THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education

232/1 **Paper 1**

PHYSICS – (Theory)

Mar. 2022 – 2 hours

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 16 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.**

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Section	Questions	Maximum Score	Candidate's Score
A	1–14	25	
B	15	10	
	16	12	
	17	11	
	18	10	
	19	12	
	Total Score	80	

SECTION A (25 marks)

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

1. **Figure 1** shows part of the thimble scale of a screw gauge with 50 divisions.

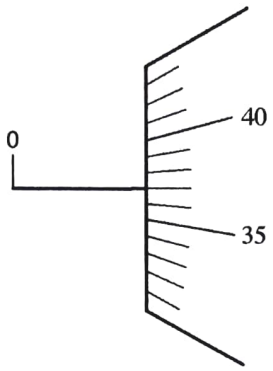

Figure 1

On the diagram, draw the sleeve scale to show a reading of 3.87 mm. (1 mark)

2. **Figure 2** shows a siphon used to empty a tank.

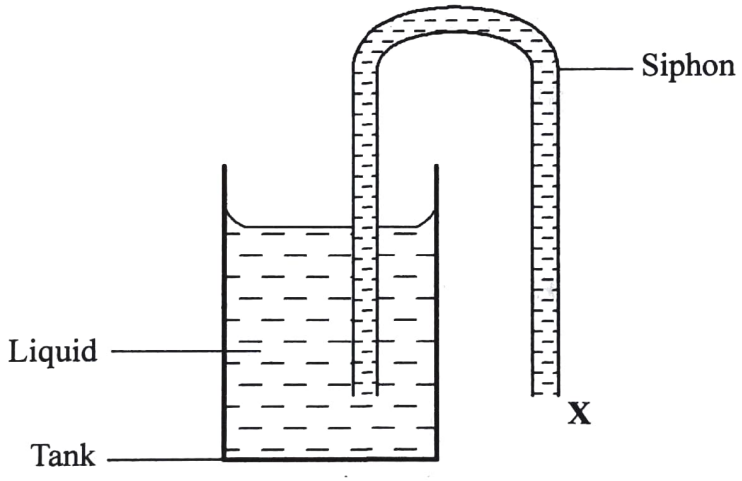

Figure 2

In order to start the siphon, state why:

(a) it must be full of liquid. (1 mark)

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(b) end **X** must be below the level of the liquid in the tank. (1 mark)

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3. **Figure 3(a)** shows a horizontal tube containing air trapped by a mercury thread of length 5 cm. The length of the enclosed air column is 7.5 cm. The atmospheric pressure is 76 cmHg.

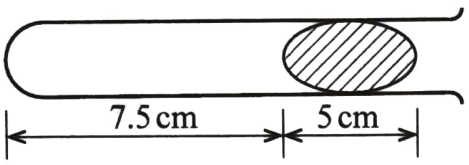

Figure 3(a)

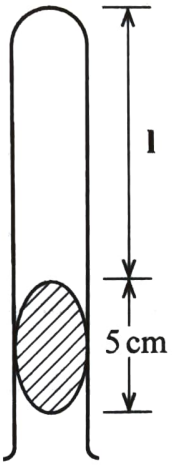

Figure 3(b)

The tube is then turned vertically with its mouth facing down as shown in **Figure 3(b).**

(a) Determine the length **l** of the air column. (3 marks)

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(b) State the reason why the mercury thread did **not** fall out in **Figure 3(b).** (1 mark)

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4. In a Physics experiment, a student filled a burette with water up to a level of 15 ml. The student ran out 3 drops of water each of volume 2 cm^3 from the burette into a beaker. Determine the final reading of the burette. (2 marks)

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5. State **two** factors that affect the angular velocity of a body moving in a circular path. (2 marks)

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6. **Figure 4** shows two capillary tubes **X** and **Y** of different diameters dipped in mercury.

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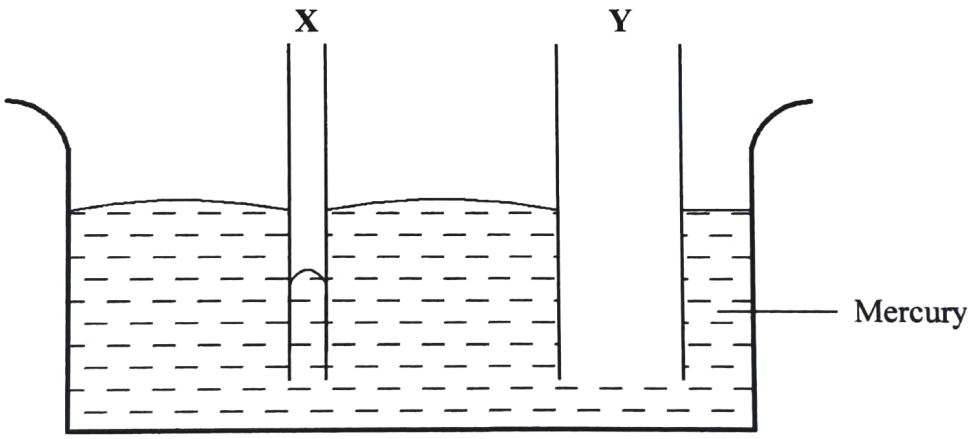

Figure 4

Complete the diagram to show the meniscus in **Y**. (1 mark)

7. In an experiment, a drop of black ink is introduced at the bottom of a container filled with water. It is observed that the water gradually turns black. State the effect on the observation when the experiment is carried out using water at a lower temperature. (1 mark)

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8. **Figure 5** shows two identical springs arranged side by side and supporting a weight of 50 N.

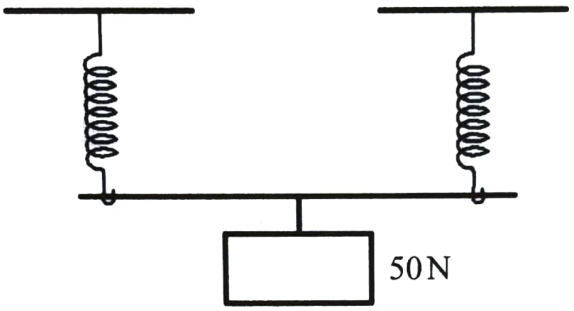

Figure 5

When the same weight is supported by one of the springs above, it produces an extension of 1 cm. Determine the effective spring constant of the arrangement in **Figure 5.** (3 marks)

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9. On the axes provided, sketch a graph of density against temperature between 4 °C and 10 °C. (1 mark)

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10. State the reason why a student climbing a hill tends to bend forward. (1 mark)

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11. **Figure 6** shows a graph of temperature against time for a pure molten substance undergoing cooling.

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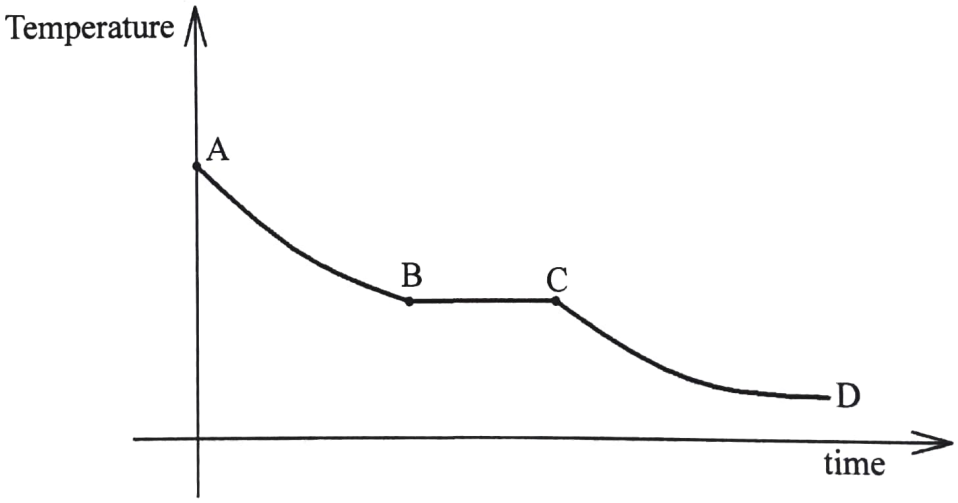

Figure 6

Explain what happens to the substance in region BC. (2 marks)

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12. **Figure 7** shows a uniform rod AB 2 m long and of mass 1 kg. It is pivoted 0.5 m from end A and balanced horizontally by a string attached 0.1 m from end B.

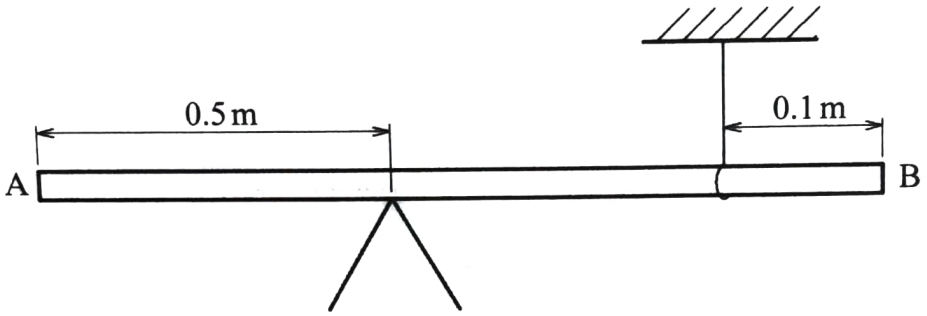

Figure 7

Determine the tension in the string. (*take* $g = 10 Nkg^{-1}$) (2 marks)

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13. **Figure 8** shows two pieces of ice A and B trapped using a wire gauze in a large beaker containing water.

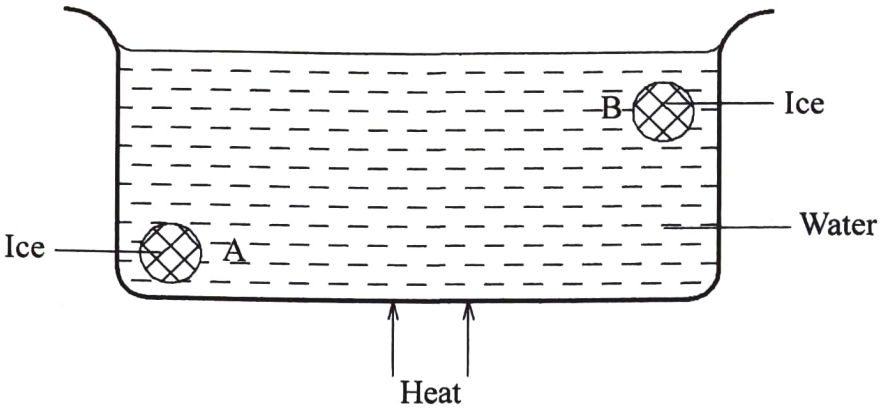

Figure 8

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Heat is supplied at the centre of the base of the beaker as shown. State the reason why B melted earlier than A. (1 mark)

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14. **Figure 9** shows a folded piece of paper. A stream of air is blown underneath the paper.

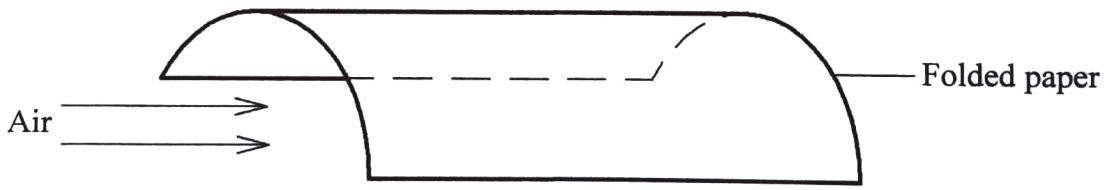

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Figure 9

Explain why the paper collapsed. (2 marks)

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SECTION B (55 marks)

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

15. (a) **Figure 10** shows a wooden block of volume 90 cm^3 floating with $\frac{1}{3}$ of its body submerged in water of density 1 g cm^{-3}. ($g = 10 Nkg^{-1}$)

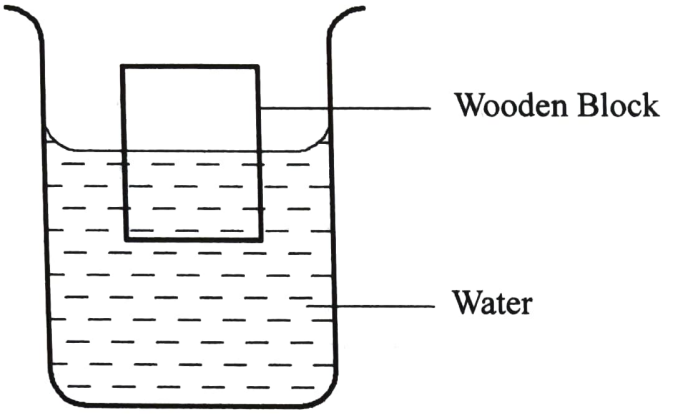

Figure 10

Determine:

(i) the weight of the block. (3 marks)

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(ii) the weight of a metal block that can be placed onto the block so that its top surface is on the same level as the water surface. (3 marks)

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(b) **Figure 11** shows a solid metal suspended in oil using a thread.

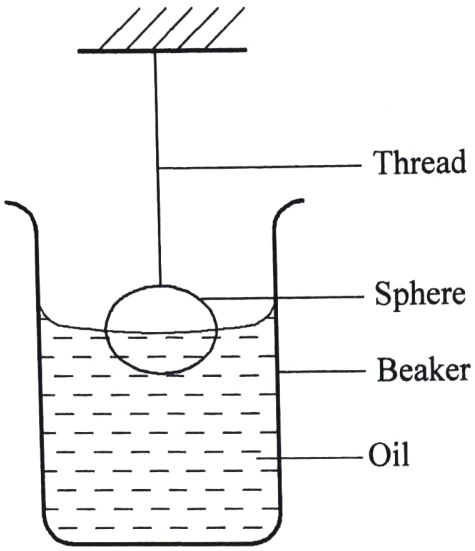

Figure 11

(i) Other than upthrust, list **two** other forces acting on the sphere. (2 marks)

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(ii) The oil is carefully and gradually drawn from the beaker. State the effect on each of the two forces in 15(b)(i). (2 marks)

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16. (a) Define the term "*specific latent heat of fusion.*" (1 mark)

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(b) Ice of mass 5 g at a temperature of –10 °C is immersed into 10.5 g of hot water at 100 °C in a container of negligible heat capacity. All the ice melts and the final temperature of the mixture is 40 °C. Assuming there are no heat losses to the surrounding and taking the specific latent heat of fusion for ice as L_f. ($C_{water} = 4200\ Jkg^{-1}K^{-1}$ *and* $C_{ice} = 2100\ Jkg^{-1}K^{-1}$).

Determine the:

(i) heat lost by the hot water. (3 marks)

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(ii) heat gained by ice from –10 °C to 0 °C. (2 marks)

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(iii) heat required to melt the ice in terms of L_f. (1 mark)

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(iv) heat gained by the melted ice. (2 marks)

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(v) specific latent heat of fusion of ice. (3 marks)

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17. **Figure 12** shows a hydraulic lift system. The radius of the small piston is 5.64 cm while that of the large piston is 14.24 cm. The small piston is operated using a lever. A force of 100 N is applied to the lever.

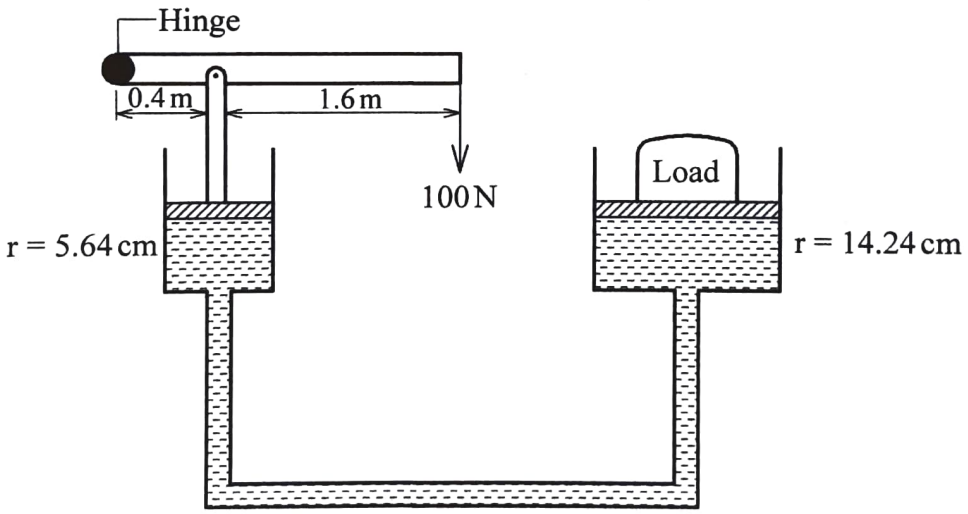

Figure 12

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Determine the:

(a) pressure exerted by the smaller piston. (5 marks)

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(b) load that can be lifted. (3 marks)

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(c) mechanical advantage of the system. (3 marks)

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18. (a) A bus moving initially at a velocity of $20\,ms^{-1}$ decelerates uniformly at $2\,ms^{-2}$.

(i) Determine the time taken for the bus to come to a stop. (3 marks)

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(ii) Sketch the velocity – time graph for the motion of the bus up to the time it stopped. (2 marks)

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(iii) Use the graph to determine the distance moved by the bus before stopping. (1 mark)

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(b) A car of mass 1000 kg travelling at a constant velocity of $40\,ms^{-1}$ collides with a stationary metal block of mass 800 kg. The impact takes 3 seconds before the two move together. Determine the impulsive force. **(4 marks)**

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19. (a) State **two** conditions necessary for a body to be in equilibrium. (2 marks)

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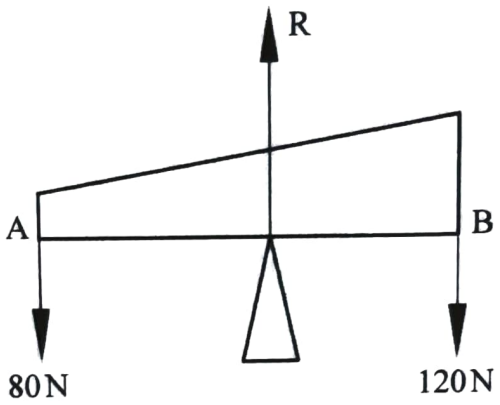
(b) **Figure 13** shows a non-uniform log of wood AB of length 4 m. The log is held horizontally by applying forces of 80 N at end A and 120 N at end B.



Determine:

(i) the value of R. (1 mark)

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(ii) the position of the centre of gravity of the log from end B. (3 marks)

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(c) You are provided with a metre rule, a knife edge and a mass m_1.

(i) Describe how the position of the centre of gravity of the metre rule can be determined using the knife edge. (2 marks)

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(ii) Using the position of the centre of gravity determined in 19(c)(i) and the mass m_1, describe how the mass M of the metre rule can be determined. (4 marks)

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THE KENYA NATIONAL EXAMINATIONS COUNCIL
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232/2 **Paper 2**

PHYSICS – (Theory)

Mar. 2022 – 2 hours

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	Questions	Maximum Score	Candidate's Score
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B	14	10	
	15	12	
	16	9	
	17	13	
	18	11	
	Total Score	80	

SECTION A (25 marks)

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

1. **Figure 1** shows a ray of light incident on a plane mirror.

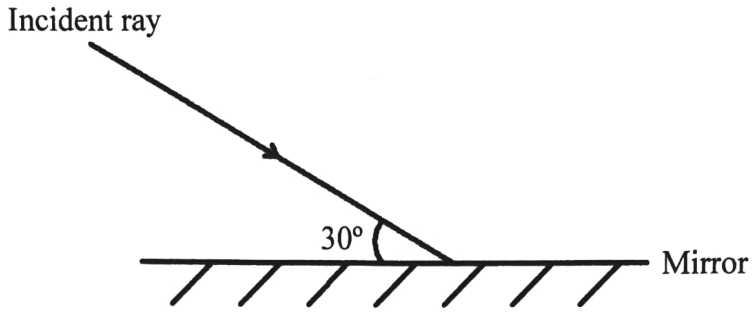

Figure 1

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Complete the diagram to show the path of the reflected ray. (1 mark)

2. **Figure 2a, 2b** and **2c** show the process of charging an electroscope by induction.

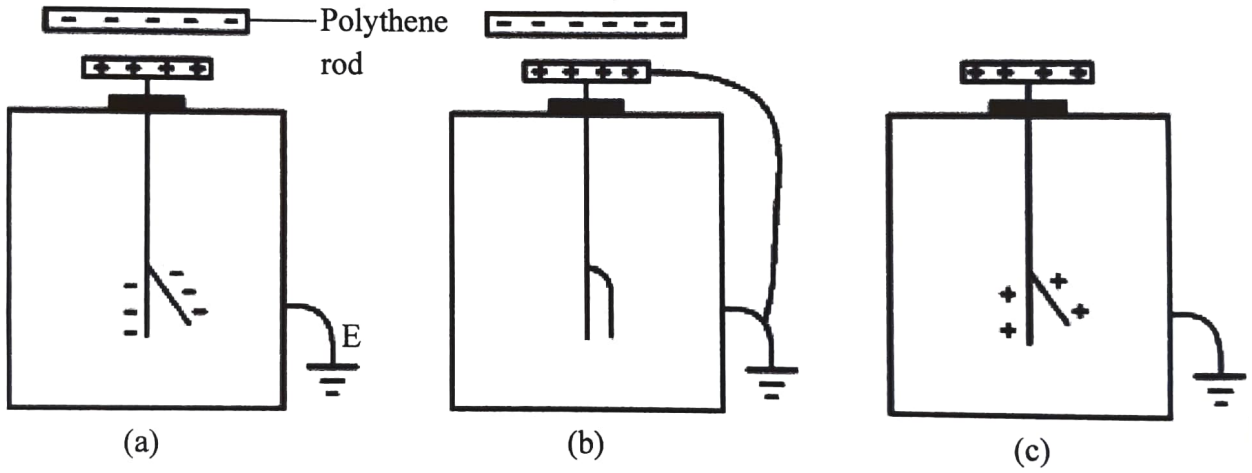

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Figure 2

It is observed that the leaf rises in (a), collapses in (b) and then rises in (c). Explain why the leaf collapses in (b). (3 marks)

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3. State **one** use of capacitors. (1 mark)

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4. **Figure 3** shows a graph of magnetic strength against time for two nails P and Q when magnetised in a solenoid. P and Q are of the same size but are made of different materials.

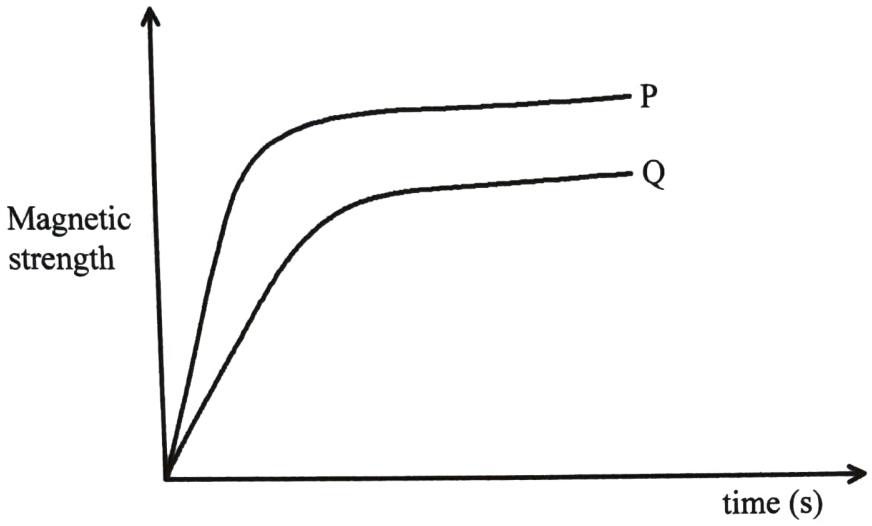

Figure 3

(a) Identify the material that is magnetised faster. (1 mark)

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(b) Use the domain theory to explain the answer in 4(a). (2 marks)

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5. State the meaning of the term *principal focus* of a convex mirror. (1 mark)

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6. **Figure 4** shows a current carrying conductor placed between the poles of two magnets. (*The direction of the current is into the paper*).

Figure 4

Sketch the magnetic field produced between the conductor and the poles of the magnets. (2 marks)

7. **Figure 5** shows two coherent sources of sound A and B in phase. O is a point equidistant from A and B.

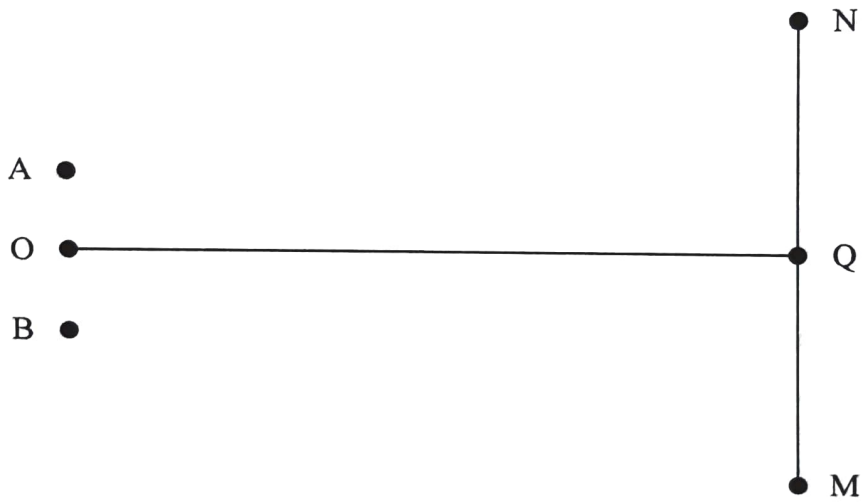

Figure 5

An observer moves from M to N through Q. Explain what is observed at point Q. **(3 marks)**

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8. State **one** factor that affects the speed of sound in water. (1 mark)

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9. **Figure 6** shows a ray of light incident on a prism with a critical angle of 42°.

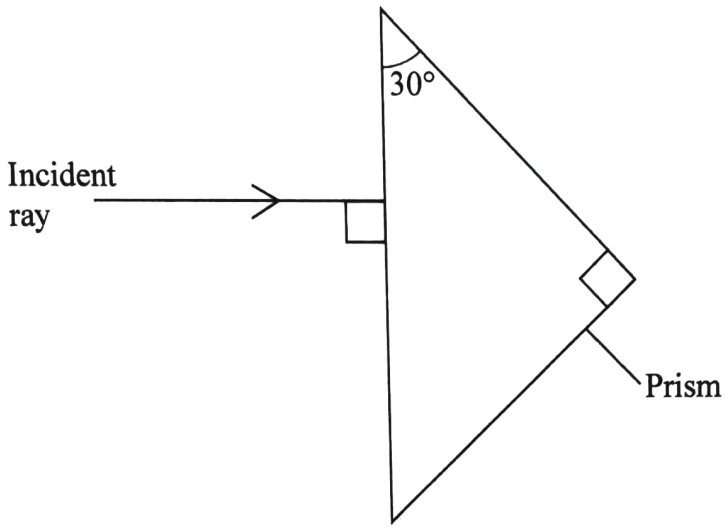

Figure 6

Complete the diagram to show the path of the ray through the prism. (2 marks)

10. It is observed that when the heat current of the cathode ray tube is increased, the intensity of the cathode rays increase. Explain this observation. (2 marks)

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11. A current of 2A flows through a bulb for 2.5 minutes. Determine the quantity of charge that flows through the bulb. (3 marks)

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12. **Figure 7** shows UV light passing through an aperture and incident on the cathode of a photocell.

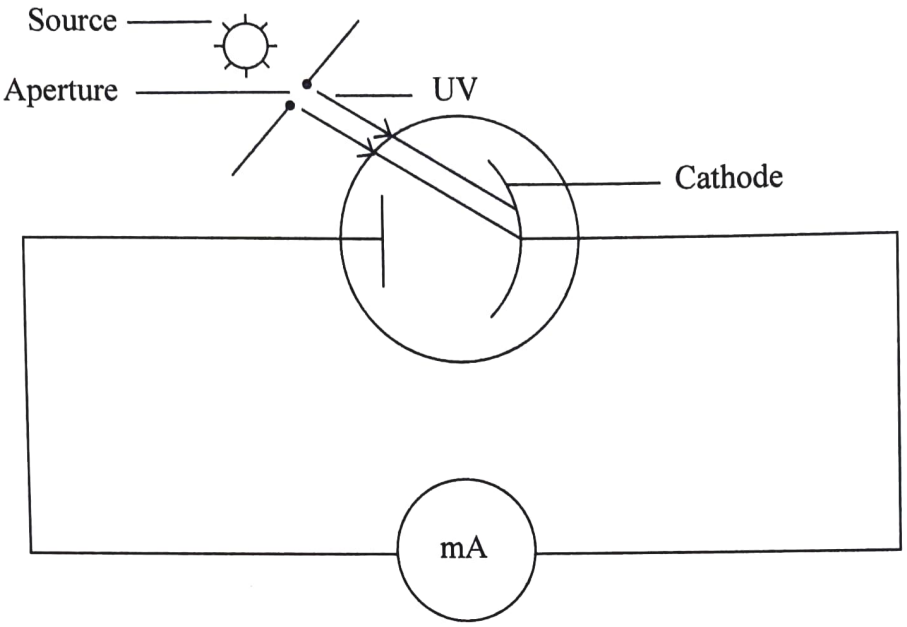

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Figure 7

(a) State what is observed on the milliammeter when the size of the aperture is increased. (1 mark)

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(b) State the reason for the answer in 12(a) (1 mark)

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13. State the property of radio waves that makes them suitable for use in communication. (1 mark)

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SECTION B

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

14. (a) State and explain how increase in temperature affects the conductivity of a semiconductor. (2 marks)

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(b) **Figure 8** shows a graph of potential difference (V) across a bulb against the current (I) through the bulb obtained from an experiment.

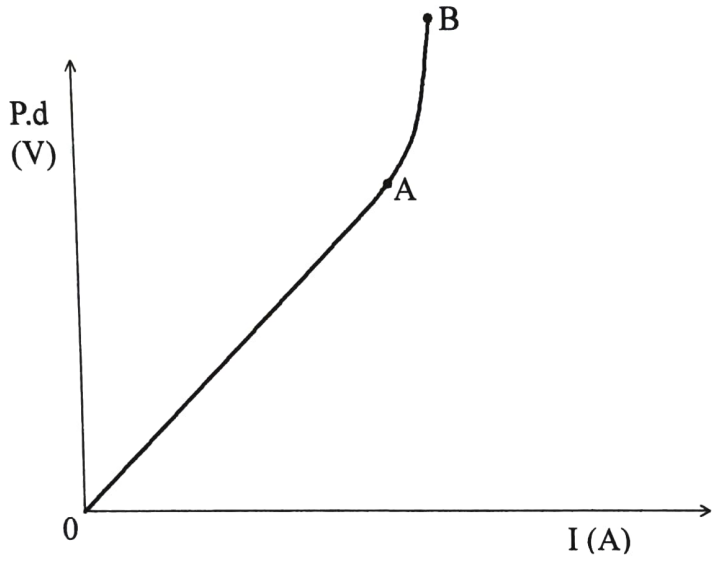

Figure 8

Explain why parts:

(i) OA is straight. (1 mark)

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(ii) AB is curved. (2 marks)

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(c) A circuit consists of 20 identical lamps connected in series to 240 V mains supply. Determine the potential difference across each of the lamps. (2 marks)

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(d) **Figure 9** shows a circuit consisting of two identical lamps and three ammeters A_1, A_2 and A_3 connected to a cell.

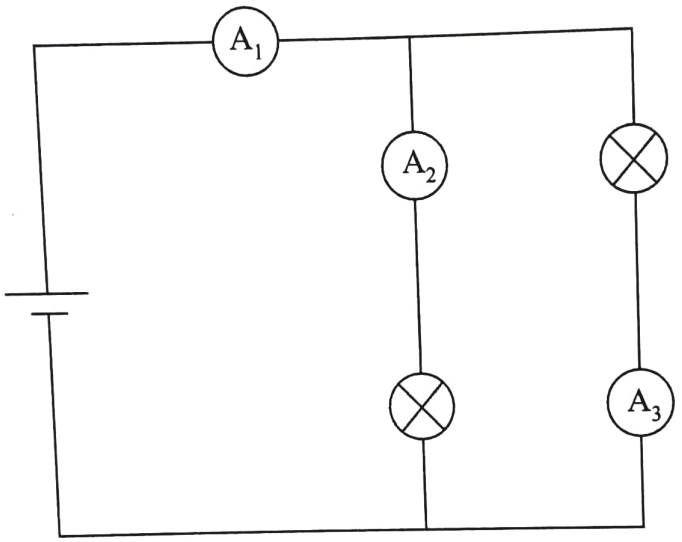

Figure 9

Given that ammeter A_1 reads 0.5 A:

(i) state the reading on Ammeter A_3. (1 mark)

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(ii) explain the answer 14(d)(i). (2 marks)

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15. (a) State the use of the eye piece lens in a compound microscope. (1 mark)

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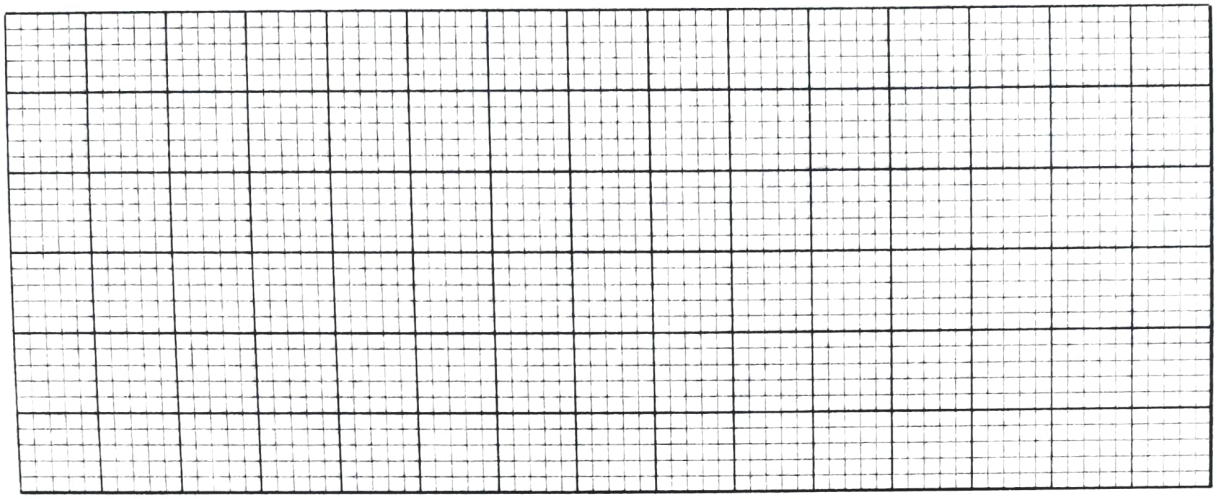
(b) On the grid provided, draw a ray diagram to show how a convex lens forms a magnified real image. (3 marks)



(c) **Figure 10** shows a defect of vision in a human eye.

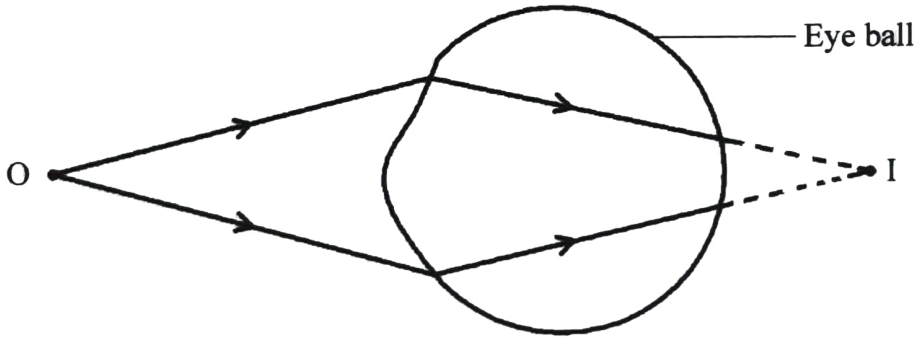


Figure 10

(i) State the type of defect shown. (1 mark)

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(ii) State the type of lens that can be used to correct this defect. (1 mark)

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(iii) On the same figure, draw rays to show how the lens in 15(c)(ii) corrects the defect. (2 marks)

(d) **Figure 11** shows a graph of image distance (V) against the object distance (U) obtained in an experiment to determine the focal length of a concave mirror.

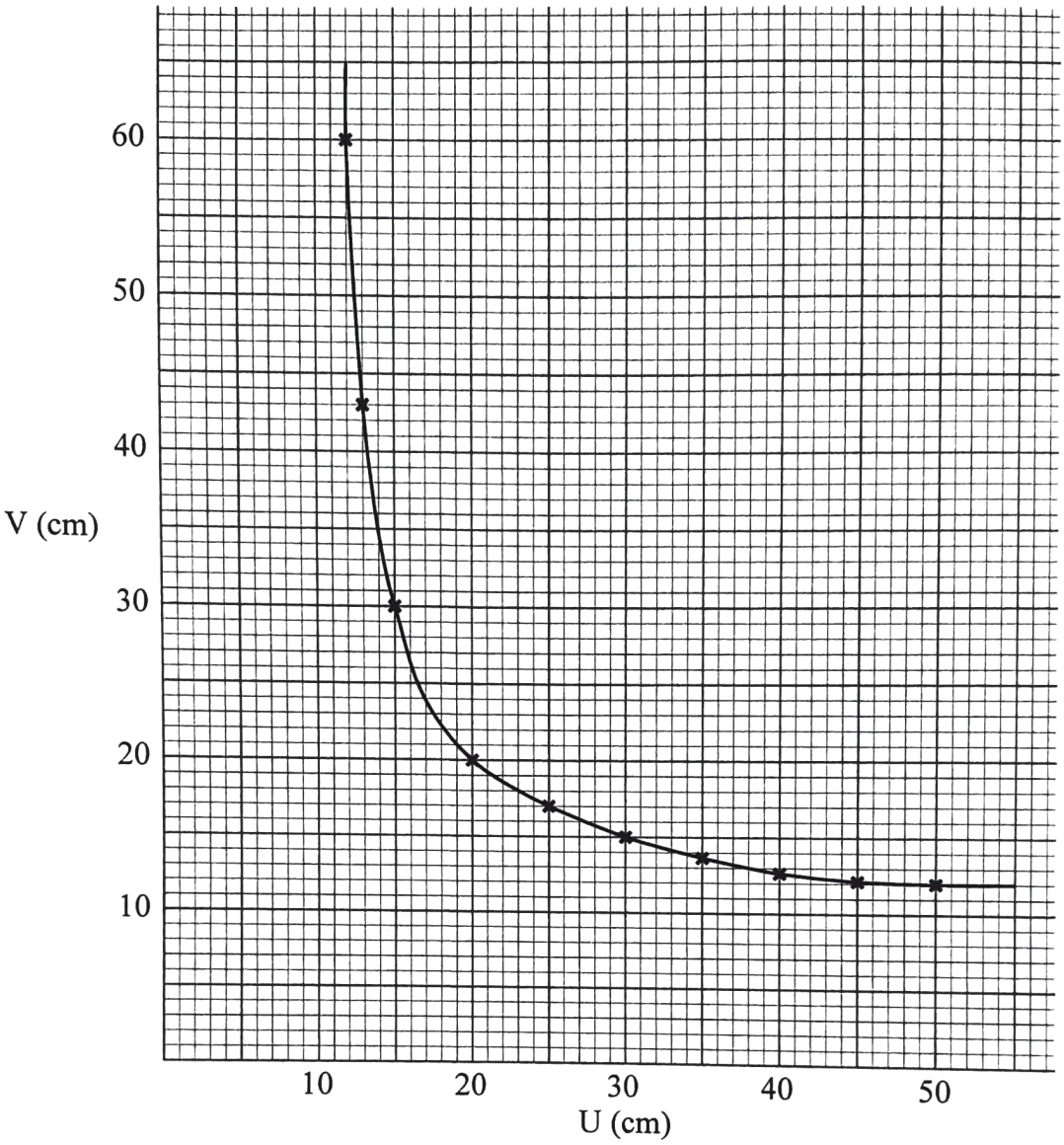

Figure 11

(i) Identify and mark a point X on the graph where V = U. (1 mark)

(ii) Use the point X to determine:

I. the radius of curvature r. (2 marks)

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II. the focal length of the lens f. (1 mark)

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

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(b) **Figure 12** shows a bar magnet being moved towards a solenoid. The solenoid is connected to a galvanometer.

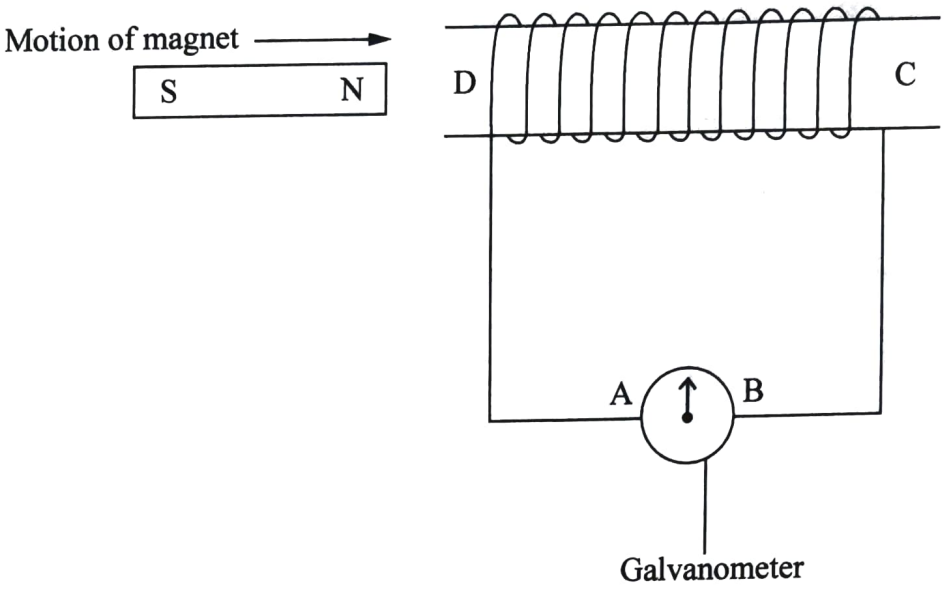

Figure 12

(i) Indicate on the diagram the direction of the induced current in the solenoid. (1 mark)

(ii) Identify the pole induced at D. (1 mark)

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(iii) Explain the answer in 16(b)(ii). (2 marks)

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(iv) Apart from the number of turns in the solenoid, state **two** factors affecting the magnitude of the induced current. (2 marks)

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(c) Explain how laminating the core of a transformer increases its efficiency. (2 marks)

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17. (a) Explain how a fuse protects electrical devices from damage. (2 marks)

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(b) State and explain why the voltage in mains electricity is stepped up before long distance transmission. (3 marks)

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(c) **Figure 13** shows how power can be transmitted from the generating station through transformers P, Q and R to the consumers.

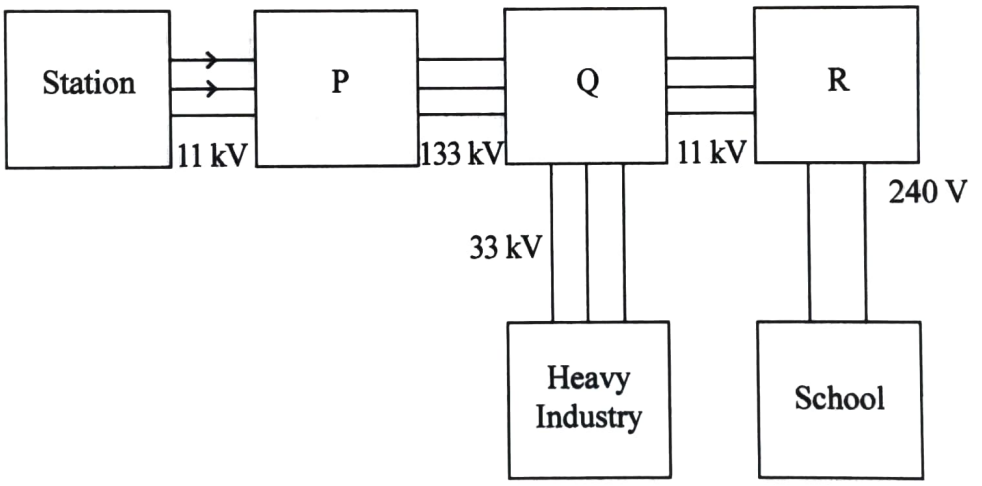

Figure 13

(i) Identify the type of transformer labelled P. (1 mark)

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(ii) Explain how the number of turns in the primary and secondary coils of transformer P affects its output voltage. (3 marks)

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(iii) State the reason why one of the wires from R to the school should be earthed. (1 mark)

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(d) A power station generates 11 kV at a current of 1A. The voltage is stepped up to 160 kV before being transmitted through electric cables. Assuming the transformer is 100% efficient, determine the secondary current. (3 marks)

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18. (a) **Figure 14** shows a cathode ray tube. A metal plate is placed between the anode and the screen.

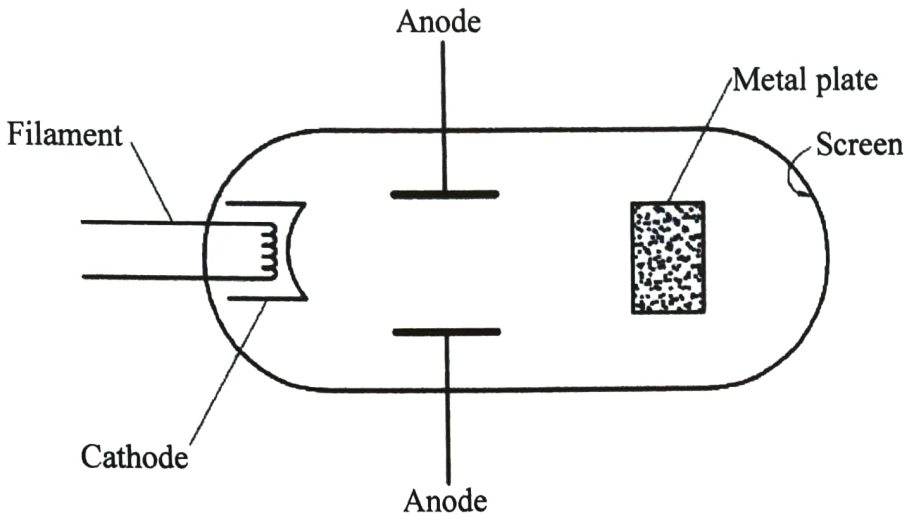

Figure 14

(i) State with a reason what would be observed on the screen when the cathode rays are produced. (2 marks)

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(ii) State the effect on the cathode rays produced when the anode potential is increased. (1 mark)

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(b) Explain how X-rays produce photographs of fractures in bones. (2 marks)

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(c) **Figure 15** shows monochromatic light incident on the cathode of a photo cell connected to a milliammeter (mA) and three cells in series. The anode of the photocell may be connected to points P, Q, R and S through a jockey.

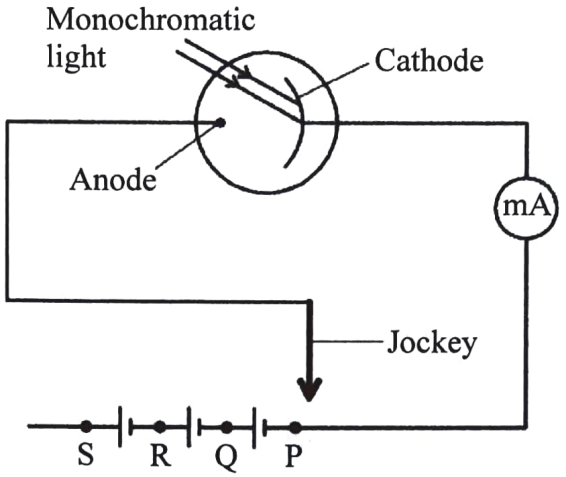

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Figure 15

State what would be observed when the jockey is:

(i) connected to point P. (1 mark)

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(ii) connected to points P to Q to R and then to S. (1 mark)

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(d) Explain the answer in (c)(ii) (2 marks)

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(e) State how radioactivity may be used to detect oil leakage in an underground pipeline. (2 marks)

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