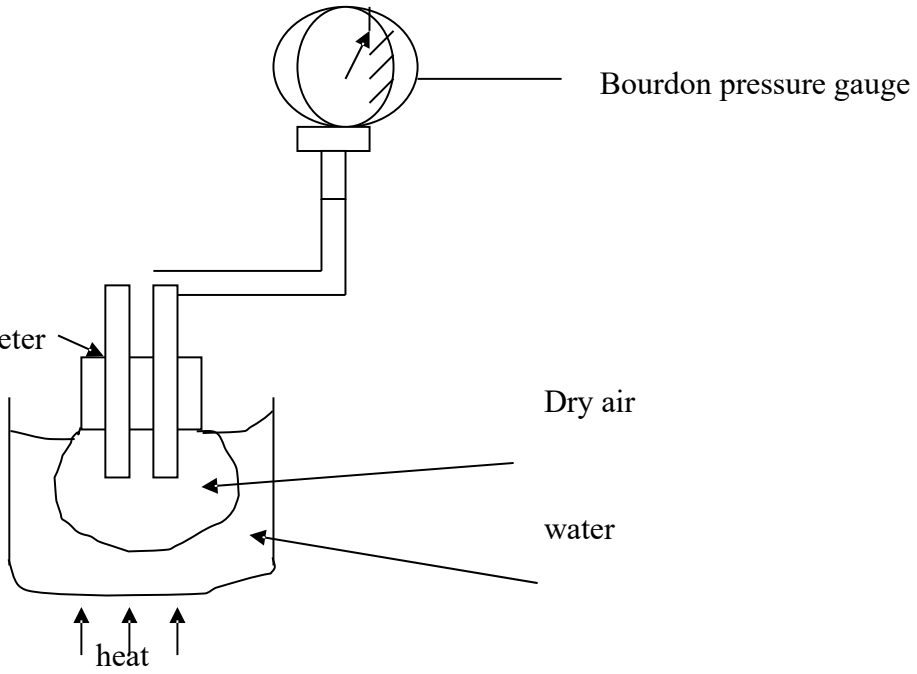


Fig 7

i) Describe how the measurements are obtained in the experiment (3 marks)

ii) Explain how the results from the experiment can be used to determine the relationship between temperature and pressure (2 marks)

c) A bicycle tyre is pumped to a pressure of 2.2×10^5 pa at 23°c. After a race the pressure is found to be 2.6×10^5 pa. Assuming the volume of the tyre did not change, what is the temperature of the air in the tyre. (3 marks)

d) Air is trapped inside a glass tube by a thread of mercury 240mm long. When the tube is held horizontally the length of the air column is 240mm.

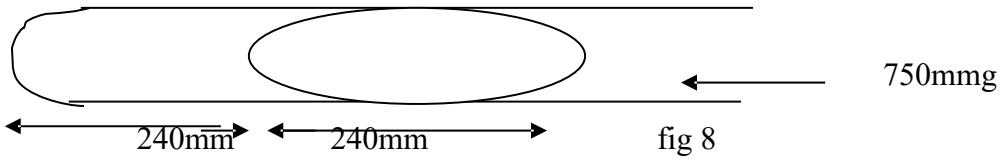


fig 8

Assuming that the atmospheric pressure is 750mmHg and the temperature is constant, calculate the length of the air column when the tube is vertical with open and down.

(3 marks)

13. (a) An object is released to fall vertically from height of 100m. At the same time another object is projected vertically upward with velocity of 40m/s.

(i) Calculate the time taken before the objects meet (3mks)

……

……

……

……

(ii) At what height do the objects meet? (2mks)

……

……

(b) A string of negligible mass has a bucket tied at the end. The string is 60cm long and the bucket has a mass of 45g. The bucket is swung horizontally making 6 revolutions per second. Calculate

(i) The angular velocity (2mk)

……

……

……

(ii) The angular acceleration (2mks)

……

……

……

(iii) The tension on the string (2mks)

……

……

……

(iii) The linear velocity (1mk)

……

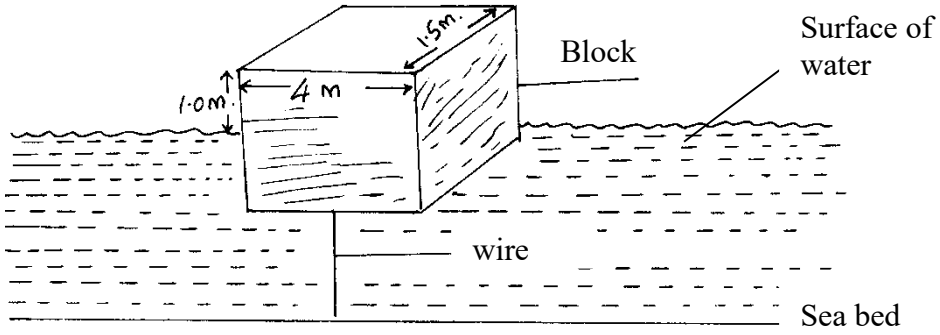
……

14. a) State Archimedes' principle. (1mk)

……

……

(b) The figure 9 below shows a rectangular buoy of mass 4000kg tethered to the sea-bed by a wire. The dimensions are 4m x 1.5m x 2.2m.



Calculate the :-

(i) Weight of sea water displaced by the buoy (density of sea water = 1100kg/m^3) (3 mks)

……

……

……

(ii) Upward force exerted on the buoy by the water. (1mk)

……

(iii) Tension in the wire (2mks)

……

……

(c) A test tube of mass 10g and uniform cross-sectional area 4cm^2 is partly filled with lead shots and floats vertically in water with 5cm of its length submerged.

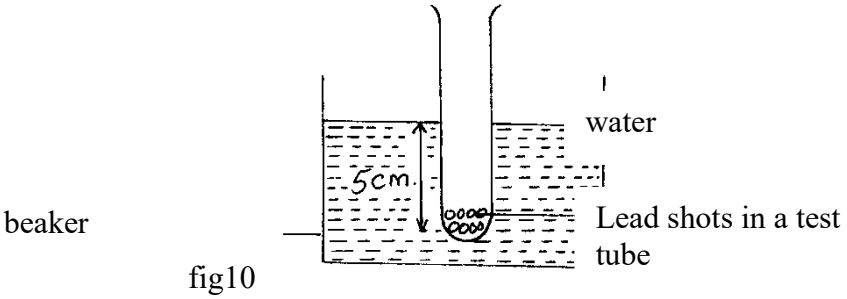


fig10

Find the:-

(i) Mass of the lead shots. (2mks)

……

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……
……

(ii) Length of the test tube that would be submerged in a liquid of density $0.75g/cm^3$. (2mks)

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15. (a) State two differences between boiling and evaporation. (2 mk)

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(b) 1200g of a liquid at 10^0C is poured into a well-logged calorimeter. An electric heater rated 1KW is used to heat the liquid. The graph in fig 4 below shows the variation of temperature of the liquid with time.

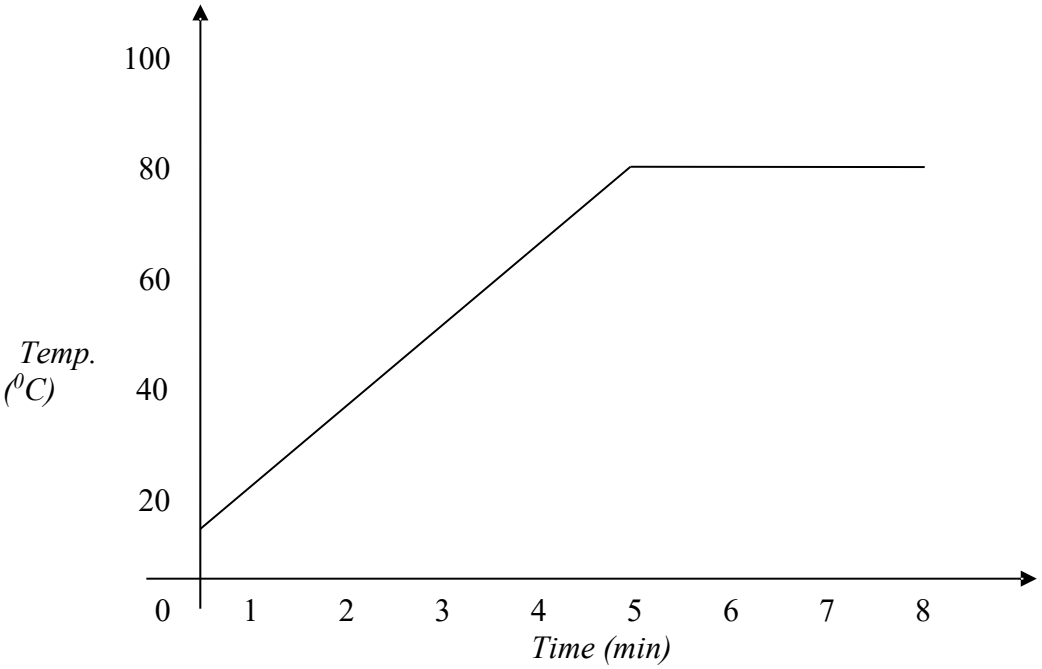

Fig. 4

Use the graph to answer the following questions:

(i) What is the boiling point of the liquid? (1 mk)

……
……

(ii) How much heat is given out by the heater to take the liquid to the boiling point? (2 mks)

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……
……

(iii) Determine the specific heat capacity of the liquid stating any assumptions made. (2 mks)

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(iv) If 50g of the liquid vapour was collected by the end of the 8th minute, determine the specific latent heat of vaporization of the liquid. (2 mks)

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16. (a) (i)State Newton's second law of motion. (1 mk)

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……

(ii) A striker kicks a ball of mass 250g initially at rest with a force of 75N. if the foot was in contact with the ball for 0.10sec. Calculate the take off velocity of the ball. (2 mks)

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……

(b)A bullet of mass 20g moving at 400 m/s strikes a block of wood of mass 3.5kg initially at rest. The bullet sticks into the block and the two move off together on a horizontal surface,where a frictional retarting force of 4N is acting between the block and surface.

(i) Determine the initial common velocity of bullet and wooden block. (2 mks)

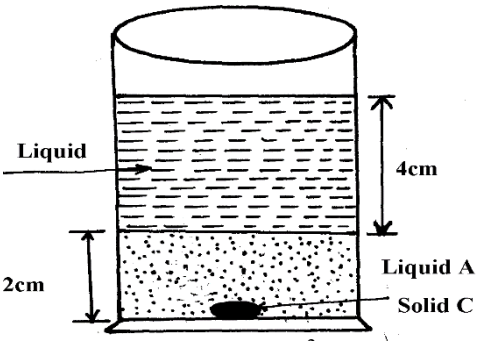
……
……..
……
……

(ii) What distance does the block move before coming to rest? (3 mks)

……
……

(c) Two immiscible liquids are poured in an open container to the levels shown in the diagram below.

Figure 11



If the densities of the liquids **A** and **B** are 1g/cm^3 and 0.8g/cm^3 respectively and the atmospheric pressure 760 mmHg, find the total pressure acting upon solid **C** at the bottom of the container. (Take density of mercury to be 13.6g/cm^{3}and g = 10 N/Kg) (3 mks)

PAPER 3(PRACTICAL)

Question 1 (20 marks)

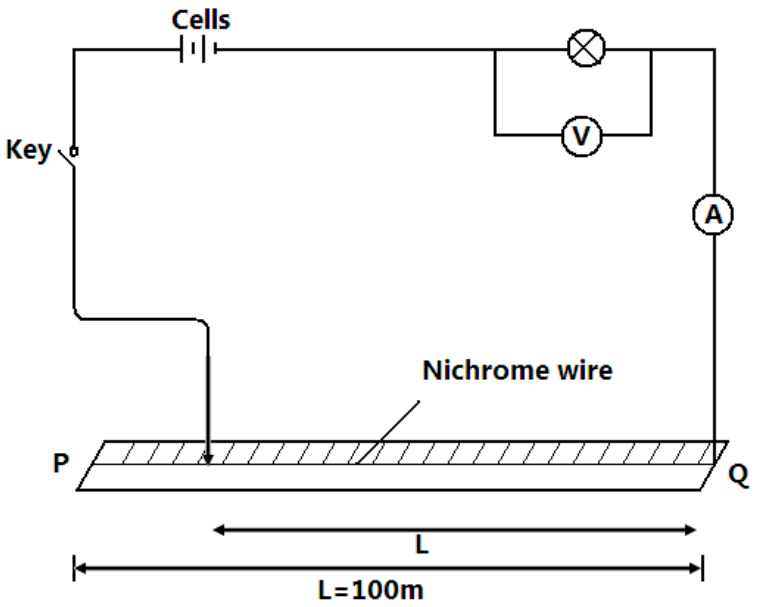
You are provided with the following

-Two dry cell
-One bulb
-Voltmeter (0 – 3V)

-Ammeter (0 – 1A)
-Amounted nicrome wire mounted on a millimeter scale
-Switch
-Seven connecting wire at least two with crocodile clips
-Micrometer screw gauge

Proceed as follows:

a) i). Set up the circuit as shown in the figure 1 below.



ii) With the crocodile clip at p, take the voltmeter reading and ammeter reading. Record v and 1 repeat the readings for L=80, 60, 40, 20 and 0cm respectively and complete the table below. (5mks)

Length, L(cm)	100	80	60	40	20	0
Voltage, V(V)						
Current, I (A)						

iii). What changes do you observe on the bulb as L decreases from p? (1mrk)

……

……

……

iv).Plot a graph of ammeter reading (y=axis) against voltmeter readings. (5mrks)

v). Determine the slope of the graph at V=1 volt. (2mrks)

vi). What physical quantity is represented by the slope of the graph at any given point? (1mrk)

b. (i) Given the apparatus in a (i) above, draw a diagram of the circuit you would use to determine the current through the resistant wire and the potential difference across. (1mrk)

ii).Set up the circuit you have drawn. Record the ammeter reading I and the wire reading V when L=100cm (2mks)

V=…… I=……..

iii). Using a micrometer screw gauge, measure the diameter of the wire. (1mrk)

d=……m

iv). Calculate the quantity:

$p= 0.785 \frac{(V)}{I} \frac{d^2}{L}$ and give its units, where L is one meter. (2mrks)

Question 2

You are provided with the following:-

- Vernier callipers
- Micrometer screw gauge
- Masses; 10g, 20g, 50g and 100g
- A helical spring
- Metre rule or half metre rule

Proceed as follows

(a) Determine the number of complete turns of the helical spring.

N = _____ (1 Mark)

(b) Measure the external diameter of the spring using the vernier callipers

D = _____ m (1 Mark)

(c) Use the micrometer screw gauge to determine the diameter of the wire of the spring.

d = _____ m (1 Mark)

(d) Determine the value of m (2 Marks)

$N = \frac{0.4D}{dm}$

……

……

……

(e) Suspend the helical spring vertically alongside the clamped half metre rule as shown in figure 1 below. Determine the length L_0, of the spring before loading it.

L_0 = _____ cm

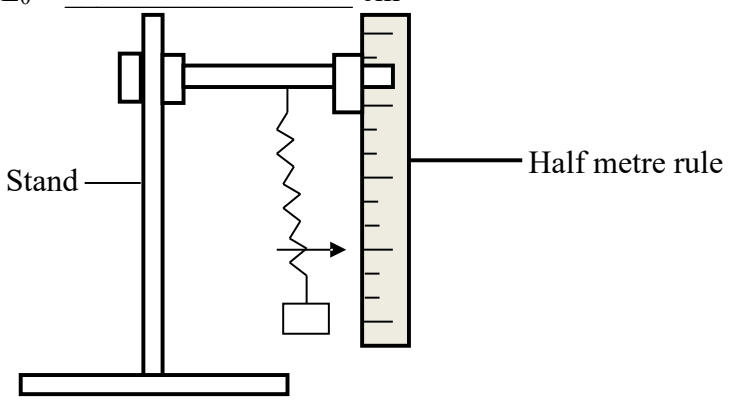


Figure 2

(f) Load the spring with a mass of 20g and determine the new reading on the metre rule. (L) Record this in the table below.

(g) Calculate the extension e = L – L_0 due to the mass of 20g and record the value in the table given below. Repeat step f for other masses and complete the table.

Mass (g)	0	10	20	30	40	50	60	70	80	90	100
Weight (N)											
Reading (L) (cm)											
Extension e (cm)											
$\frac{1}{e}$ (cm^{-1})											

(6 Marks)

(h) Plot a graph of weight (N) against $\frac{1}{e}$ (cm^{-1}) (4 Marks)

(i) Determine the slope (s) of the graph at a mass of 45g (2 Marks)

……
……

(j) Given that m = $\frac{-255T}{(S+60)^2}$

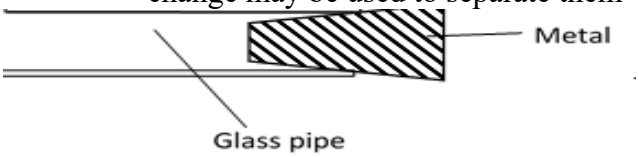
Determine the value of T where (S) is the slope at 45g (3 Marks)

……
……
……
……

KCSE REPLICA 10
PAPER 1

SECTION A 25 MARKS: Attempt all the questions in this section

1. The figure below shows a piece of metal stuck in a hollow glass pipe. .Explain how temperature change may be used to separate them (2mark)



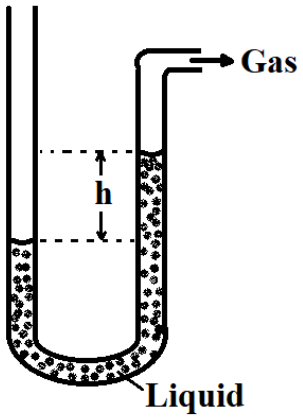
2. Form four students were playing football game during which the ball got deflated. Explain what happened to its density (2marks)

3. Micrometer screw gauge A has a zero error of – **x** mm. Micrometer screw gauge B has a zero error of **x** mm When used to measure the diameter of a tube the difference between their readings is 0.04mm. If the actual diameter of the tube is 5.56mm determine**x** hence state the reading of micrometer screw gauge A(3 marks)

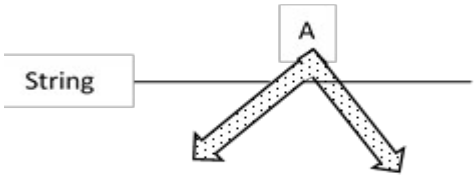
4. A car of mass 1000kg travelling at a constant velocity of 40m/s collides with a stationary metal block of mass 800kg. The impact takes 3s before the two move together. Determine the impulsive force (3marks)

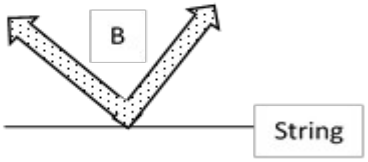
5. The figure below shows a drop of water about to fall from a pipette and after falling. Explain why the shapes of the drop are different (2 marks)

6. Figure shows a liquid manometer. The gas pressure is 755mmHg and that of the surround is 760mmHg. The height h is 80mm. Determine the density of the liquid. (Take density of mercury = 13600kgm^{-3} and g =10Nkg^{-1}) (3 marks)

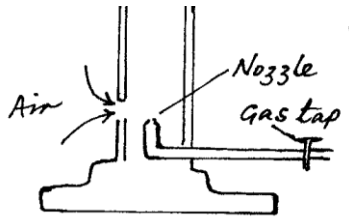


7. A student balances a V - shaped uniform wire on a tight string as shown in A and B. With reason state the one which is easier to do (2marks)

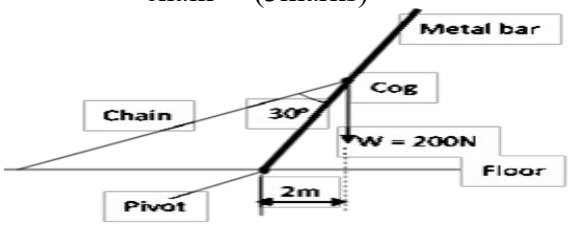




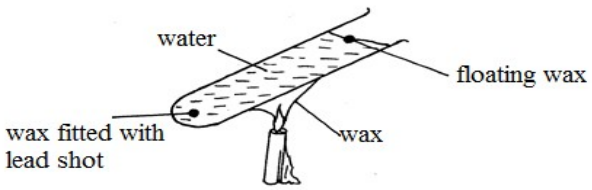
8. The figure below shows a Bunsen burner. Explain how air is drawn into the burner when the gas tap is opened. (2marks)



9. The figure shows a uniform metal bar of length 10m and weight W = 200N held at equilibrium by a light chain fixed at the cog and tethered on the floor using a light chain. Determine the tension of the chain (3marks)



10. A student set up the apparatus as shown below. The boiling tube was heated in the middle as shown

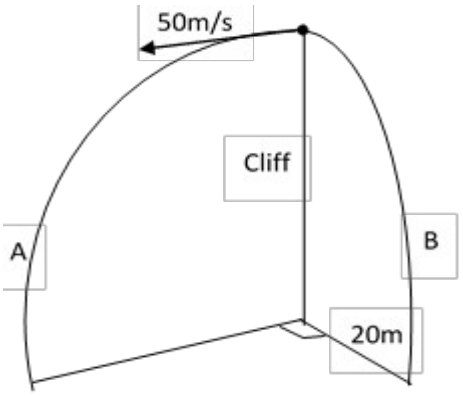


a. State the role of the lead shot in the experiment (1mark)

b. With reason, state the wax that will melt first (2marks)

SECTION B 55 MARKS: Attempt all the questions in this section

11. Marble A is projected horizontally from the top of a cliff at a velocity of 50m/s. The height of the cliff from its foot is 31.25m. At the same time another marble B is projected horizontally from the same point. The figure below shows the trajectories taken by the marbles



Determine

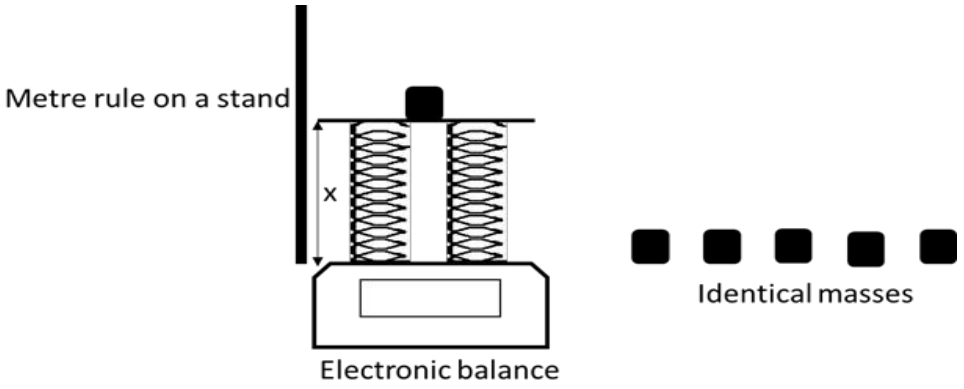
a. The distance of marble A from the foot of the cliff as it hits the ground
(3marks)

b. Vertical velocity of marble A as it hits the ground (2marks)

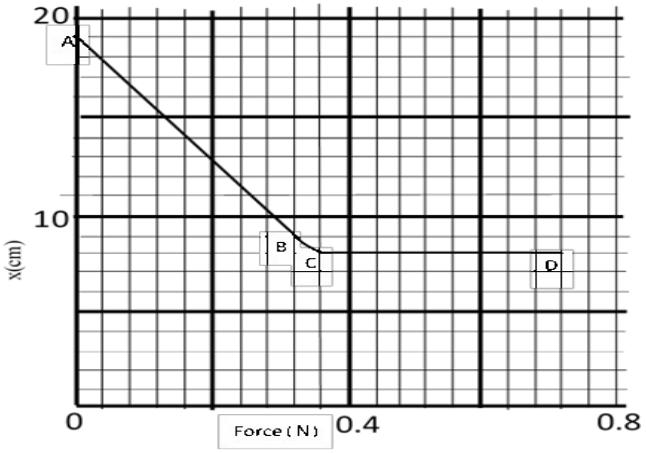
c. Horizontal velocity of marble B as it hits the ground (2marks)

d. The shortest distance between the marbles upon hitting the ground (2marks)

12. The figure below shows two identical light springsand other apparatus used in an experiment



After the data was collected the following graph was obtained



a. State two measurements taken in the experiment (2mark)

b. Explain how the measurements can be used to come up with the graph (2marks)

c. Explain the graph in sections

i. AB (2marks)

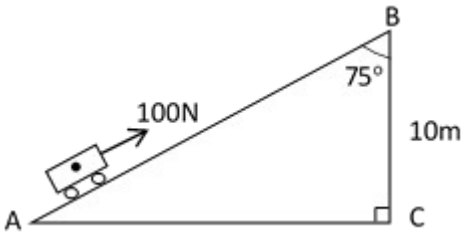
ii. CD (2marks)

d. Determine the spring constant of each spring (3marks)

e. Determine the work done in section CD (2marks)

f. On the same axes sketch the graph expected when the experiment is repeated using one of the springs only (1mark)

13. The figure **below** shows an inclined plane on which a trolley of mass 30kg is pulled up a slope by a force of 100N, parallel to the slope. The trolley moves so that its centre of mass travels from points A to B.



(i) Determined the work done on the trolley against the gravitational force in moving from **A** to **B**. (2 marks)

(ii) Determine the work done by the force in moving the trolley from **A** to **B**. (3 marks)

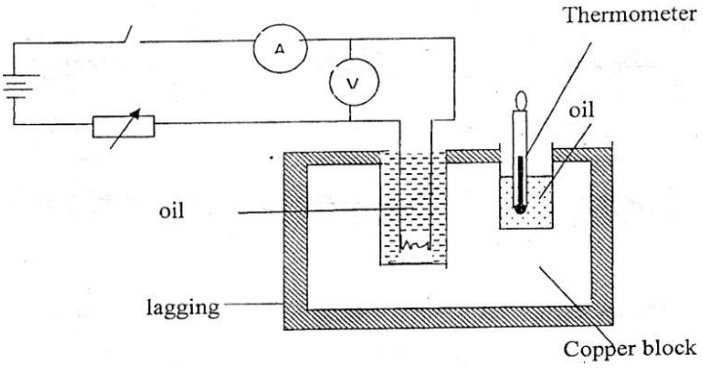
(iii) Determine the percentage of the work input that goes to waste (3 marks)

(iii) Determine the frictional force. (1 mark)

(v) Determine the mechanical advantage of the system. (1 mark)

(vi) Find the velocity ratio (1 mark)

14. a. The figure below shows a set-up that can be used to determine the specific heat capacity of a metal block.



I) Other than temperature and current, state **two** measurements that should be taken in the experiment to determine the specific heat capacity of the block.(2marks)

II) Describe how the method can be used to determine the specific heat capacity of the metal block. (3marks)

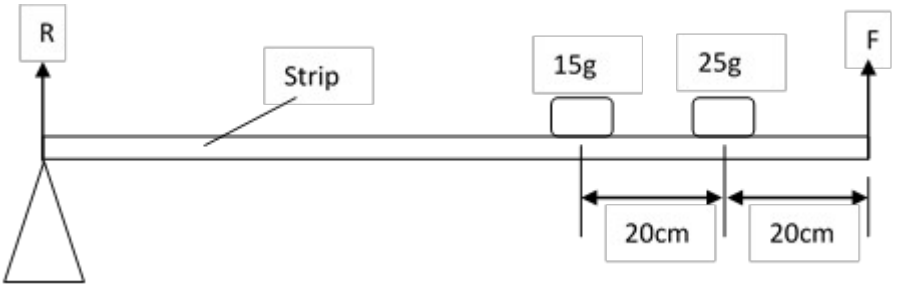
III) State the purpose of oil in the set-up. (1mark)

(ii) A well lagged copper can together with a copper stirrer of total heat capacity 60JK $^{-1}$ contains 200g of water at 20^0C. Dry steam at 100^0C is passed in while the water is stirred until the content reach a temperature of 50^0C. Determine the mass of condensed steam. (Specific latent heat of vaporization of water is 2.26 X 10 ^{6} J/kg and specific heat capacity of water is 4200 J/kgK)(4marks)

15. a) A uniform metal strip is 3.0cm wide 0.6cm thick and 100cm long. The density of the metal is 2.7g/cm^3.

I. Determine the weight of the metal strip. (2marks)

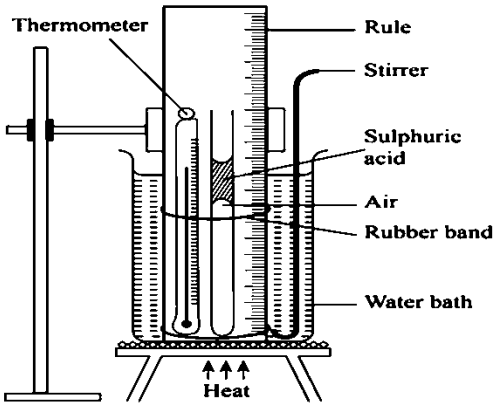
The strip is used to support two masses in equilibrium by applying force F as shown below.



II. Determine the value of F (3 marks)

III. Determine reaction R due to the pivot (2 marks)

b) The Figure belowshows a set up that may be used to verify a gas law.



I. State the law being verified (1mark)

II. State two functions of the concentrated Sulphuric acid in the experiment (2marks)?

III. State one assumption in the experiment (1mark)

PAPER 2

SECTION A (25 MARKS)

*Answer **ALL** the questions in this section in the spaces provided*

1. (a)Distinguish between real and virtual Image (1mark)

……

……

……

b)A pinhole camera forms an image of size 10cm. The object is 5m tall and 20m away from the pinhole. Find the length of the pinhole camera. (2marks)

……

……

……

2.Why is it safer to carry explosive fuels in metal cans instead of plastic can? (1mark)

……

……

3.The **figure 1** below shows a cross section of a dry cell.

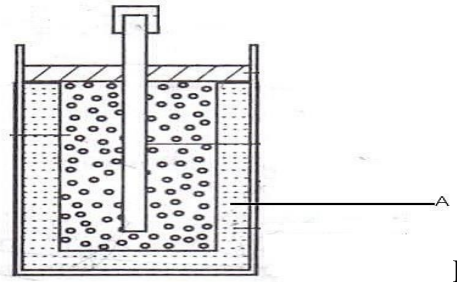


Figure 1

(i) Name the part labeled A (1 mark)

……

……

(ii) State the use of manganese (iv) oxide in the cell (1 mark)

……

……

4.a) The **figure 2** below shows a soft iron bar that's placed in a coil near a free suspended magnet.

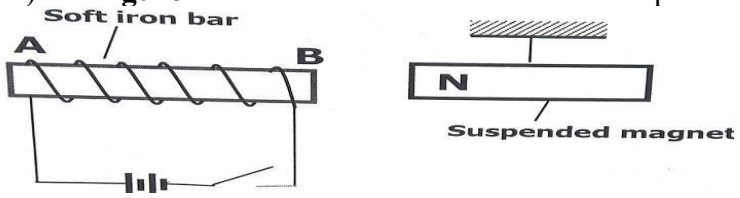


figure 2

State and explain the observation made when the switch is closed. (2marks)

……

……

……

b.) Give a reason why attraction in magnetism is not regarded as a reliable method of testing for polarity. (1mark)

……

5.Explain the termwavelength in terms longitudinal wave (1mark)

……

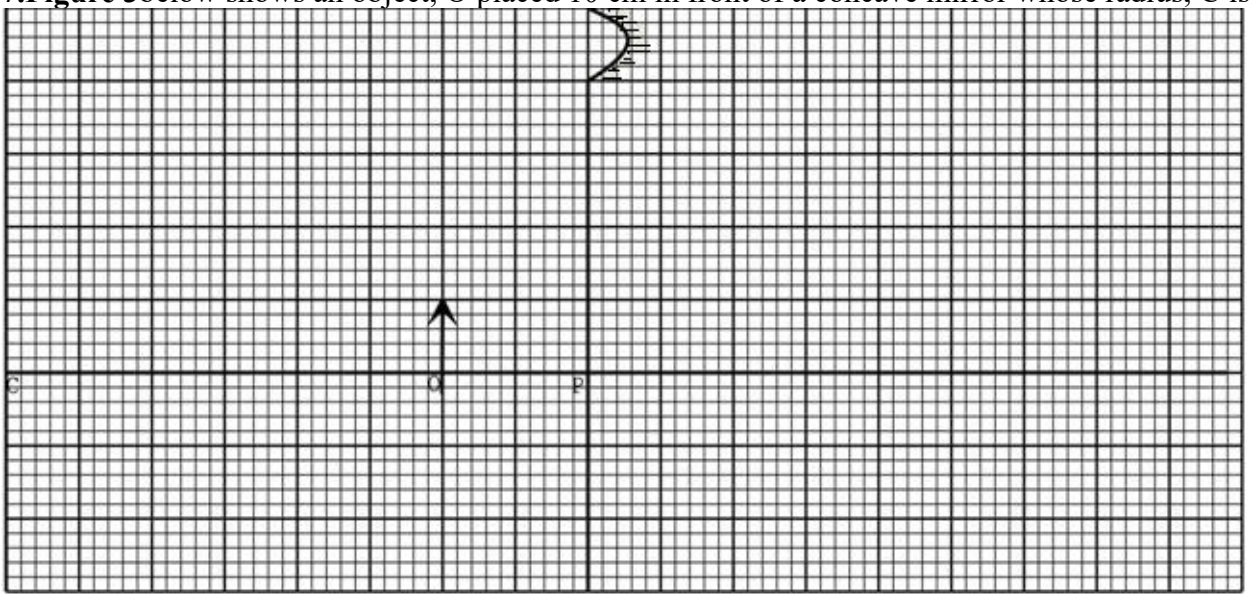
6.(a) State the effect of pressure on the speed of sound in air. (1mark)

……

(b) A boy stands 190m from a high wall and claps his hands. If he hears an echo1.3 Seconds later, calculate the speed of sound in air. (2marks)

……
……
……

7.Figure 3below shows an object, O placed 10 cm in front of a concave mirror whose radius, C is 40 cm.



On the same figure, draw a ray diagram to show the position of the image formed. (3 marks)

8.State any factor that determine the heating effect by an electric current.

(1mark)

……

9.**Figure 4** shows the table of electromagnetic. Spectrum in the increasing order of wavelengths.

P	**x-rays**		**Q**	**Infra-red**		

a).Identify the radiation marked (1mark)

Q. –……

b) State the application of radiation marked **P** (1mark)

……

10.Light travels from glass to air as shown in **figure 5**. The refractive index of glass 1.5

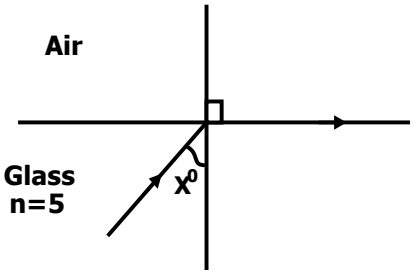


figure 5.

(a) Determine angle **x** (2marks)

……
……
……

11.**Figure 6** shows air molecules in front of a hollow, wooden box B set vibrating by a tuning fork.

figure 6

i)State the reason of mounting the tuning fork on the box which is open at one end. (1mark)

……

……

ii)What is the name given to this kind of wave? (1 mark)

……

12.The **figure 7** below shows an isolated negative charge placed closer to a negatively charged plate. Draw the electric field patterns. (1mark)

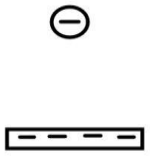


figure 7

13.Kenya launched the use of optical fibres in communication recently. State why optical fibres are preferred to ordinary cables (1mark)

……

……

SECTION B(55MARKS)

14.(a)State **two** ways in which the speed of rotation of a motor can be increased (2marks)

……

……

b)The **figure 8** below shows a simple electric bell circuit

Switch

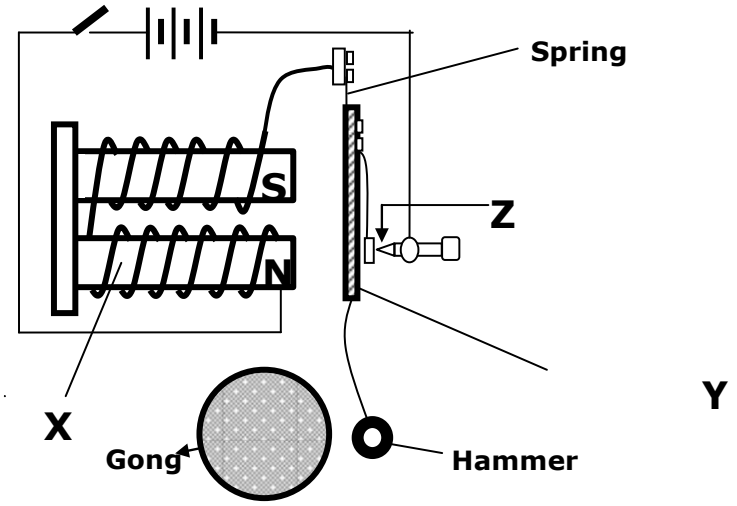


figure 8

i) Name the parts labeled. (2marks)

I) X……

II) Y ……

ii) When the switch is closed, the hammer hits the gong repeatedly. Explain why:

I) The hammer hits the gong. (2marks)

……
……
……

II) The hammer hits the gong repeatedly (2marks)

……
……
……

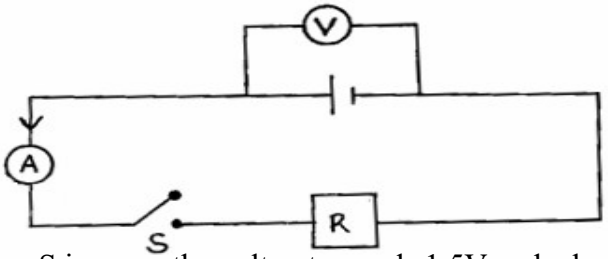
iii) If the armature is made of steel metal, it is observed that the bell will take longer to ring. Explain this observation . (1 mark)

……
……

iv) Nametwo adjustment should be done to the system to make it operate effectively with a lower voltage battery? (2mark)

……
……

15. (a) In an experiment to determine the internal resistance of a cell, the following circuit was used.



It was noted that when S is open, the voltmeter reads 1.5V and when S is closed the voltmeter reads 1.3V and ammeter reads 0.2A.

(i) Define the term e.m.f of the cell. (1mark)

……

(ii) Determine the lost voltage. (1mark)

……

……

(iii)Determine the value of R. (2marks)

……

……

(iv) Determine the internal resistance of the cell. (3marks)

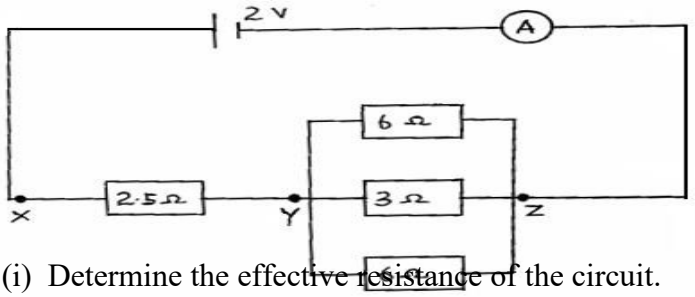
……

……

……

……

(b) Study the circuit **below** and answer the questions that follow.



(i) Determine the effective resistance of the circuit. (3marks)

……

……

……

(ii) Determine the p.d between X and Y. (2marks)

……

……

16.(a) (i)Define capacitance of capacitor (1mark)

……

……

(ii)A positively charged rod with a pointed end is brought near a candle flame as shown**fig. 9**.

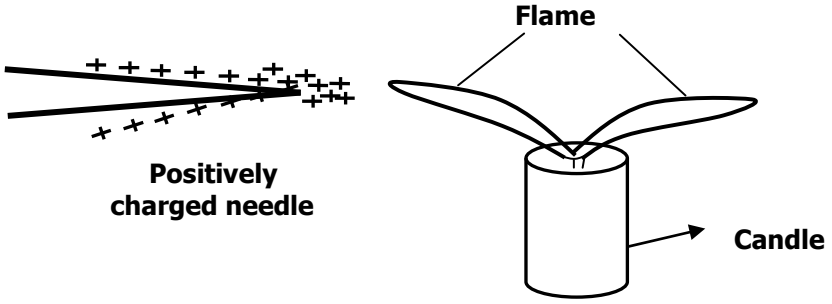


fig.9

Explain why the flame burns in the direction shown (1mark)

……

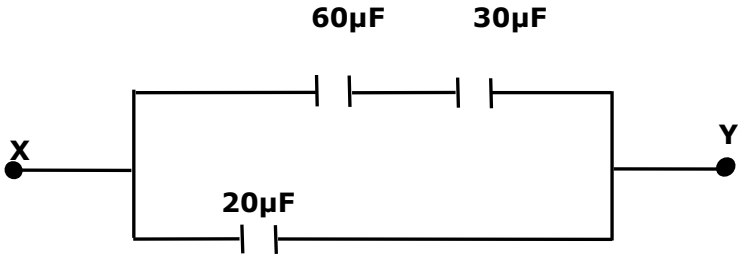
……

b). One of the factors which affect the capacitance of a parallel plate capacitor is the area of overlap of the plates. Name **two** other factors. (2marks)

……

……

c).Calculate the effective capacitance of the capacitors shown across points X and Y. (3marks)

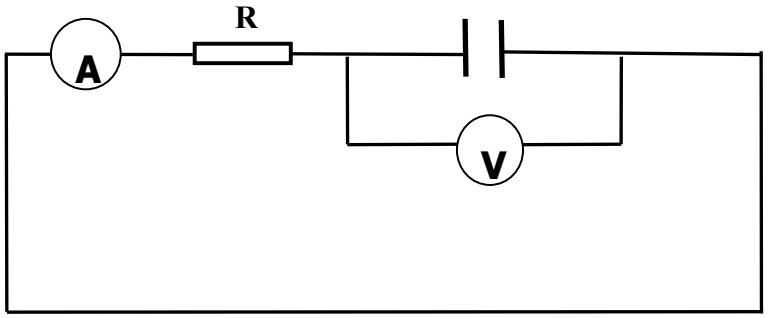


……

……

……

d).A capacitor was full charged to a potential of 40v. The capacitor is connected as shown in the figure below to discharge at load resistor R. Sketch a graph to show how the capacitor discharges with time (2 marks)



……

……

……

17.(a)Water waves from a given source move from a deeper a shallow to end. What effect would this have on the;

(i) Frequency (1mark)

……

(ii)Wavelength (1mark)

……

(iii) Velocity of the wave(1mark)

……

(b).The **figure 10** shows wave fronts approaching a wide opening

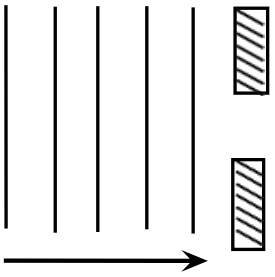


figure 10

i)Complete the diagram to show the appearance of the wave fronts after crossing the opening (2mark)

(ii)State what would be observed on the pattern if the gap was made smaller (1mark)

……

……

c.) **Figure 11** below shows light rays from two coherent sources S_1 and S_2 falling on screen. Dark and bright fringes are observed between A and B

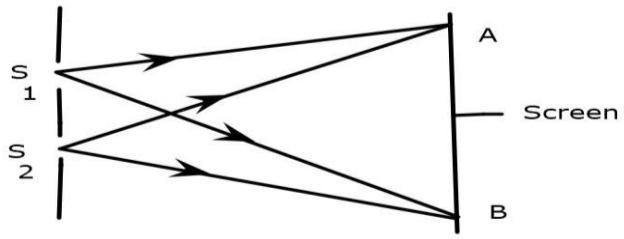


figure 11

i) State the function of S_1 and S_2 (1mark)

……

ii) State how

I. Bright fringes are formed (1mk)

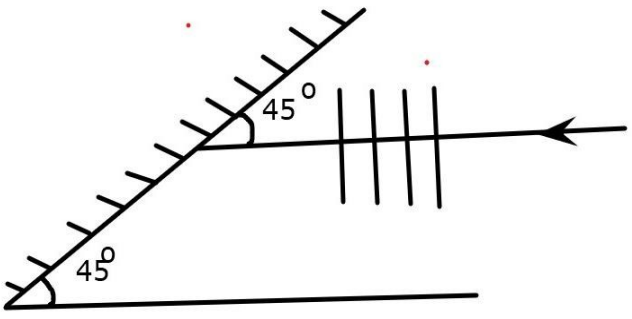
……

……

II. Dark fringes are formed (1mark)

……

c). **Figure12**below shows plane water waves incident on a plane reflector placed at an angle to the path of the waves.



Complete the diagram to show the reflected waves (2marks)

18. (a) Define the term principal focus for in converging lens(1mark)

……

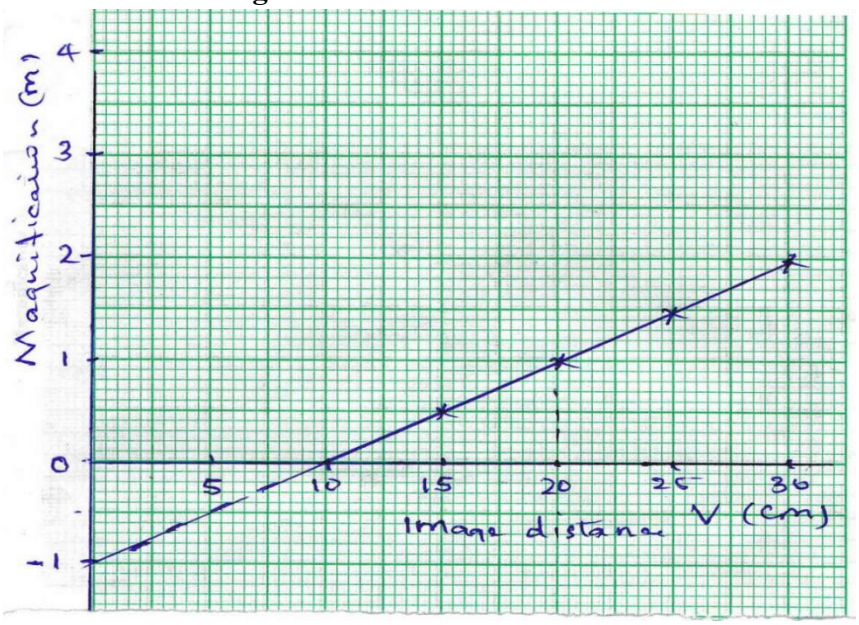
……

b) Sketch on a diagram to illustrate how a convex lens is used as a magnifying glass. (3 marks)

……

……
……
……

(c) In an experiment to determine the focal length of a converging lens using lens formula, several values of image distance corresponding to value of object distance u were determined and a graph of magnification m against image distance v, plotted as shown in **Figure 13**



The equation of the graph can be represented by the equation $m = \frac{v}{f} - 1$

(i) State the significance of the gradient of the graph (1mark)

……
……

(ii) From the graph, determine the focal length of the lens. (3marks)

……
……
……
……

(iii) Determine the value of object distance for which the image is not magnified. (1mark)

……
……

(iv) An object of height 10.5cm stands before a diverging lens of focal length 20cm and a distance of 10cm from the lens. Determine the image distance. (3 marks)

……
……
……
……
……
……

PAPER 3

QUESTION 1

PART A

You are provided with the following:

-A watch glass
-A piece of plasticine
-A marble
-A Stopwatch
-An electronic balance (*to be shared*)
- Vernier calipers (*to be shared*)
- Geometrical set

Proceed as follows:

(a) Measure the mass, **m** of the marble.

m = ……g ($^1/_2$mark)

b) Place the watch glass on the table. Cut the plasticine into two pieces and use them to hold the watch glass firmly on the table as shown in **Figure 1**.

c). Release the marble from one end of the watch glass and time 5 complete oscillation with the stopwatch. Repeat this one more time.

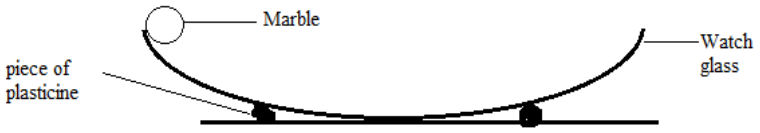


Figure 1

d) Record your values in the **Table 1** ($1^1/_2$ marks)

Attempt	Time for **5** oscillations (seconds)	Periodic time, **T**(s)
1st		
2nd		

Table 1

e) Find the average periodic time **T** (1mark)

f) (i)Measure the diameter of the marble with the Vernier calipers, hence find its radius

Diameter, **d** = …… (1mark)

Radius, **r** = ……m ($^1/_2$mark)

(ii)Determine the volume of the marble given that $V=\frac{4}{3}\pi r^3$ where $\pi=3.142$ (1mark)

(iii)Calculate the radius of the curvature of the watch glass R from the formula $R - r = \frac{5gT^2}{7(2\pi)^2}$

Where $g=10m/s^2$ and $\pi=3.142$ (1mark)

PART B

You are provided with the following:

- A glass prism
- A plain sheet of paper
- A soft board
- 4 optical pins
- 2 Thumb tacks

Proceed as follows:

g) (i)Firmly fix the plain sheet of paper on the soft board using the thumb tacks and place the prism at the centre of the paper. Trace the outline of the prism using a pencil.

(ii)Remove the prism from the outline and label the vertices of the outline L, M and N as shown in **Figure 2**

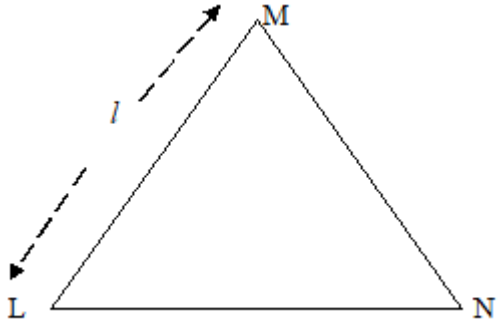


Figure 2

Measure Angle LMN and length, **l** using a ruler

Angle LMN = …… (1mark)

Length, l = …… (1mark)

iii) On the side ML mark a point and draw the normal at that point. Measure an angle T, 60° from the line LM and draw a line along this angle as shown in **Figure 3.**

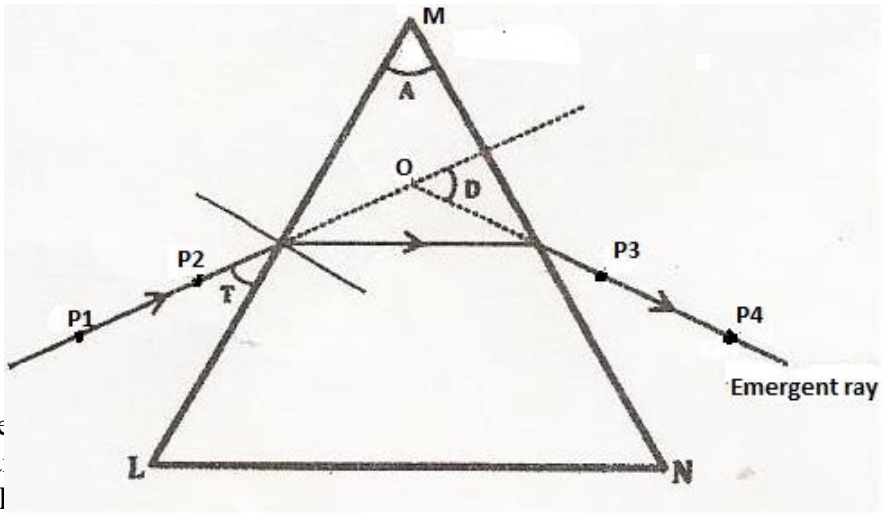


Figure 3

iv). … at a distance of 3cm from each other … and P_4 so that they appear to be on straight …

v). … ins P_3 and P_4. Extend the line … so that the two lines cross each other at point O. Determine angle D and record it in the **Table 2**

h). (i)Repeat the procedure and complete the **Table 2** (2 $^1/_2$marks)

Angle T (°)	60°	50°	40°

$Angle\ D(°)$			
$Angle\ I°(90° - T)$			

Table 2

(ii) Determine the average value D_m of D (1mark)

iii) Determine the constant ***k*** for the glass prism from the formula (2marks)

$$k = \frac{\sin(\frac{A + D_m}{2})}{\sin\frac{A}{2}}$$

iv) State the significance of ***k*** (1mark)

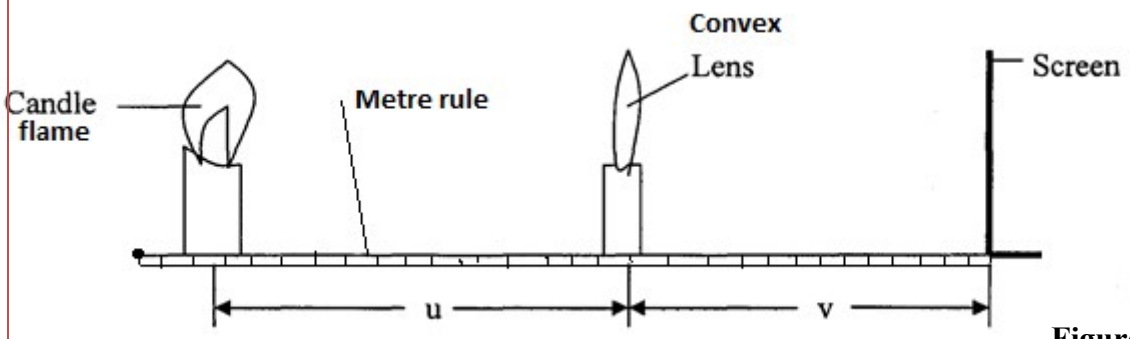
PART C

You are provided with the following:

- A lens holder
- Convex lens
- A candle
- A white screen
- A metre rule

Proceed as follows:

i) Set up the apparatus as shown in **Figure 4**



he candle flame.

Figure 4

u (cm)	v (cm)	$m = \frac{v}{u}$
30		
50		

Table 3

(ii) Given that the focal length f of the lens satisfies the equation $f = \frac{v}{m+1}$, determine the average value of the focal length, f. (2 marks)

QUESTION 2

You are provided with the following:

- An ammeter (**0 – 1 A**)
- A voltmeter (**0 – 3 V** or **0 – 5 V**)
- A variable resistor
- A **10Ω** carbon resistor
- A piece of resistance wire
- Two new dry cells
- A cell holder
- A switch
- Seven connecting wires

Proceed as follows:

a) Take the resistant wire and coil it around the biro pen to make a coil.

b) Set up the apparatus as shown **Figure 5** below such that the **10Ω** carbon resistor and the coil are in parallel connection.

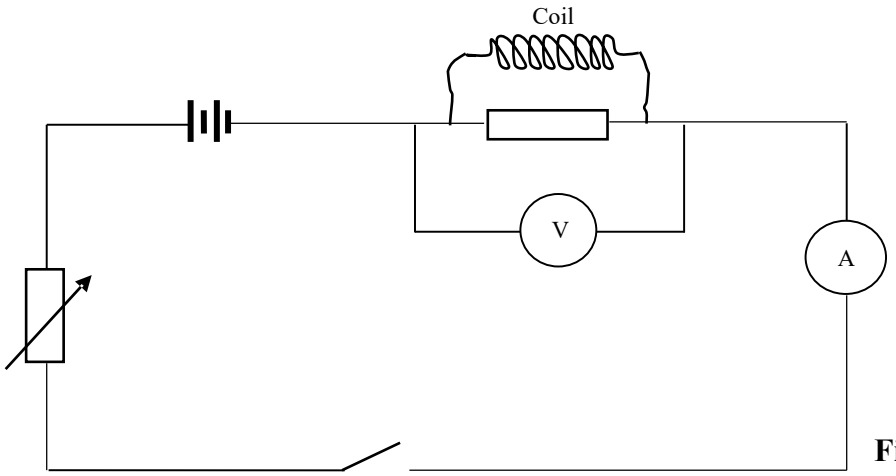


Figure 5

c) Close the switch and the adjust the variable resistor such that the ammeter read a current of I_1=**0.08A** and record the corresponding voltmeter reading V_1

i) V_1 =…… (1mark)

ii) Calculate resistance $R_1 = \frac{V_1}{I_1}$ (1mark)

d) Repeat (c) above for current of I_2 = **0.16A** and record the corresponding voltmeter reading V_2

i) V_2 =…… (1mark)

ii) Calculate resistance $R_2 = \frac{V_2}{I_2}$ (1mark)

e) Find the average value of resistance **R** (1mark)

f) Determine the resistance, **C** of the coil (2marks)

g) Now set up the apparatus as shown in **Figure 6** below such that the voltmeter is connected across the cells, **10Ω** carbon resistor and the coil are in parallel connection.

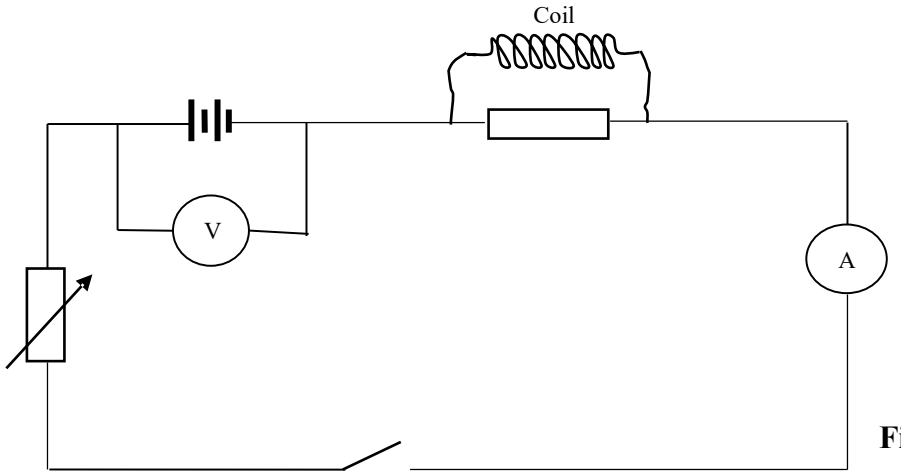


Figure 6

h) Close the switch and the adjust the variable resistor such that the ammeter reads a current of **0.04A** and note the corresponding voltmeter reading. Record the value in the **Table 4** below.

i) Repeat (h) above for other values of current and voltage and complete the **Table 4** below

Current, I (A)	**0.04**	**0.08**	**0.12**	**0.16**	**0.20**	**0.24**
Voltage, V(V)						

(4marks) **Table 4**

j) On the grid provided plot a graph of **Voltage, V (V)** against **Current, I (A)** (5marks)

k) Determine the slope of the of the graph (2marks)

l) Given that graph is related to equation **E = V + Ir** where **E** and **r** are the emf and internal resistance of the cells respectively, use your graph to determine the value of:

E =…… (1mark)

r =…….. (1mark)