THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

232/1 **PHYSICS (Theory)** **Paper 1**

Nov. 2023 – 2 hours

Serial No.
26359626

Name: ..... **Index Number:** .....

Candidate's signature: ..... **Date:** .....

Instructions to candidates

(a) Write your name and index number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
(c) This paper consists of **two** sections; **A** and **B.**
(d) Answer **all** the questions in sections **A** and **B** in the spaces provided.
(e) ***All*** *working* ***must*** *be clearly shown in the spaces provided in this booklet.*
(f) Non-programmable silent electronic calculators may be used.
(g) **This paper consists of 12 printed pages.**
(h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
(i) **Candidates should answer the questions in English.**

For Examiner's Use Only

Section	Questions	Maximum Score	Candidate's Score
A	1 - 13	25	
B	14	11	
	15	11	
	16	11	
	17	11	
	18	11	
Total Score		80	

SECTION A (25 marks)

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

1 State **one** way in which Physics contributes to the study of History. (1 mark)

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2 It is observed that diffusion is faster in gases than in liquids. State the reason for this observation. (1 mark)

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3 A boarding school has two identical tanks A and B filled with water. All the surfaces of tank A are painted silvery shiny while the surfaces of tank B are painted black. It is observed that, for bathing in the morning, most of the students prefer fetching water from one particular tank.

(a) Identify the tank preferred by the students in the morning. (1 mark)

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(b) Explain why students prefer to use water in the tank identified in 3(a). (2 marks)

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4 **Figure 1** shows a uniform metre rule of negligible weight pivoted at the 40 cm mark. It is kept at equilibrium by a spring balance attached at the 100 cm mark and force F at the 60 cm mark.

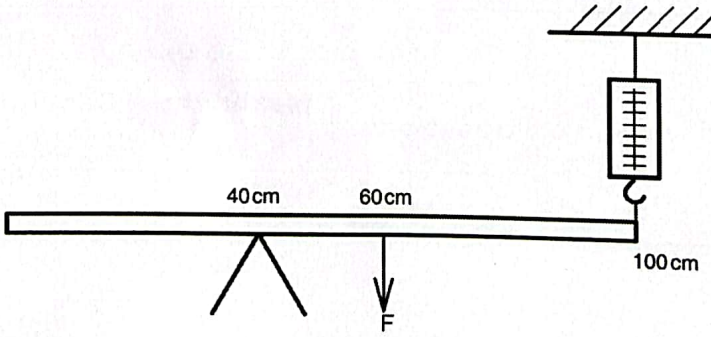

Figure 1

The reading on the spring balance is 1 N. Determine the value of F. (3 marks)

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5 A mass of 40 g is suspended from a spring causing it to stretch. When a 20 g mass is added to it, the spring stretches further by 1.6 cm. Determine the spring constant.
(*gravitational field strength g=10 Nkg^{-1}*) (2 marks)

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6 **Figure 2** shows a test tube containing air and fitted with a sliding cork. The tube is suspended horizontally by a thread.

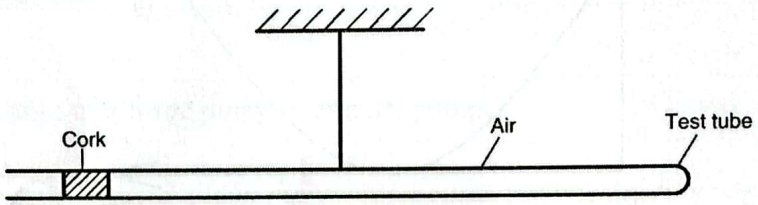

Figure 2

When the test tube was heated slightly, the cork moved and the tube tilted.

(a) State the direction in which the tube tilted. (1 mark)

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(b) Explain why the tube tilted as in 6(a). (2 marks)

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7 **Figure 3** shows two identical tennis balls K and L moving in air. Ball K spins as it moves while ball L does not.

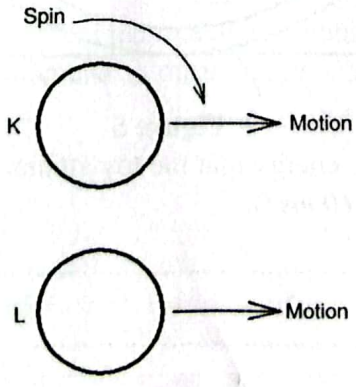

Figure 3

It is observed that ball K falls down faster than ball L. Explain this observation. (3 marks)

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8 **Figure 4** shows a velocity - time graph of a certain object.

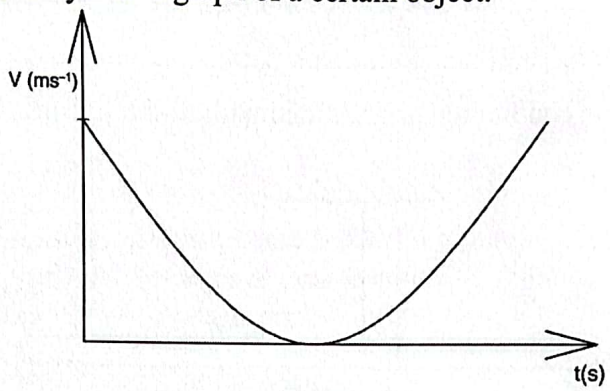

Figure 4

Describe the motion of the object. (2 marks)

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9 **Figure 5** shows a toy car of mass 250 g moving from rest on a curved frictionless bowl of height 0.2 m.

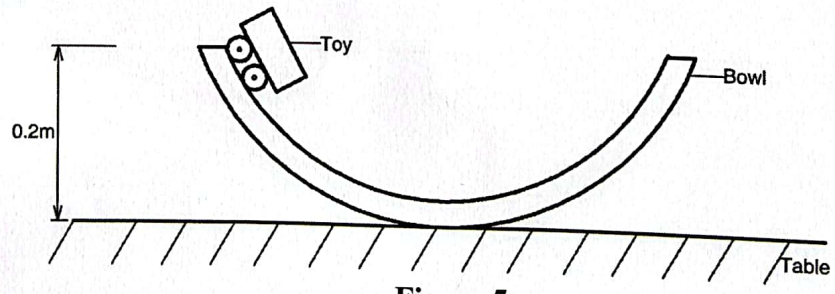

Figure 5

Determine the maximum kinetic energy that the toy attains.
(*gravitational acceleration g is 10 ms⁻²*).

(3 marks)

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10 State **one** factor that determines the speed at which a car negotiates a level circular path. (1 mark)

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11 A student observed that a burn by steam from boiling water was more severe than a burn by the boiling water. State the reason for this observation. (1 mark)

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12 State **one** advantage of a force pump over a lift pump. (1 mark)

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13 State **one** possible source of error that may occur when carrying out an experiment to verify Charles' Law. (1 mark)

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SECTION B (55 marks)

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

14 (a) State **two** properties of alcohol that make an alcohol thermometer more suitable than a mercury-in-glass thermometer in measuring temperature. (2 marks)

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(b) **Figure 6** shows Six's maximum and minimum thermometer.

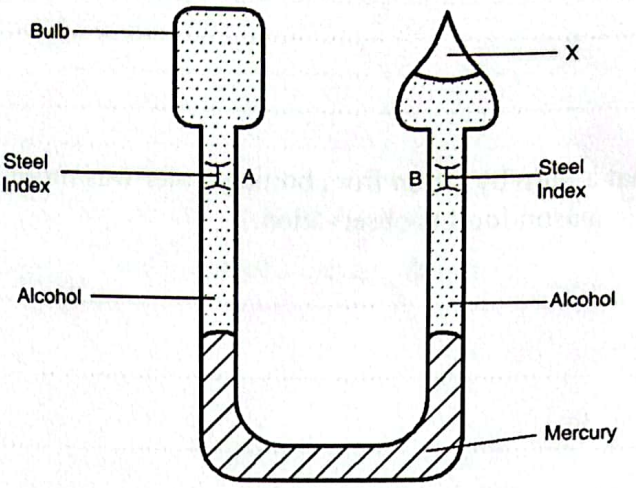

Figure 6

(i) State the purpose of the:

I. part labelled X; (1 mark)

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II. mercury. (1 mark)

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(ii) State the reason why indices A and B are made of steel. (1 mark)

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(iii) Explain how the maximum temperature for a given day is determined using this type of thermometer. (3 marks)

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(iv) State the reason for the shape of the meniscus of mercury in **Figure 6.** (1 mark)

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(c) **Figure 7** show a cork stuck in the neck of glass bottle.

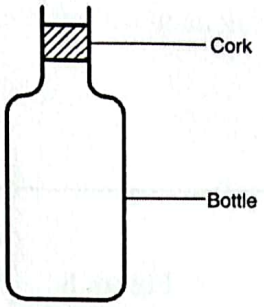

Figure 7

Explain how the cork can be removed from the bottle without breaking the bottle or the cork. (2 marks)

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15 (a) Explain the following observations:

(i) A trolley moving on a bench in a straight line eventually comes to rest; (2 marks)

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(ii) A passenger is jerked forward when a vehicle is suddenly stopped. (2 marks)

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(b) **Figure 8** shows a graph of velocity against time for two identical ball bearings dropped into water and glycerine.

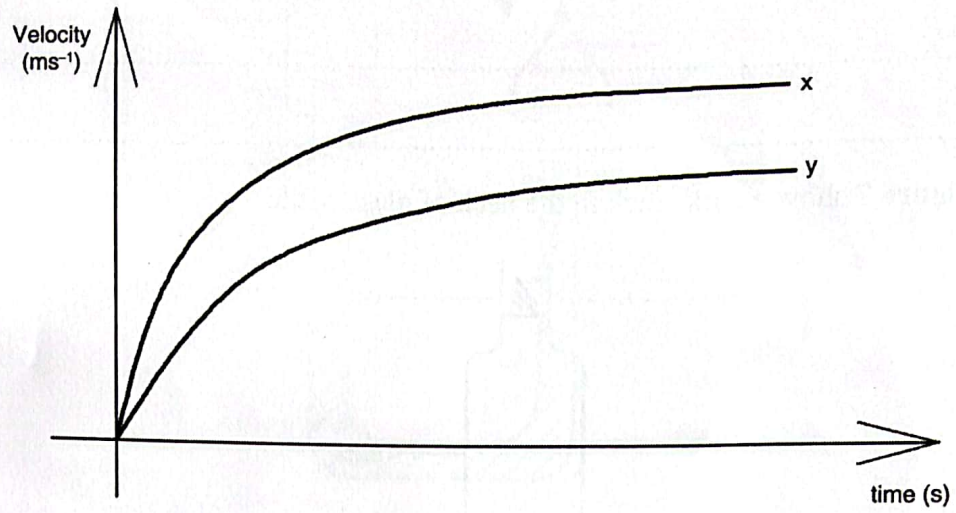

Figure 8

State with a reason which of the two curves x or y shows the velocity of the ball bearing falling through water. (3 marks)

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(c) **Figure 9** shows a student of mass 60 kg standing on a weighing balance calibrated in newtons in a lift. The lift is accelerating upwards at 0.25 ms^{-2}.

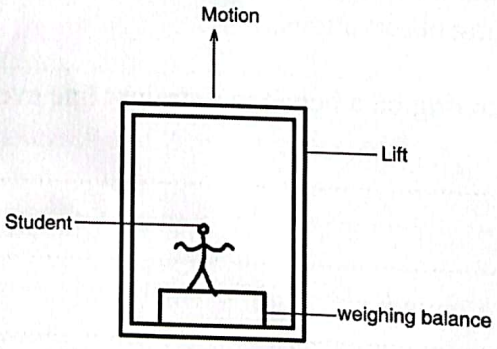

Figure 9

Determine the reading on the weighing balance. (3 marks)

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(d) State one way of reducing frictional force experienced by an object sliding on a flat surface. (1 mark)

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16 (a) **Figure 10 (a)** shows two similar bottles P and Q of the same weight while **Figure 10 (b)** shows bottle P kept afloat in water using an inflated balloon.

(a) (b)

Figure 10

Bottle P in **Figure 10 (b)** is then replaced with bottle Q in **Figure 10 (a).**

(i) State what is observed on bottle Q. (1 mark)

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(ii) Explain the observation in part (i). (2 marks)

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(b) A piece of metal weighs 0.6 N in air and 0.5 N when fully submerged in water. When the metal is fully submerged in liquid L, it weighs 0.54 N. Determine the:

(i) relative density of the metal. (3 marks)

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(ii) relative density of liquid L. (3 marks)

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(iii) density of liquid L. (2 marks)

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17 (a) In an experiment to estimate the diameter of an oil molecule, an oil drop of volume 6.55×10^{-5} cm^3 was placed on the surface of water. The oil spread to form a circular patch of diameter 8 cm.

(i) Determine the:

I. area of the oil patch; (2 marks)

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II. diameter of the oil molecule. (3 marks)

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(ii) State **two** assumptions made in such an experiment. (2 marks)

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(iii) State any **two** possible sources of error in the experiment. (2 marks)

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(b) Describe how the experiment in 17(a) could be used to determine the extent of accidental oil spillage in the sea. (2 marks)

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18 (a) **Figure 11** shows two liquids L and M each of mass 1 kg in identical containers. Liquid L has higher heat capacity than liquid M.

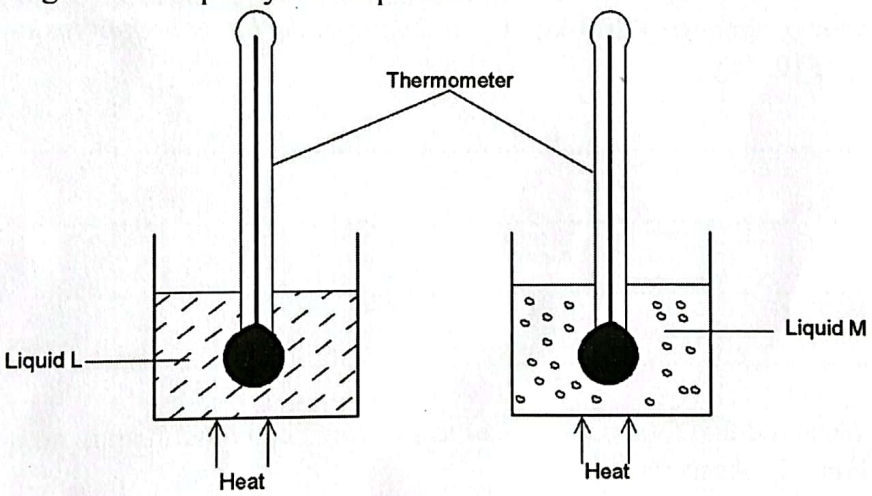

Figure 11

The liquids are heated with the same amount of heat for the same length of time.

(i) State the observation made on the readings of the two thermometers. (1 mark)

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(ii) Explain the observation in part (i). (2 marks)

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(iii) State **two** ways in which heat losses in the two calorimeters can be minimized. (2 marks)

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(b) A block of ice at 0 °C and of mass 5 g is placed into a calorimeter containing 50 g of water at 25 °C. If all the ice melted, determine the final temperature of the mixture. (*Assume that negligible heat is absorbed by the calorimeter). Take the specific heat capacity of water as* $4200 Jkg^{-1}k^{-1}$ *and the specific latent heat of fusion of ice as* $3.5 \times 10^5 Jkg^{-1}$ (4 marks)

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(c) It is observed that food cooks faster in a covered container than in an open container. Explain this observation.

(2 marks)

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THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

Paper 2

232/2 # PHYSICS (Theory)

Nov. 2023 - 2 hours

Serial No.
27719618

Name: ..... **Index Number:** .....

Candidate's signature: ..... **Date:** .....

Instructions to candidates

(a) Write your name and index number in the spaces provided above.
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For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1 - 14	25	
B	15	11	
	16	10	
	17	13	
	18	11	
	19	10	
Total Score		80	

SECTION A: (25 marks)

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

1 State with a reason the effect of reducing the heater current on the x-rays produced in an x-ray tube. (1 mark)

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2 State **one** property of a magnet. (1 mark)

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3 State the importance of using the correct colour codes in the domestic wiring system. (1 mark)

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4 Using the energy band theory, explain the difference between conductors and semi-conductors. (3 marks)

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5 State **one** quantity that must be kept constant for Ohm's law to hold. (1 mark)

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6 **Figure 1** shows an object placed near the eye of a long sighted person.

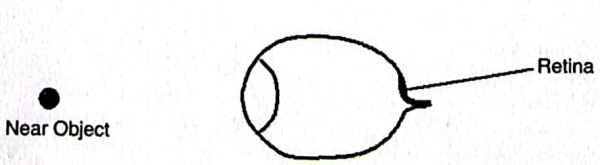

Figure 1

Complete the diagram to show where the image is formed. (2 marks)

7 **Figure 2** shows a student using a small plane mirror to view her image.

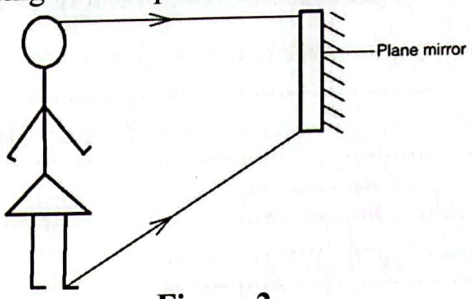

Figure 2

Explain why the student is able to see her face but not her legs in the mirror. (2 marks)

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8 **Figure 3** shows a coil made from tungsten being used to heat some water in a beaker at a constant voltage.

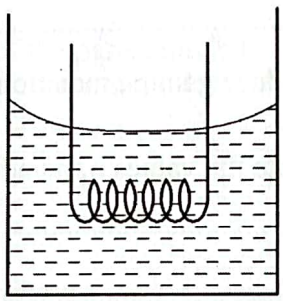

Figure 3

State **two** ways in which the coil can be improved so that the water boils in a shorter time. (2 marks)

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9 Describe how a cathode ray oscilloscope may be used to measure the voltage of an alternating signal. (3 marks)

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10 Explain why it is not advisable to leave a lead acid accumulator in the discharge condition for a long time. (2 marks)

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11 State **two** properties that distinguish electromagnetic waves from mechanical waves. (2 marks)

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12 Thorium element decayed to produce gamma radiation as shown in the equation below:

$${}^{a}_{90}Th \rightarrow {}^{230}_{b}Th + \gamma$$. State the values of a and b. (2 marks)

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13 A student observed a rainbow when it was raining and the sun was shining. Explain how dispersion of white light by rain drops leads to the formation of the rainbow. (2 marks)

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14 State the reason why sound waves get refracted away from the ground on a hot day. (1 mark)

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SECTION B: (55 marks)

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

15 (a) **Figure 4** shows a gold - leaf electroscope.

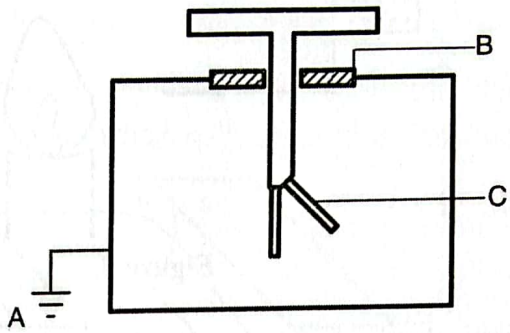

Figure 4

(i) Identify the part labelled A. (1 mark)

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(ii) State the function of the parts labelled.

(I) B (1 mark)

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(II) C (1 mark)

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(b) A highly negatively charged rod is slowly brought close to a lightly positively charged gold leaf electroscope.

(i) State what is observed on the gold leaf. (1 mark)

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(ii) Explain the observation made in b(i). (2 marks)

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(c) **Figure 5** shows a thin wire connected to a highly positively charged rod and placed close to a candle flame.

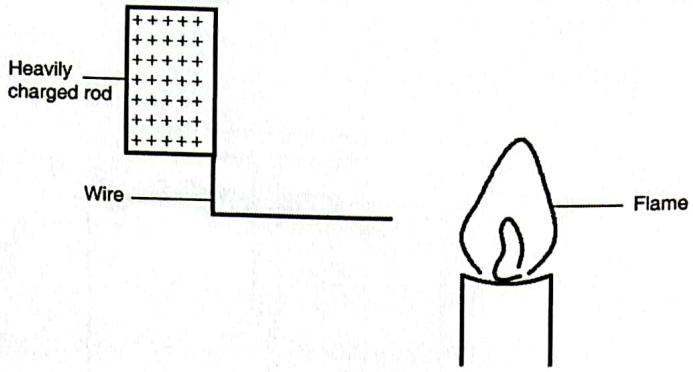

Figure 5.

(i) State what is observed on the flame when the wire is brought closer. (1 mark)

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(ii) Explain the reason for the observation in c(i) (1 mark)

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(d) **Figure 6** shows an arrangement of three capacitors in a circuit.

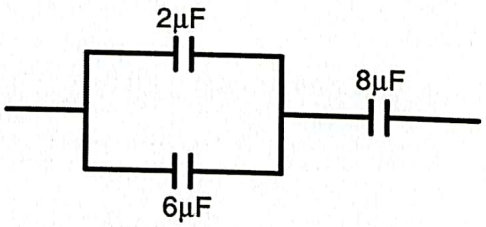

Figure 6

Determine the effective capacitance of the arrangement. (3 marks)

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16 (a) State Fleming's left hand rule. (1 mark)

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(b) **Figure 7** shows an electric motor with a coil ABCD in the magnetic field.

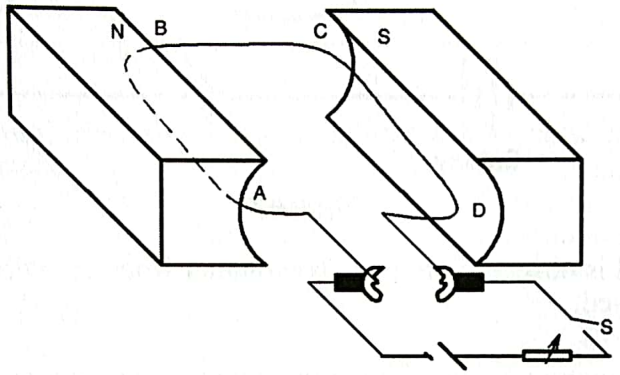

Figure 7

(i) Indicate with an arrow on the coil **ABCD**, the direction of the current I when switch S is closed. (1 mark)

(ii) State the direction in which the coil rotates when the switch is closed. (1 mark)

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(iii) Explain what makes the coil to rotate. (3 marks)

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(iv) State **three** ways in which the power of this motor can be increased. (3 marks)

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(v) State the purpose of the rheostat in the setup. (1 mark)

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17 (a) **Figure 8** shows a setup that may be used to investigate photoelectric effect. In the setup, a UV source is placed close to the window.

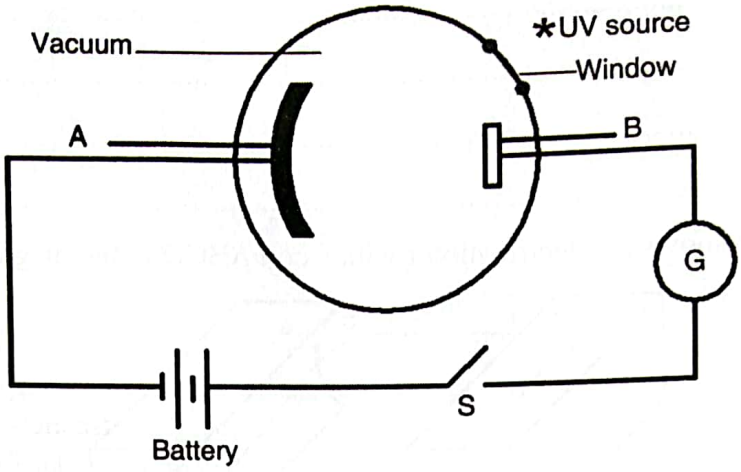

Figure 8

(i) Explain what is observed on the galvanometer when the window is opened and the switch is closed. (3 marks)

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(ii) Explain why parts A and B are placed in a vacuum. (2 marks)

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(b) A photon of red light has a wavelength of 8.0×10^{-1} m. Determine the energy it contains. (*Planks constant h is 6.63×10^{-34} Js and the speed of light c is 3.0×10^{8} ms^{-1}*) (3 marks)

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(c) A metal surface has a work function of 4.5 eV. (*Planks constant h is $6.63x10^{-34}$ Js and the electronic charge e is $1.6x10^{-19}$* C).

Determine the;

(i) work function of the metal in joules (J). (2 marks)

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(ii) maximum wavelength of a radiation that will cause electrons to be emitted from the surface. (3 marks)

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18 a) **Figure 9** shows the image produced by a concave mirror of focal length 20 cm.

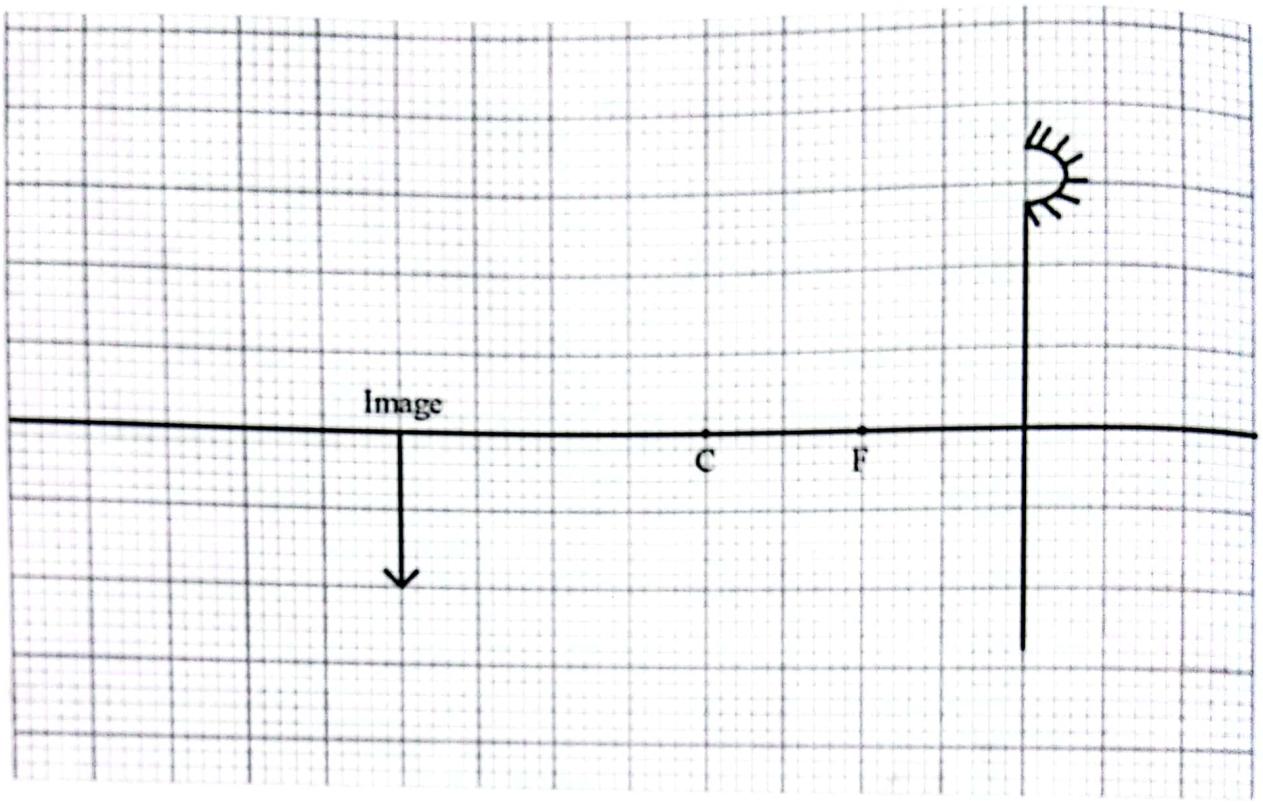

Figure 9

(i) On the same diagram draw rays to show the position of the object. (3 marks)

(ii) Given that the diagram is drawn to scale, determine the:

(I) distance of the object from the mirror;

(1 mark)

.....

(II) magnification.

(3 marks)

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(b) **Figure 10** shows a ray of light incident at the pole of a convex mirror.

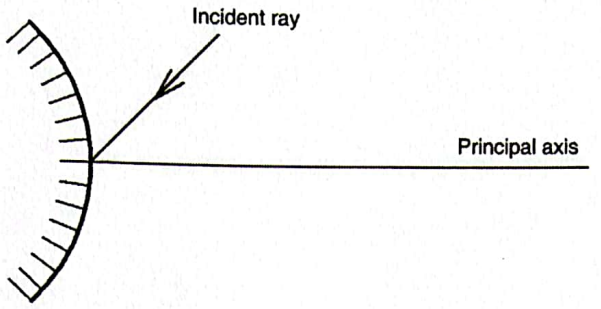

Figure 10

(i) Complete the diagram to show how the ray may be used to locate the image formed by the mirror. (2 marks)

(ii) State any **two** characteristics of the image formed. (2 marks)

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19 (a) A cliff obstructs an observer from seeing an approaching car. Explain how the sound from the car reaches the observer before the car emerges. (2 marks)

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(b) **Figure 11** shows a displacement - time graph for a certain wave motion.

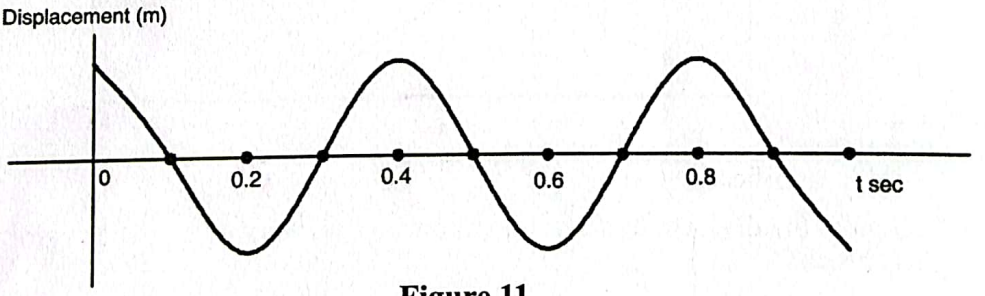

Figure 11

(i) Determine the:

(I) period T; (1 mark)

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(II) frequency f. (2 marks)

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(ii) On the same axis draw a wave whose frequency is twice the one obtained in part (II).
(2 marks)

(c) (i) State the meaning of the term "*refraction*".
(1 mark)

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(ii) **Figure 12**, shows a rectangular glass block, dipped in a ripple tank in which plane water waves are generated.

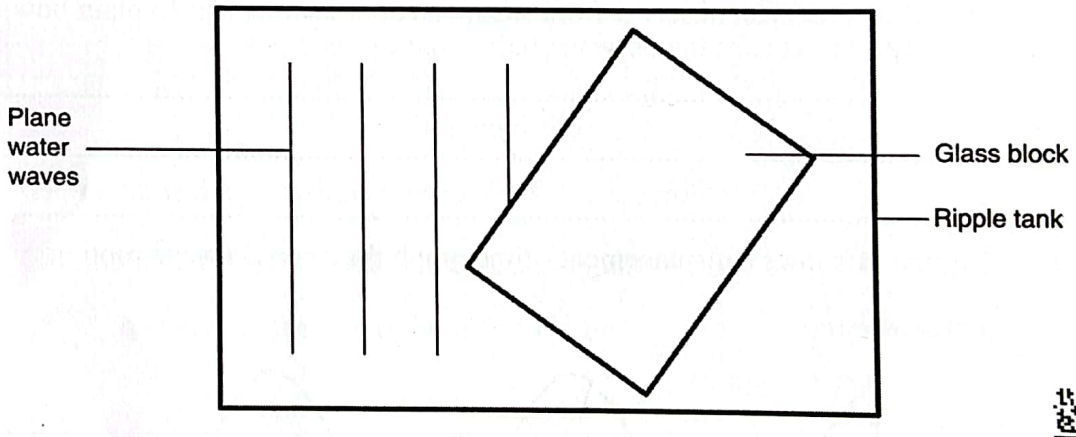

Figure 12

Complete the diagram to show how the water waves move in the region that has the glass block.
(2 marks)

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THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

232/3

PHYSICS (Practical)

Paper 3

Nov. 2023 – 2½ hours

Serial No.
28759618

Name: ..... **Index Number:** .....

Candidate's signature: ..... **Date:** .....

Instructions to candidates

(a) Write your name and index number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above.
(c) Answer all the questions in the spaces provided in the question paper.
(d) You are supposed to spend the first 15 minutes of the 2½ hours allowed for this paper reading the whole paper carefully before commencing your work.
(e) Marks are given for a clear record of the observations actually made, their suitability, accuracy and the use made of them.
(f) Candidates are advised to record their observations as soon as they are made.
(g) Non-programmable silent electronic calculators may be used .
(h) This paper consists of **11** printed *pages.*
(i) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
(j) **Candidates should answer the questions in English.**

For Examiner's Use Only

Question 1

	d	g	h	i
Maximum Score	8	5	3	4
Candidate's Score				

Total

Question 2

	a	b	c	d	f	g(ii)	g(iii)
Maximum Score	1	2	4	5	3	4	1
Candidate's Score							

Total

Grand Total	

Question 1

You are provided with the following:

- a strip of manila paper marked with an equal division scale on one end.
- a plane mirror
- a biconvex lens
- two pieces of wooden blocks
- a stand, boss and clamp
- some glycerine in a beaker
- a dropper
- a half metre rule

Proceed as follows:

(a) Place the mirror on a horizontal surface and place the lens at the center of the mirror.

(b) Clamp the wooden blocks so that they hold the strip of manilla with the millimetre scale facing upwards at a height *h* above the center of the lens. Let *h* initially be about 300 mm (30 cm). **(See Figure 1).**

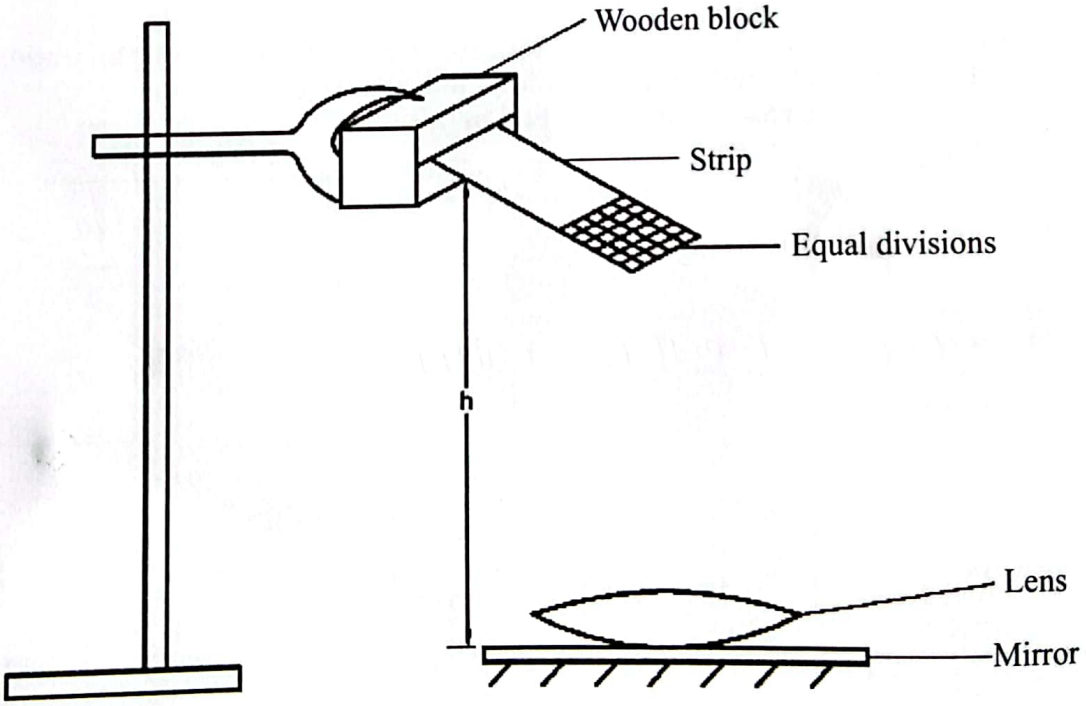


Figure 1

(c) With the eye vertically above the lens, adjust the position of the mirror and lens so that you can see the image of the strip in the central region of the lens.

Using the divisions on the scale on the top side of the strip, determine the width p of the image when the object (strip) is 300 mm above the lens.(***see figure 2***)

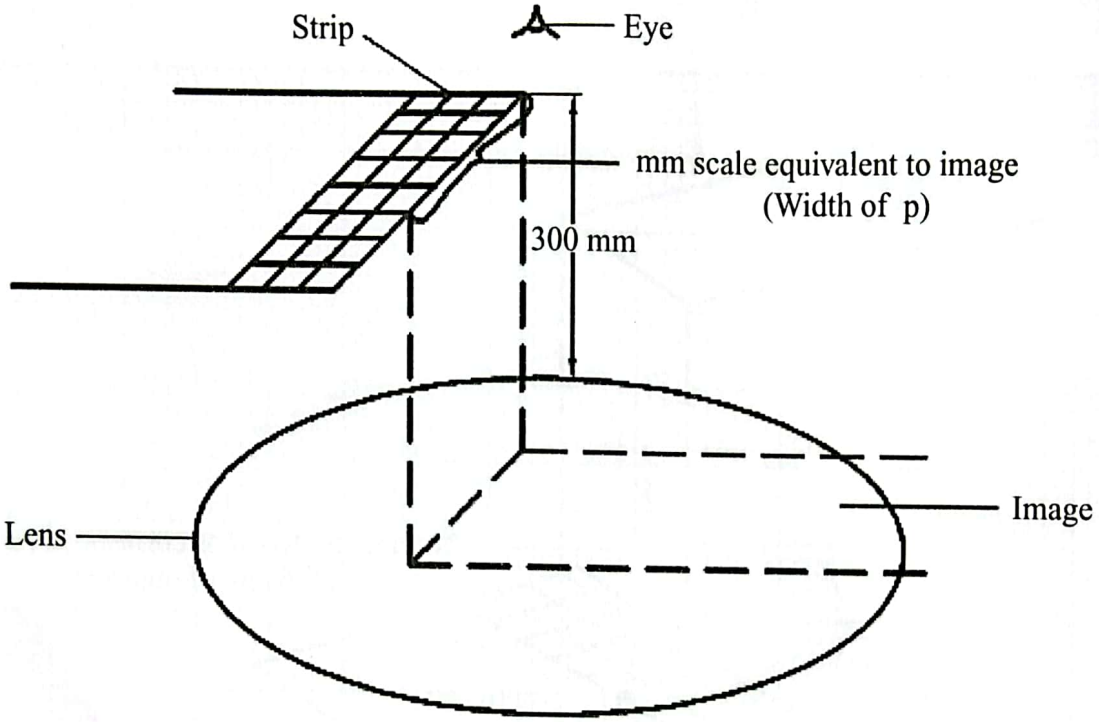


Figure 2

p (width of image) = ... divisions

(d) Repeat (c) to obtain p for other values of h shown in **Table 1**. Record the results in **Table 1**.

(***Hint: When the image is larger than the object, turn the strip upside down so that the scale faces downwards. In this case the width of the image*** $= \frac{100}{n}$ ***where n is the number of divisions on the image corresponding to the full width of the object).*** See **figure 3**

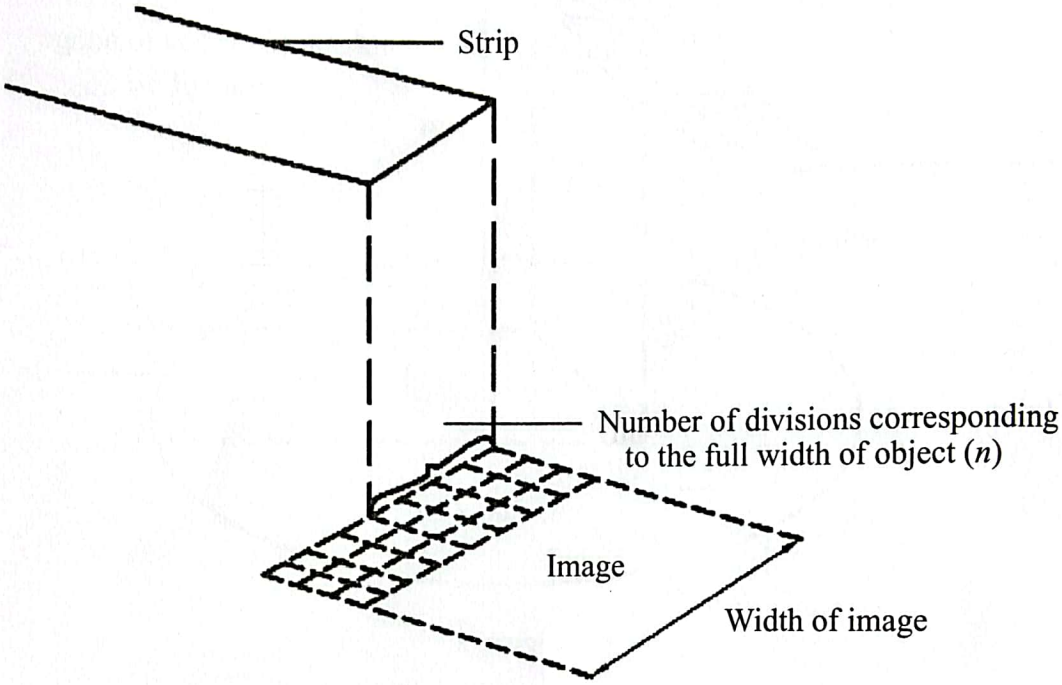


Figure 3

(e) Remove the lens. Put 8 drops of glycerine in the center of the mirror. Replace the lens on top of the glycerine.

(f) Repeat (c) to obtain values of the width q for the corresponding values of h in **Table 1**, (***upto h = 180 mm***). Complete **Table 1**.

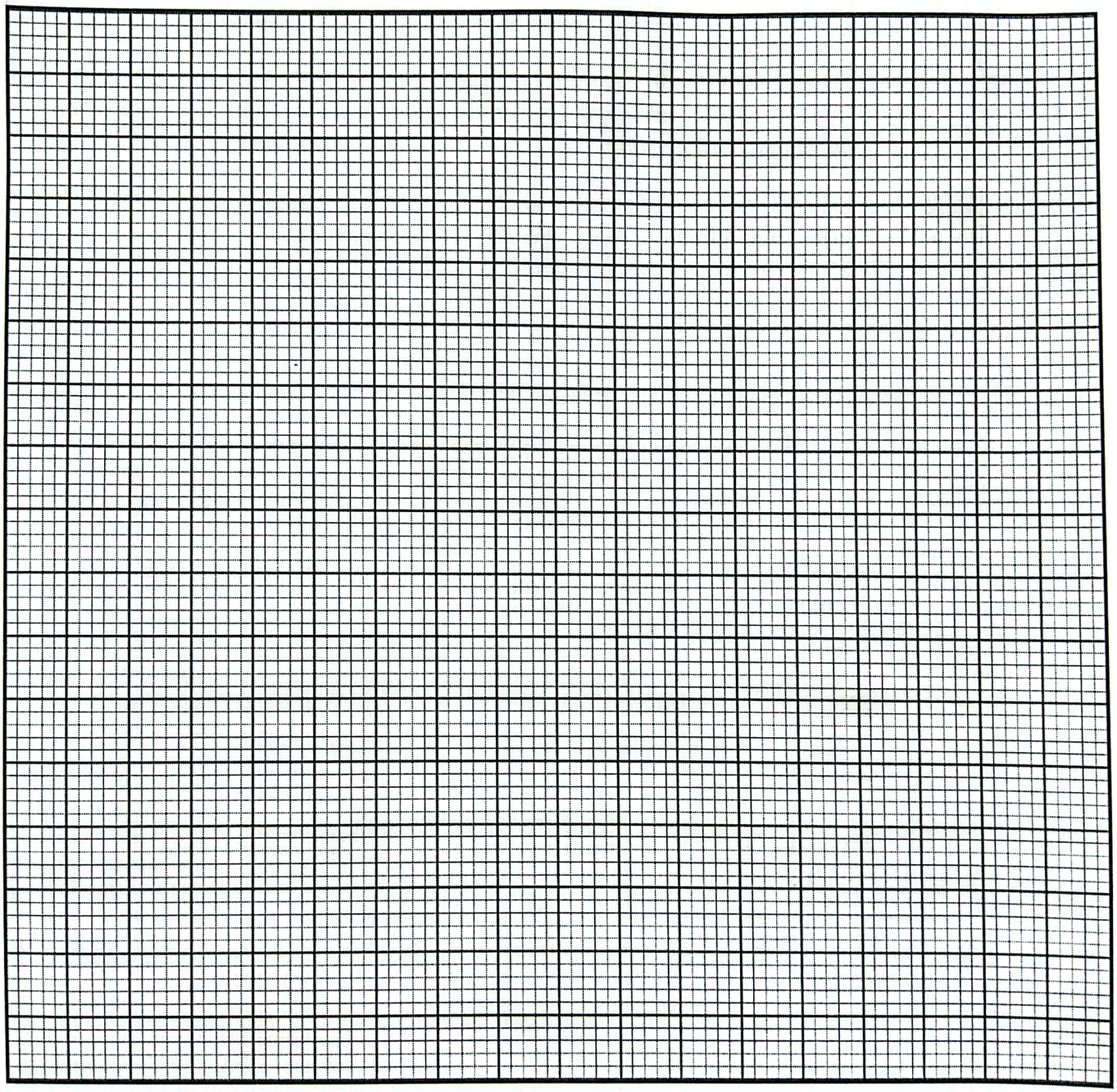
(g) On the grid provided, plot a graph of p (y axis) against h. (5 marks)

(h) Use the same axes as in (g) to plot a graph of q (y axis) against h. (3 marks)

Table 1

h (mm)	300	280	250	230	200	180	150	130
p (division)								
q (division)								

(8 marks)



(i) From the graphs determine the:

(i) values of h in each case when the image size is 10 divisions.

h_p = ... (1 mark)

h_q = ... (1 mark)

(*Where h_p is the value of h for p and h_q is the value of h for q when the width of the image is 10 divisions).*

(ii) the refractive index η of glycerine given that: $\eta = 2 - \frac{h_p}{h_q}$ (2 marks)

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Question 2

You are provided with the following:

- Two dry cells
- A galvanometer
- Two cell holders
- Two switches
- A voltmeter
- An ammeter
- A jockey
- Nine connecting wires
- A resistance wire mounted on a millimetre scale labelled **A B**.
- A resistance wire mounted on a millimetre scale labelled **P Q**.
- A component **X**
- A thermometer
- Two beakers one containing water
- One carbon resistor labelled 10 Ω
- A source of hot water (*to be shared*)

Proceed as follows:

PART A

(a) Set up the circuit as shown in **Figure 4**.

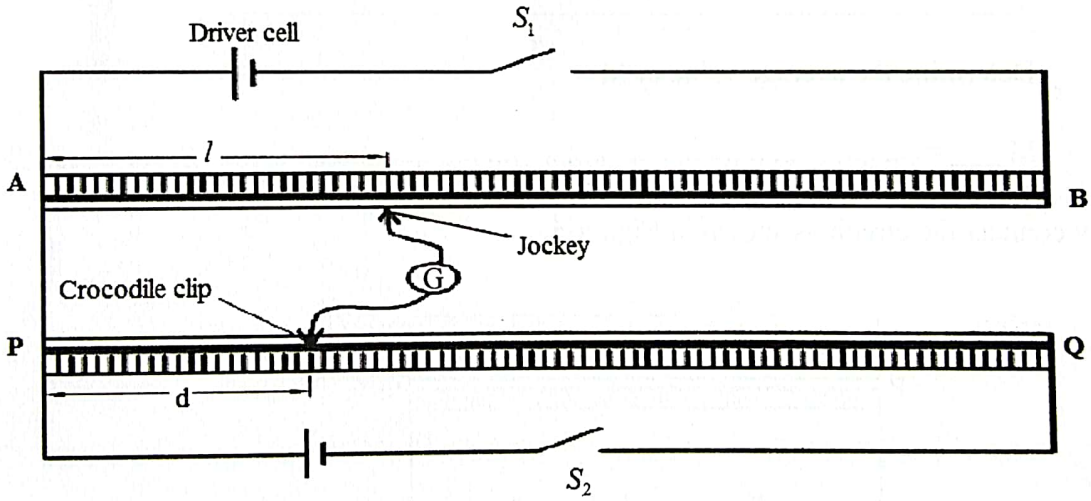

Figure 4

With S_1 and S_2 open, connect a voltmeter across the driver cell and record the voltmeter reading E.

E = ... volts (1 mark)

(b) (i) Adjust distance *d* to 10 cm from P. Move the jockey along AB to obtain the balance length *l*. (***No deflection on the galvanometer***)

l = ... cm. (1 mark)

(ii) Determine constant m given that $m = \frac{l}{d}$ (1 mark)

.....

.....

.....

(c) (i) Repeat (b) for the other values of *d* in **Table 2** and complete the **Table 2.** (2 marks)

Table 2

d(cm)	**10**	**30**	**50**
l (cm)			
$m = \frac{l}{d}$			

(ii) Determine the average value of M

$M_{average}$ = ... (2 marks)

(d) Now connect the circuit as shown in **Figure 5.**

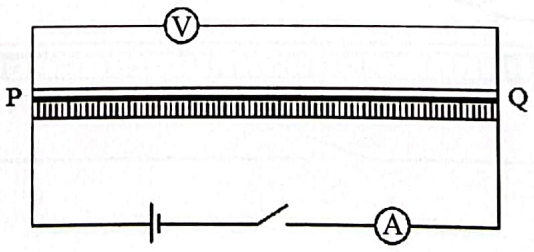

Figure 5

(i) Measure and record the current I through the circuit and the potential difference (p.d.) across PQ.

I =..... (1 mark)

V =..... (1 mark)

(ii) Determine the resistance R of the wire. (1 mark)

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(iii) Determine constant **K** given that: $\frac{E}{KI} = R$ (2 marks)

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PART B

(e) Connect the circuit as shown in **Figure 6**. Add cold water to the beaker until component *X* is just covered.

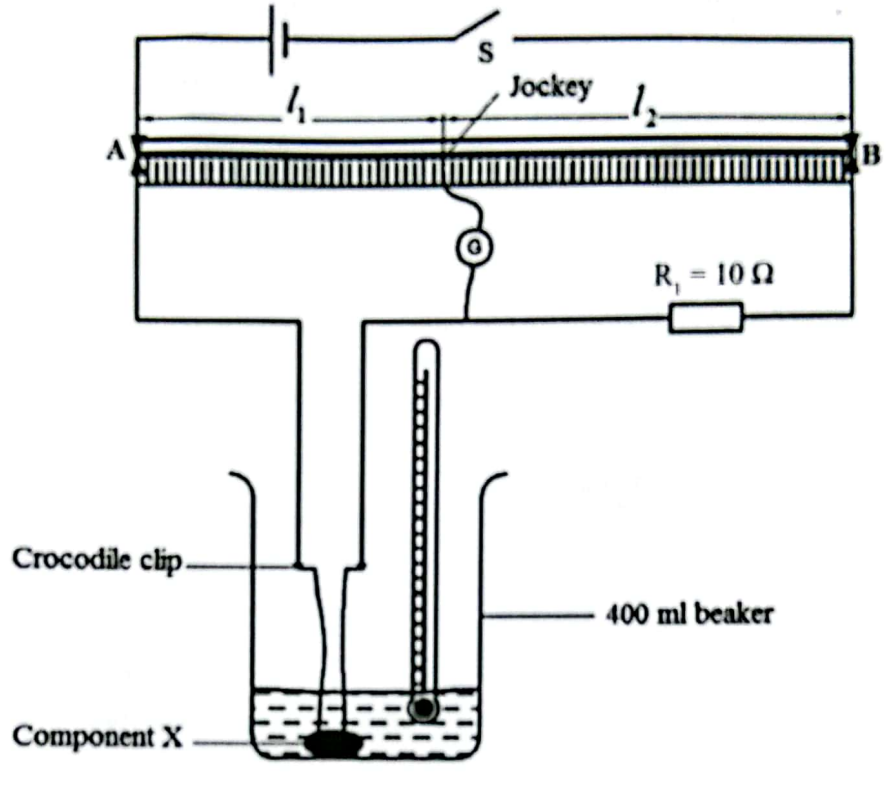

Figure 6

(f) (i) Record the initial temperature of the water in the beaker θ_o

θ_o = ...°C

(1 mark)

Close the switch and adjust the position of the jockey on wire **AB** until there is balance. ***(No deflection on the galvanometer)***

(ii) Record the balance lengths l_1 and l_2

l_1 = ...

l_2 = ... **(1 mark)**

Open the switch.

(iii) Determine the initial resistance R_o of the component X given that: $R_o = 10\frac{l_1}{l_2}$ (1 mark)

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(g) Raise the temperature of the water covering component X by adding in little amounts of the hot water provided and stirring continuously using the thermometer.
(It may be neccesary to pour out some water in order to add more hot water)

(i) Repeat (f) for the values of temperature (θ) shown in **Table 3**.

(ii) For each of the temperatures in **Table 3**, determine the constant K, and Complete **Table 3**

Table 3

Temperature θ °C	l_1 (cm)	l_2 (cm)	$R = 10\frac{l_1}{l_2}$	$K = \frac{\log\left(R_o/R\right)}{0.4(\theta - \theta_o)}$
40				
50				

(4 marks)

(iii) Determine the average value of K. (1 mark)

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