3.4 PHYSICS (232)

The revised KCSE physics syllabus was tested for the seventh time in 2012. It was tested in two theory papers (232/1 and 232/2) and one practical paper (232/3).

3.4.1 GENERAL CANDIDATES PERFORMANCE

The candidate's performance statistics in the KCSE physics examination for the last five years are as shown in the table below.

Table 11: candidates overall performance in the years 2008 to 2012

Year	Paper	Candidature	Maximum score	Mean score	Standard Deviation
2008	1		80	25.32	14.66
	2		80	24.17	16.34
	3		40	23.92	07.31
	overall	**93,692**	**200**	**73.42**	**35.43**
2009	1		80	26.72	16.17
	2		80	20.77	14.23
	3		40	15.22	06.29
	overall	**104,883**	**200**	**62.62**	**34.02**
2010	1		80	26.11	16.95
	2		80	21.82	13.82
	3		40	22.37	07.81
	overall	**109,811**	**200**	**70.22**	**35.73**
2011	1		80	21.64	14.49
	2		80	29.43	16.41
	3		40	22.24	8.84
	overall	**120,074**	**200**	**73.28**	**36.72**
2012	1		80	26.46	13.72
	2		80	31.91	17.00
	3		40	17.40	6.88
	overall	**119,654**	**200**	**75.72**	**34.58**

From the table it can be observed that:

3.4.1.1 The candidature reduced from 120,074 in 2011 to 119,654 in 2012. There was a high drop in number of candidates taking Physics, a decrease of 420 candidates (0.35%).

3.4.1.2 There was improvement in the performance of papers 1 and 2. Paper 1 improved from a mean of 21.64 in the year 2011 to 26.46 in the year 2012 while Paper 2 (232/2) improved from a mean of 29.43 in the year 2011 to 31.91 in the year 2012.

3.4.1.3 Paper 3 (232/3) recorded a decline in performance in the year 2012.

3.4.1.4 There overall performance of physics improved from a mean of 73.28 in 2011 to 75.72 in 2012.

The following is a discussion of the questions in which candidates performed poorly.

3.4.2 Physics Paper 1 (232/1)

Question 8

In verifying the pressure law of gases, the temperature and pressure of a gas are varied at constant volume. State the condition necessary for the law to hold. (1 mark)

Candidates were required to state the condition necessary for the pressure law of gasses to hold.

Weakness

Most students were not able to interpret the pressure law experimental requirement.

Expected response

Mass of gas must be constant; (1 mark)

Question 14 (a)

An aeroplane is moving horizontally through still air at a uniform speed. It is observed that when the speed of the plane is increased, its height above the ground increases.
State the reason for this observation. (1 mark)

Candidates were required to use knowledge effect of increased speed on pressure above the plane given its shape.

Weakness

Students were not able to relate the moving plane to the aerofoil lift.

Expected response

Air above the plane moves faster than air below it (because of it's shape) creating a region of low pressure above the place hence plane experiences a lift; due to the pressure difference. (1 mark)

Question 15

(a) **Figure 6** shows a graph of volume against temperature for a given mass of gas.

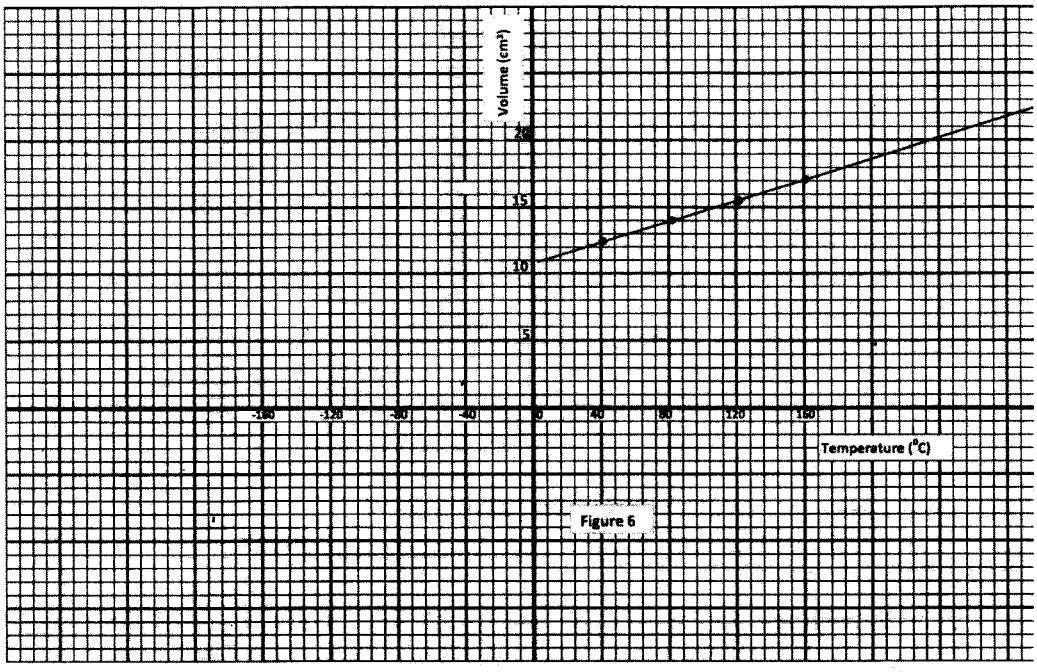


Figure 6

Use the graph to determine the absolute zero temperature in °C. (2 marks)

(b) **Figure 7** shows a horizontal tube containing air trapped by a mercury thread of length 24 cm. The length of the enclosed air column is 15 cm. The atmospheric pressure is 76 cm Hg.

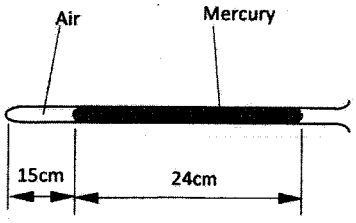


Figure 7

(i) State the pressure of the enclosed air. (1 mark)

(ii) The tube is now held in a vertical position with the open end facing upwards as shown in **Figure 8**.

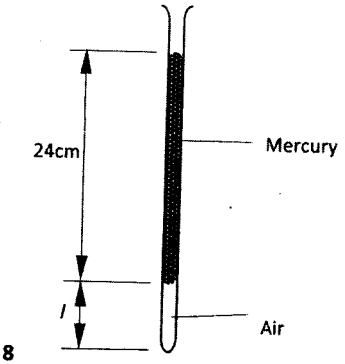


Figure 8

Determine:

(I) The pressure of the enclosed air. (1 mark)

(II) The length (ℓ) of the enclosed air column. (3 marks)

(c) In an experiment to demonstrate atmospheric pressure, a plastic bottle is partially filled with hot water and the bottle is then tightly corked. After some time the bottle starts to get deformed.

(i) State the purpose of the hot water. (1 mark)

(ii) State the reason why the bottle gets deformed. (1 mark)

(iii) Explain your answer in c (ii) (2 marks)

Candidates were required to exhibit general knowledge on atmospheric pressure and the creation of a partial vacuum due to cooling in the crushing can experiment.

Weakness

Some students were not aware of the effect of atmospheric pressure when the tube containing mercury is vertical/ horizontal.

Students were unable to relate the crushing bottle to the partial vacuum resulting from the cooling hot water in the plastic bottle. The explanation from candidates lacked the relevant physics phenomenon.

Expected response

(i) To expel air; (1 mark)

(ii) Pressure of air outside the bottle is greater than the pressure of air inside; (1 mark)

(iii) Cooling causes condensation of vapour;
Creating a partial vacuum; (2 marks)

Question 19

(a) **Figure 14** shows a lift pump.

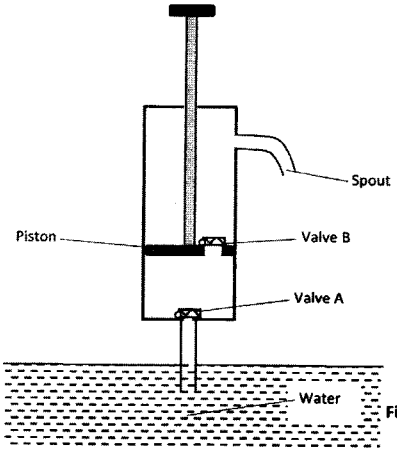


Figure 14

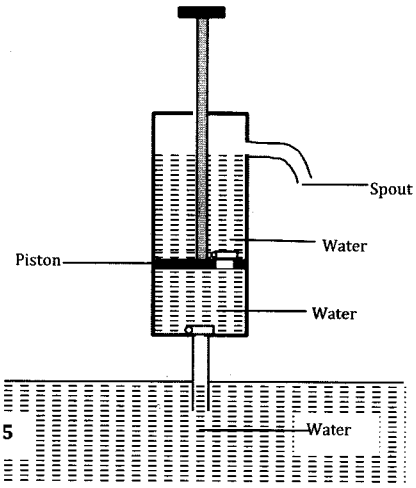


Figure 15 5

State how water is removed from the cylinder through the spout. (1 mark)

(c) A lift pump can lift water to a maximum height of 10 m. Determine the maximum height to which the pump can raise paraffin.
(take density of paraffin as 800 kgm^{-3} and density of water as 1000 kgm^{-3}). (3 marks)

(d) State **one** factor that determines the height to which a force pump can lift water. (1 mark)

Candidates were required to explain the effect on the valves of lifting the piston up or down and determine the maximum height to which a lift pump can lift paraffin.

Weakness

Though students had knowledge of the forces in play, they were unable to relate the forces to the rising levels of the liquid.

Expected response

(a) **(i)** Valve B rests under its own weight;
- pressure in the cylinder decreases and water rises into the cylinder pushing the valve open; (2 marks)

(ii) Valve A rests under its own weight and the weight of the water; high pressure is created in the region between valve A and valve B forcing valve B to open; (1 mark)

(b) The water is lifted up by the piston ad comes out through the spout; (1 mark)

(c) $P_w g h_w = P_p g h_p$;

$h_p = \frac{1000 \times 10}{800}$;

=12.5m; (3 marks)

(d)
- Force applied on piston (during downstroke);
- Ability of the parts of the pump to withstand the pressure of the liquid column;(2 marks)

3.4.3 Physics Paper 2 (232/2)

Question 1

Figure 1, shows a plane mirror XY placed equidistant from two parallel lines AB and PT.

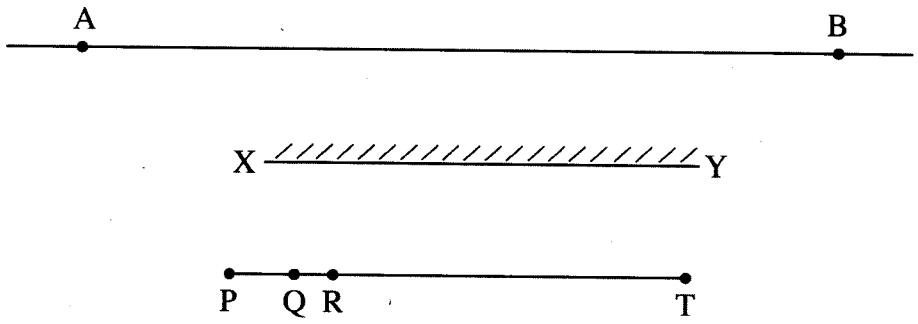


Figure 1

Four students stand at P, Q, R and T infront of the mirror

(a) Indicate the positions of the images of students at Q, R and T on line AB. (1 mark)

(b) State which of the images are visible to the student standing at P. (1 mark)

(c) Using rays indicate on the figure, how (b) above is possible. (1 mark)

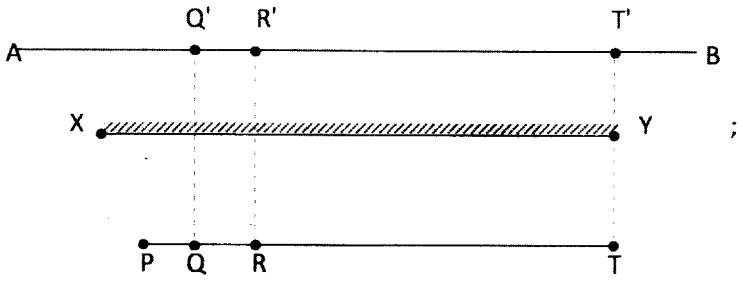
Candidates were required to indicate the positions of images in a plane mirror, state which one of the images was visible from a certain point and draw ray diagrams to illustrate their response.

Weakness

Many students were unable to state which of the images were visible to the student at P and draw rays to illustrate how that was possible. This showed lack of knowledge on locating images by use of ray diagrams in plane mirrors.

Expected response

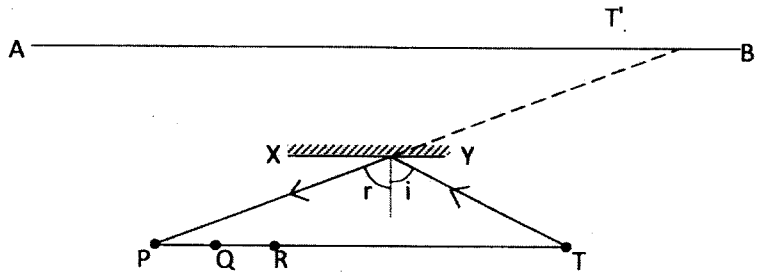
(a)



(1 mark)

(b) T and R; (1 mark)

(c)



- Reflected ray from T and R moves towards P; (1 mark)

Question 7

Figure 7, shows two similar coils P and Q around the end L and M of a piece of soft iron. A steady current passes through the coils.

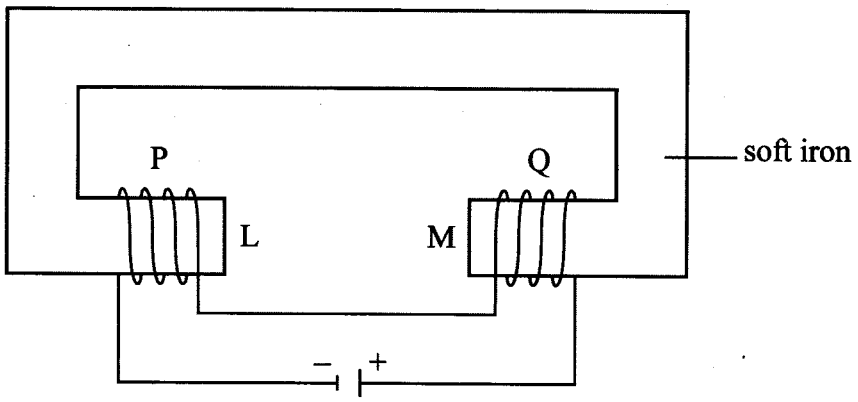


Figure 7

State the polarity of the resulting magnet at end L. (1 mark)

Candidates were required to state the resulting polarity for a magnetic material magnetized electrically.

Weakness

A good number of students confused magnetism for electrostatics.

Expected response

L - south pole; (1 mark)

Question14

(a) **Figure 12**, shows a displacement - time graph for a progressive wave.

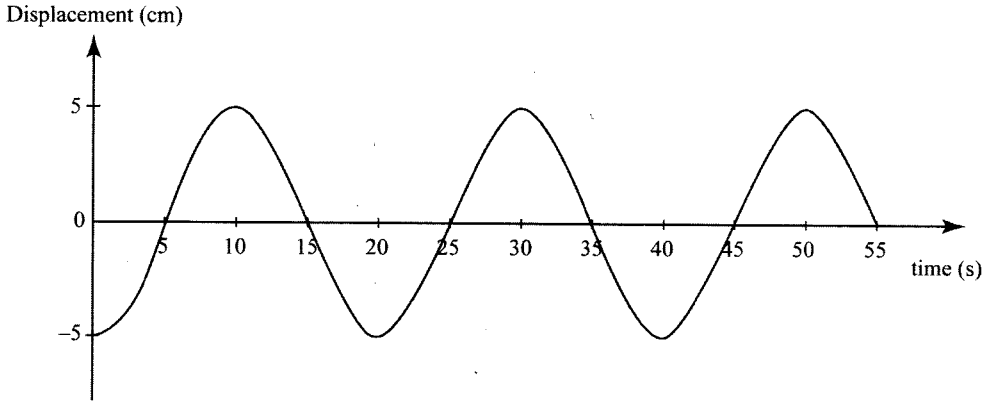


Figure 12

(i) state the amplitude of the wave. (1 mark)

(ii) determine the frequency of the wave. (4 marks)

(iii) given that the velocity of the wave is $20ms^{-1}$, determine its wavelength. (3 marks)

(b) **Figure 13** shows two identical dippers A and B vibrating in water in phase with each other. The dippers have the same constant frequency and amplitude. The waves produced are observed along line MN:

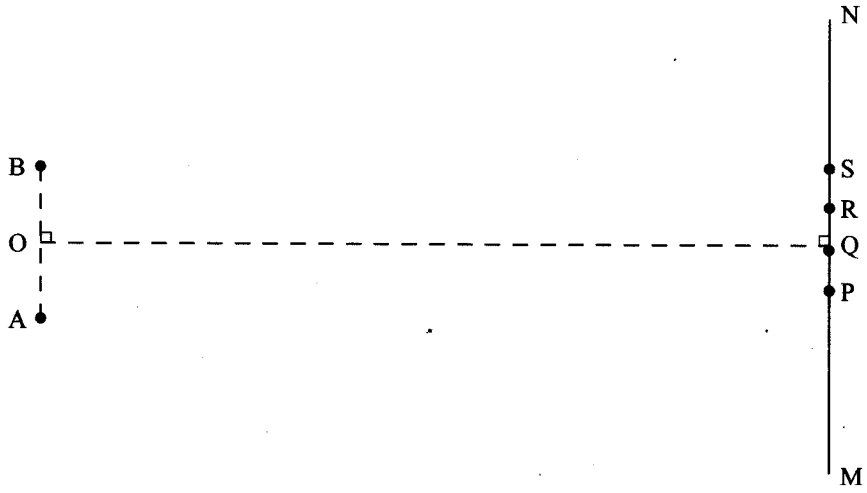


Figure 13

It is observed that the amplitudes are maximum at points Q and S, and minimum at points P and R.

(i) explain why the amplitude is maximum at Q. (2 marks)

(ii) state why the amplitude is minimum at R. (1 mark)

(iii) State what would happen if the two dippers had different frequencies. (1 mark)

Candidates were required to exhibit knowledge on progressive waves.

Weakness

Most candidates were able to calculate numerical problems successfully. However a majority were not able to explain the observations in section b of the question.

Expected response

(a) (i) amplitude = 5 cm√ (1 mark)

(ii) $T = 20s\surd$

$f = \frac{1}{T}\surd$

$f = \frac{1}{20} = 0.05\ H_2\surd$ (4 marks)

(iii) $V = \lambda f\surd$

$\lambda = \frac{20}{0.05}\surd$

$= 400\ m\surd$ (3 marks)

(b) (i) Waves at Q are in phase √ so there is constructive interference. √ (2 marks)

(ii) Waves are out of phase hence destructive interference. √ (1 mark)

(iii) Interference pattern would disappear. √ (1 mark)

3.4.4 Physics Paper 3 (232/3)

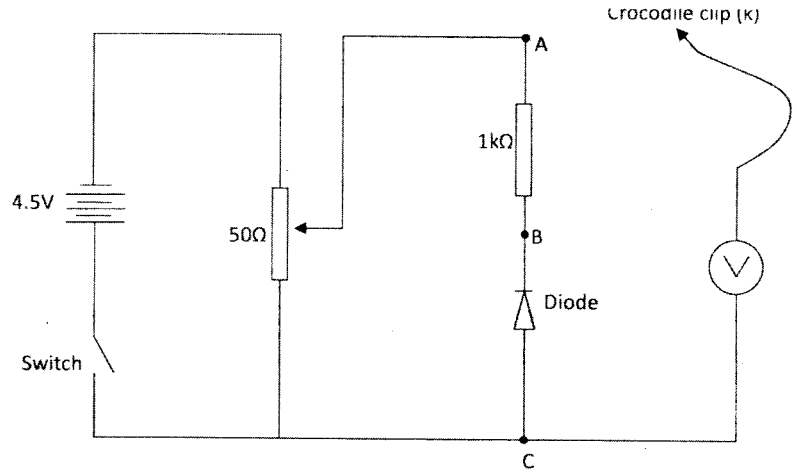
Question2

You are provided with the following:

- a voltmeter
- a diode with ends labelled B and C
- a 1 kΩ resistor
- a 50 Ω potentiometer
- 3 dry cells and a cell holder
- a switch
- 8 connecting wires (at least 4 with crocodile clips)

Proceed as follows:

(a) Set up the circuit as shown in **figure 3**.



(b) (i) Connect the crocodile clip K to point A. Adjust the potentiometer by turning the knob until the voltmeter reading is maximum.

Maximum voltmeter reading = ... volts. (1 mark)

(ii) Without adjusting the potentiometer, disconnect the crocodile clip K from point A and connect it to point B. Record the voltmeter reading.

Voltmeter reading = ... volts. (1 mark)

(iii) Explain why the voltmeter reading in b(i) is different from that in b(ii). (2 marks)

(c) Disconnect the crocodile clip K from point B and connect it to point A. Adjust the potentiometer so that the voltmeter reading V_A is 1.0 V. Disconnect the crocodile clip K from A

and connect it to point B. Record the voltmeter reading V_B.

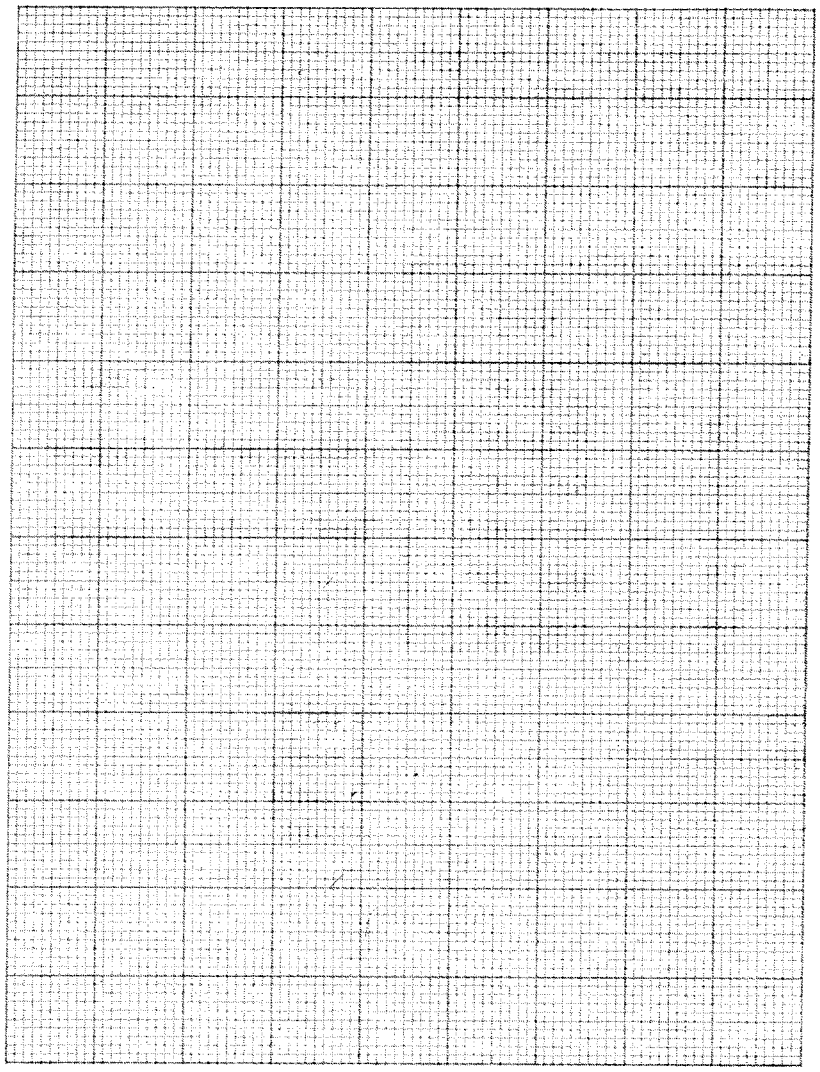
V_B = ... volts. (1 mark)

(d) By adjusting the potentiometer to obtain other values of V_A(when K is at A) shown in **table 2**, repeat the procedure in (c) to obtain the corresponding values of V_B(when K is at B) and complete the table. (7 marks)

Table 2

V_A (V)	V_B (V)	$I = \left(\frac{V_A - V_B}{1000}\right)$(A)
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

(e) On the grid provided, plot a graph of I (y-axis) against V_B. (5 marks)



(f) Use the graph to determine the resistance of the diode when the current is 0.45 mA.

(3 marks)

Candidates were required to set up the apparatus as per the diagram and follow the instructions (a - f). Candidates were required to connect a diode in a circuit such that it was forward biased as per the circuit diagram, vary the voltage across the resistor by adjusting the potentiometer and recording the corresponding voltage across the diode.

Weakness

Students were unable to:

- to connect the diode in forward bias mode,
- to draw the graphs resulting from their results,
- use the graph to determine the resistance of the diode.

Expected response

(b) (i) Maximum Voltmeter reading = 4.4 Volts (1 mark)

(ii) Voltmeter reading V_B = 3.7 Volts (1 mark)

(iii) In (i) p.d. measured is across both. (1 mark)
diode and resistor, while in (ii) p.d. is across diode only. (1 marks)

(c) V_B = 0.8 Volts. (1 mark)

(d)

V_A/V	V_B/V	$I = \frac{V_A - V_B}{1000}$ A
1.5	1.2	0.3×10^{-3}
2.0	1.7	0.3×10^{-3}
2.5	2.1	0.4×10^{-3}
3.0	2.5	0.5×10^{-3}
3.5	2.9	0.6×10^{-3}
4.0	3.4	0.6×10^{-3}

Column I = 1 mark

Values of V_B = 5 marks

Total for table = 6 marks

(e) Axes labelled 1 mark
Scale (simple & uniform) 1 mark
Plotting 3 marks
Curve (line) 1 mark

(5 marks)

(f) $I = 0.45\text{mA}$, $V_B = 2.3$ volts

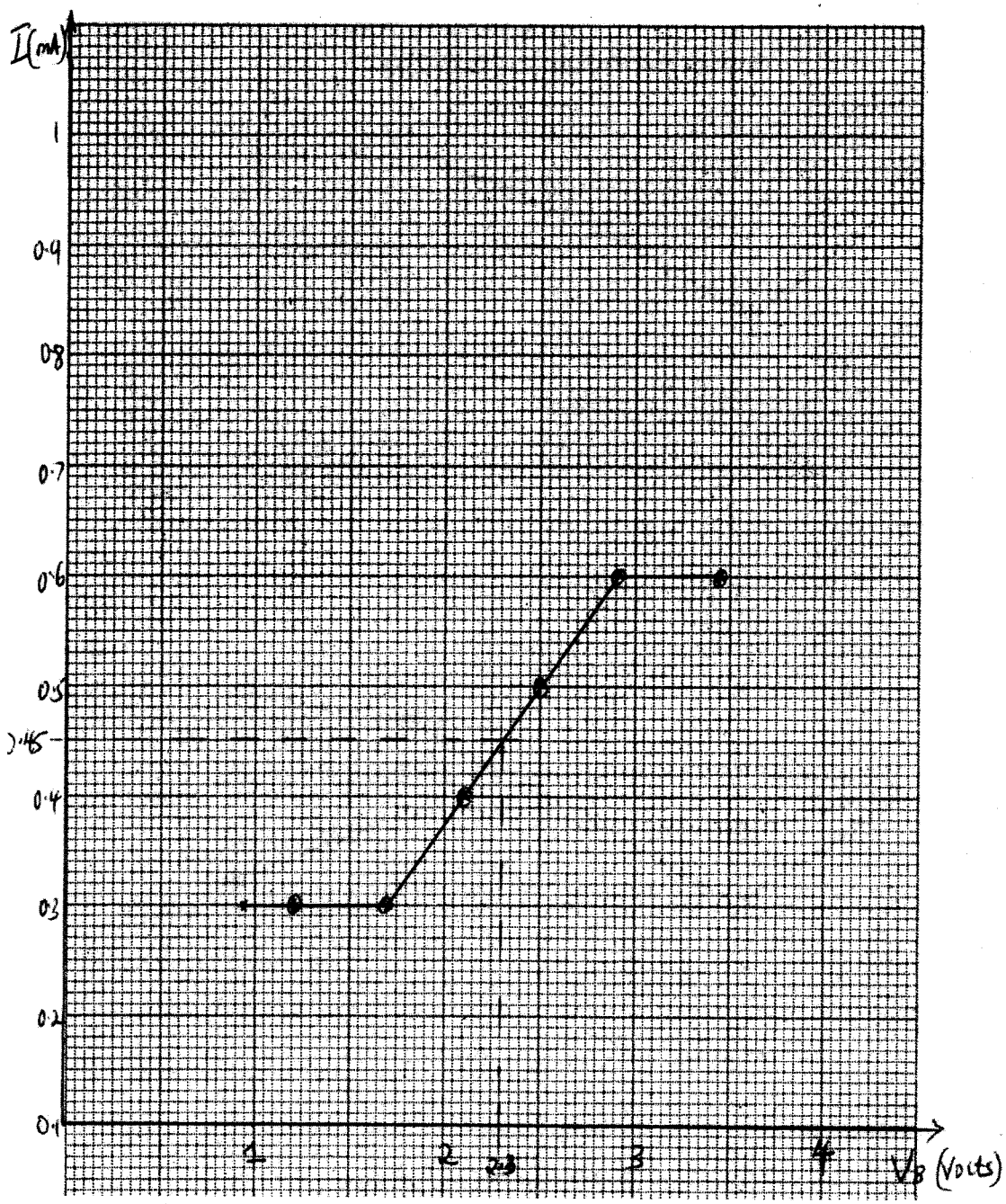
$$\therefore R = \frac{V_B}{1} = \frac{2.3}{0.45 \times 10^{-3}}$$

$$= 5.1 \times 10^3$$

$$= 5.1\,\text{k}\Omega$$

(3 marks)

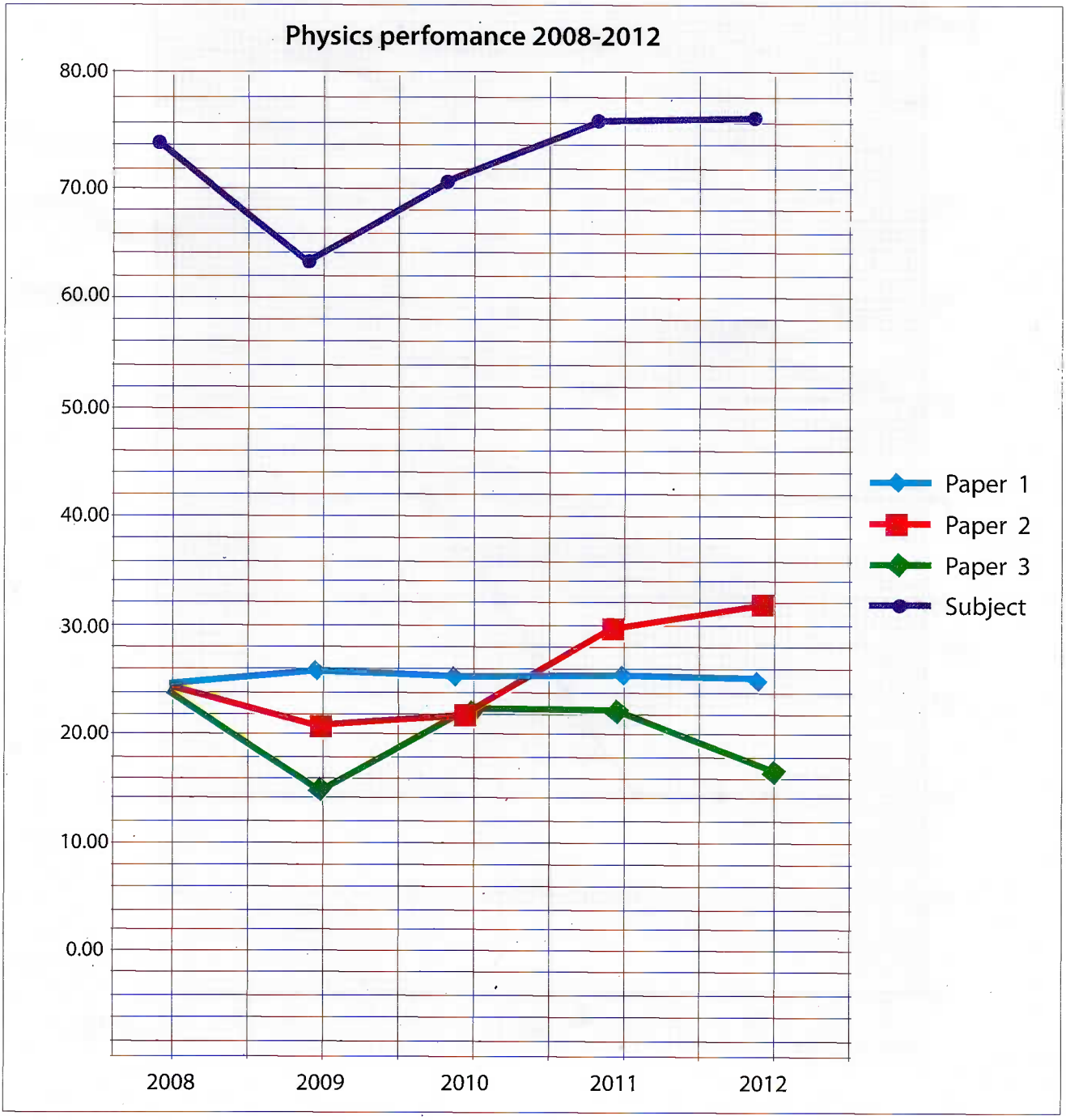
GRAPH 2



ADVICE TO TEACHERS.

- Learners should be guided on proper use of formulae and language when responding to questions to show clearly their knowledge on certain concept and skills.
- Graphical analysis should be included in the teaching of physics.
- Candidates must be advised to follow instructions in the practical paper and use the recorded data appropriately.
- During teaching learners must be made to relate the concepts to real life experiences.

The graph below shows clearly the performance trends in physics since 2008.



4.3 PHYSICS (232)

4.3.1 Physics Paper 1 (232/1)

SECTION A (25 marks)

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

1 **Figure 1** shows a measuring cylinder containing some water.

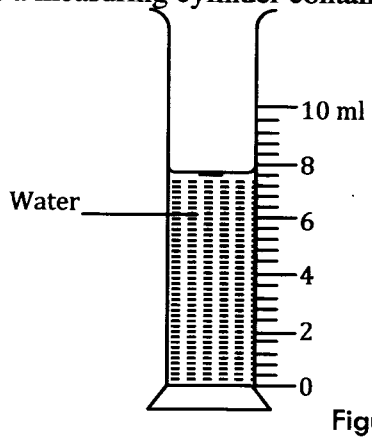


Figure 1

Determine the reading on the measuring cylinder, after three drops of water each of volume 0.6 cm^3 are added. (2 marks)

2 A student pulls a block of wood along a horizontal surface by applying a constant force. State the reason why the block moves at a constant velocity. (1 mark)

3 A solid weighs 16.5 N on the surface of the moon. The force of gravity on the moon is 1.7 Nkg^{-1}. Determine the mass of the solid. (3 marks)

4 A bottle containing a smelling gas is opened at the front bench of a classroom. State the reason why the gas is detected throughout the room. (1 mark)

5 **Figure 2** shows a flat bottomed flask containing some water. It is heated directly with a very hot flame.

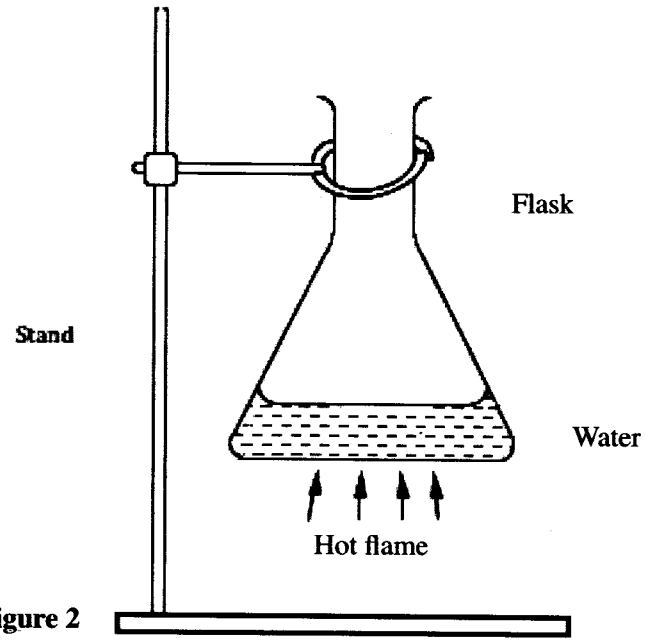


Figure 2

Explain why the flask is likely to crack. (2 marks)

6 State **two** environmental hazards that may occur when oil spills over a large surface area of the sea. (2 marks)

7 A balloon is filled with a gas which is lighter than air. It is observed to rise in air upto a certain height. State a reason why the balloon stops rising. (1 mark)

8 In verifying the pressure law of gases, the temperature and pressure of a gas are varied at constant volume. State the condition necessary for the law to hold. (1 mark)

9 State the reason why a steel sphere resting on a horizontal surface is said to be in neutral equilibrium. (1 mark)

10 **Table 1** shows the results of an experiment carried out to study the properties of a spring.

Table 1

Force (N)	0	10	20	30	40
Extension (cm)	0	2	4	6	8

State with a reason whether the experiment was done within the elastic limit of the spring. (2 marks)

11 **Figure 3** shows a graph of velocity against time for a moving body.

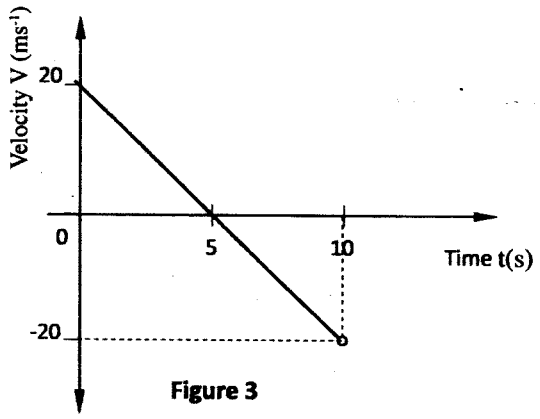


Figure 3

Describe the motion of the body during the 10 seconds. (2 marks)

12 State **two** reasons why the efficiency of a pulley system is always less than 100%. (2 marks)

13 **Figure 4** shows a graph of temperature against time when pure melting ice at 0° C is heated uniformly.

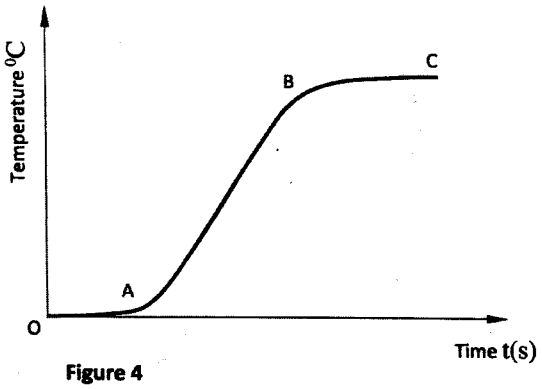


Figure 4

Explain what happens between parts:

(i) OA: .....
(ii) AB: .....

14 (a) An aeroplane is moving horizontally through still air at a uniform speed. It is observed that when the speed of the plane is increased, its height above the ground increases. State the reason for this observation. (1 mark)

(b) **Figure 5** shows parts A, B and C of a glass tube.

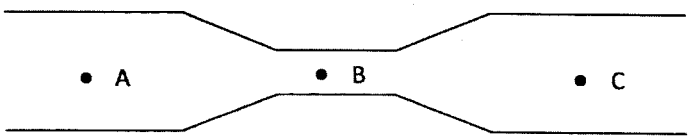


Figure 5

State with a reason the part of the tube in which the pressure will be lowest when air is blown through the tube from A towards C. (2 marks)

SECTION B: (55 marks)

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

15 (a) **Figure 6** shows a graph of volume against temperature for a given mass of gas.

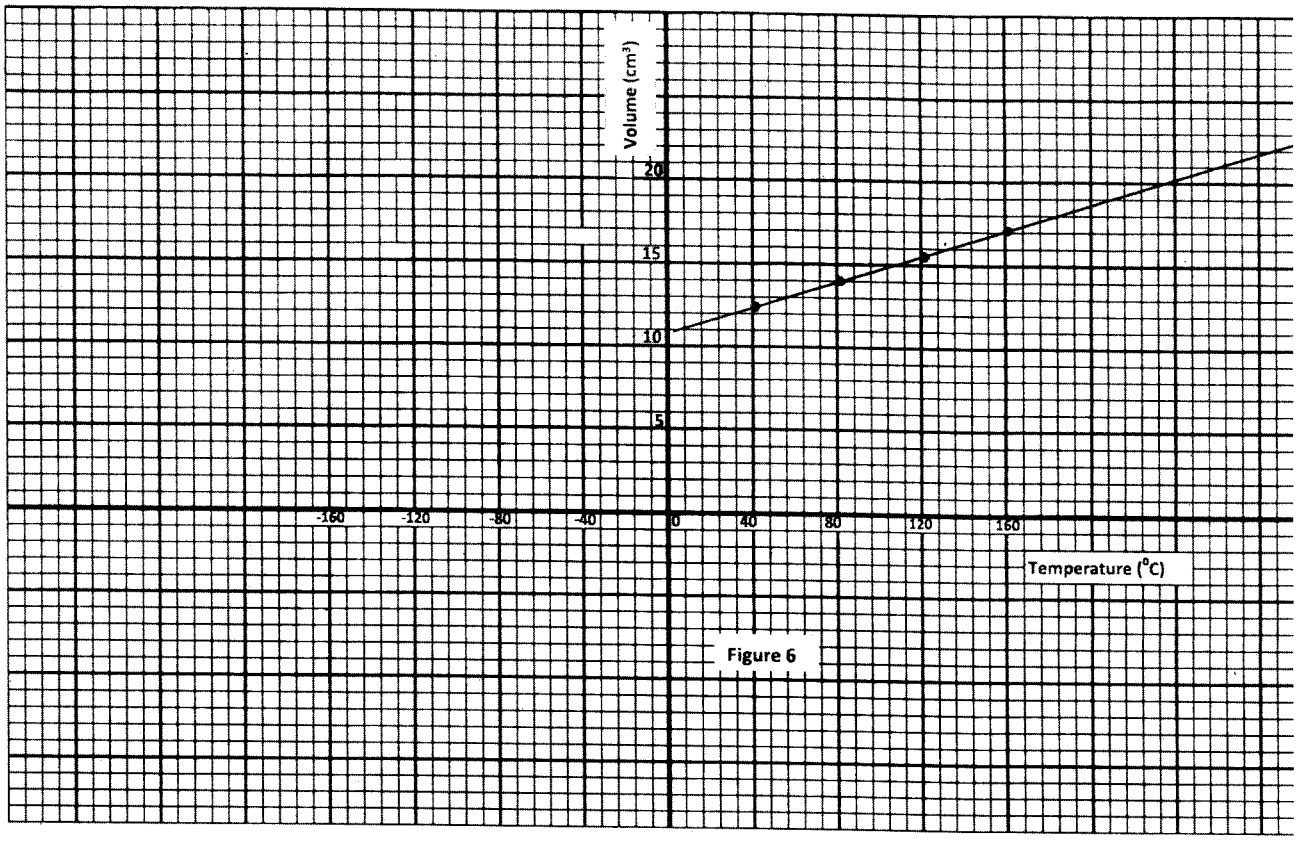


Figure 6

Use the graph to determine the absolute zero temperature in °C. (2 marks)

(b) **Figure 7** shows a horizontal tube containing air trapped by a mercury thread of length 24 cm. The length of the enclosed air column is 15 cm. The atmospheric pressure is 76 cm Hg.

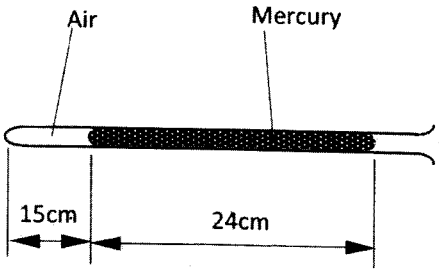


Figure 7

(i) State the pressure of the enclosed air. (1 mark)

(ii) The tube is now held in a vertical position with the open end facing upwards as shown in **Figure 8**.

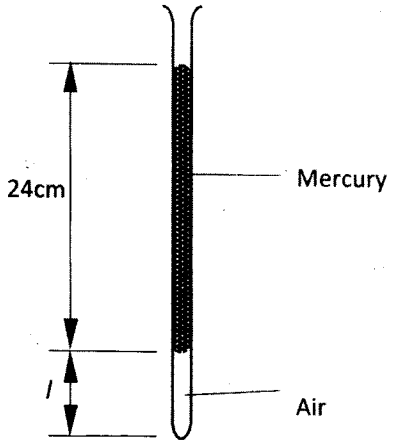


Figure 8

Determine:

(I) The pressure of the enclosed air. (1 mark)

(II) The length (ℓ) of the enclosed air column. (3 marks)

(c) In an experiment to demonstrate atmospheric pressure, a plastic bottle is partially filled with hot water and the bottle is then tightly corked. After some time the bottle starts to get deformed.

(i) State the purpose of the hot water. (1 mark)

(ii) State the reason why the bottle gets deformed. (1 mark)

(iii) Explain your answer in c (ii) (2 marks)

16 (a) **Figure 9** shows a trolley on a smooth surface being pulled by a constant force F.

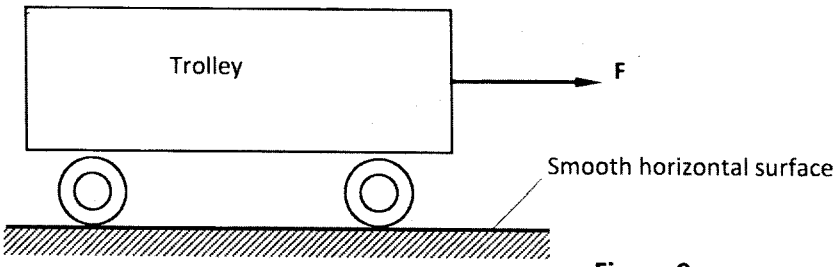
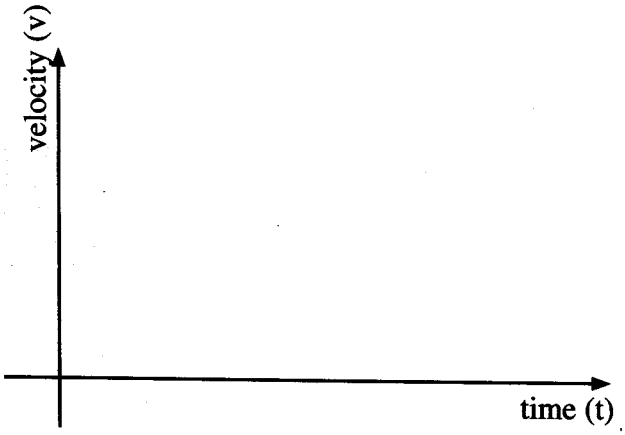


Figure 9

(i) On the axis provided, sketch the velocity-time graph for the motion of the trolley. (2 marks)



(ii) A parachute falling through the air attains terminal velocity after a short-time. State the reason why it attains terminal velocity. (1 mark)

(b) A ball of mass 200 g is thrown vertically upwards with velocity of 5 ms^{-1}. The air resistance is 0.4 N.

Determine;

(i) the net force on the ball as it moves up;

(take acceleration due to gravity g = 10 ms^{-2}) (2 marks)

(ii) the acceleration of the ball; (3 marks)

(iii) the maximum height reached by the ball. (3 marks)

(c) **Figure 10** shows the path of an object of mass m attached to a string of length r when whirled in a vertical circle at a constant speed V. A is the highest point on its path.

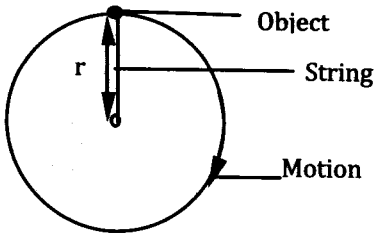


Figure 10

(i) State the forces that provide the centripetal force on the object when it is at point A. (2 marks)

(ii) Indicate with an arrow on the diagram the direction of the net force F acting on the object when it is at A. (1 mark)

17 (a) **Figure 11** shows how an underground room was ventilated. It had two vents, one at A and the other at B. A fire was lit at point C.

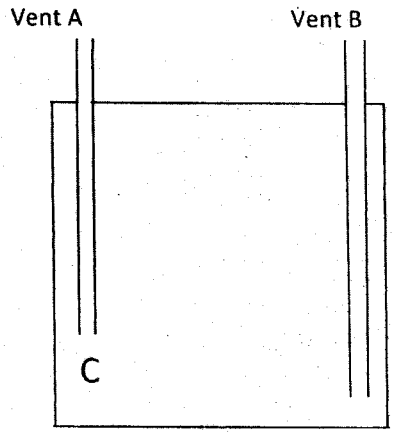
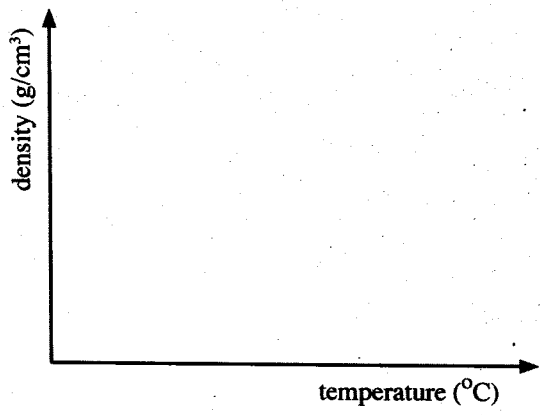


Figure 11

Explain what happened to the ventilation when the fire was lit. (3 marks)

(b) Explain how a vaccum flask minimizes loss of heat through radiation. (1 mark)

(c) In an experiment to investigate the unusual expansion of water, a fixed mass of water at 0 °C was heated until its temperature reached 20 °C. On the axis provided, sketch a graph of density against temperature of the water from 0 °C to 20 °C. (2 marks)



(d) An immersion heater rated 2.5 kW is immersed into a plastic jug containing 2 kg of water and switched on for 4 minutes. Determine;

(i) the quantity of heat gained by the water; (2 marks)

(ii) the temperature change for the water; (3 marks)
(take specific heat capacity of water as 4.2 x 10^3 $Jkg^{-1}K^{-1}$).

18 (a) **Figure 12** shows a set up used to determine the mass of a solid S. The rod is pivoted at its centre of gravity C.

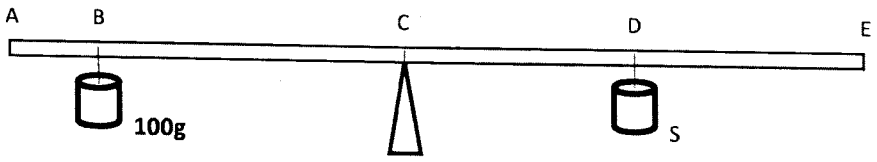


Figure 12

(i) State **two** measurements that need to be made to determine the mass of solid S. (1 mark)

(ii) Write an expression to show how the measurements in (i) above are used to obtain the mass of S. (2 marks)

(b) **Figure 13** shows a log of wood of mass 20 kg submerged in water in a pond and held in position by a string fixed to the bottom of the pond.

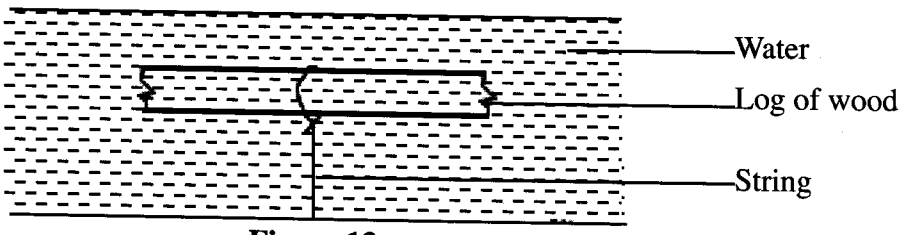


Figure 13

Given that the density of water is 1000 kgm^{-3} and that of wood is 800 kgm^{-3}, determine the;

(i) Volume of the log. (3 marks)

(ii) Upthrust on the log. (2 marks)

(iii) Tension in the string. (2 marks)

19 (a) **Figure 14** shows a lift pump.

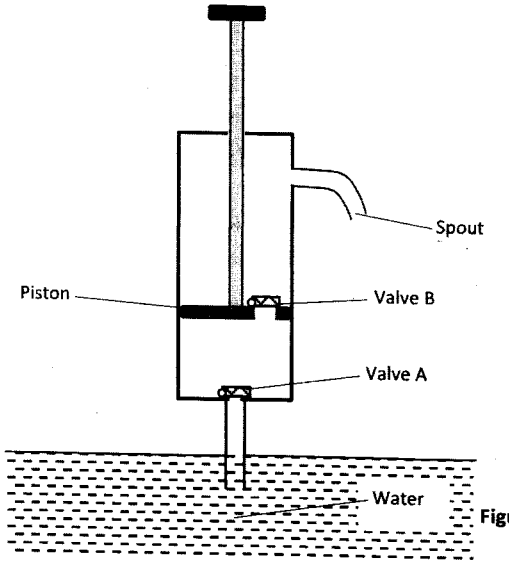


Figure 14

Explain why, when the piston is:

(i) pulled upwards, valve A opens while valve B closes. (2 marks)

(ii) pushed downwards, valve A closes while valve B opens. (2 marks)

(b) After several strokes, water rises above the piston as shown in **Figure 15**.

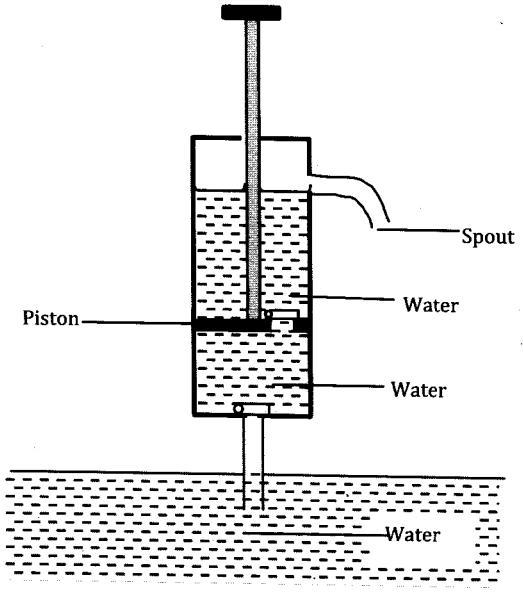


Figure 15

State how water is removed from the cylinder through the spout. (1 mark)

(c) A lift pump can lift water to a maximum height of 10 m. Determine the maximum height to which the pump can raise paraffin.
(take density of paraffin as 800 kgm^{-3} and density of water as 1000 kgm^{-3}). (3 marks)

(d) State **one** factor that determines the height to which a force pump can lift water.
(1 mark)

SECTION A (25 marks)

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

1 **Figure 1**, shows a plane mirror XY placed equidistant from two parallel lines AB and PT.

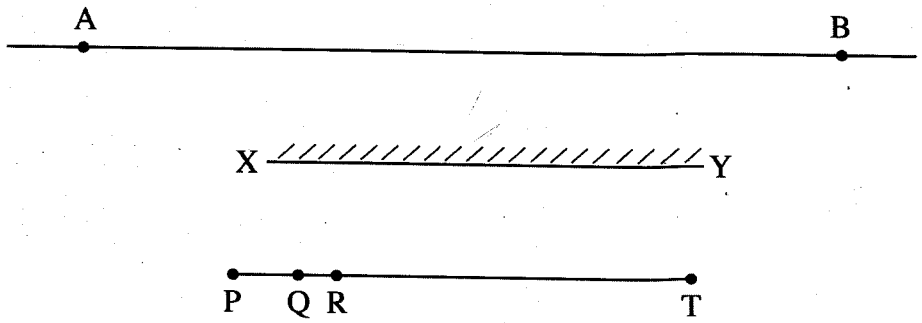


Figure 1

Four students stand at P, Q, R and T infront of the mirror

(a) Indicate the positions of the images of students at Q, R and T on line AB. (1 mark)

(b) State which of the images are visible to the student standing at P. (1 mark)

(c) Using rays indicate on the figure, how (b) above is possible. (1 mark)

2 **Figure 2**, shows two mirrors PQ and QR inclined at an angle of 110°. A ray of light is incident on mirror PQ at an angle of 60°.

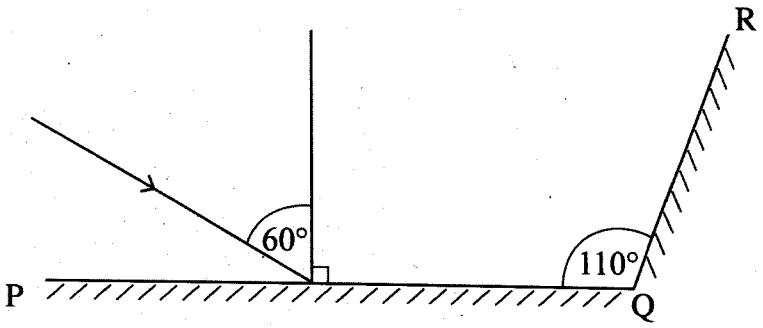


Figure 2

Complete the diagram to determine the angle of reflection of the ray in the mirror QR.

(3 marks)

3 **Figure 3**, shows four identical light bulbs connected to a 15 volts battery whose internal resistance is negligible.

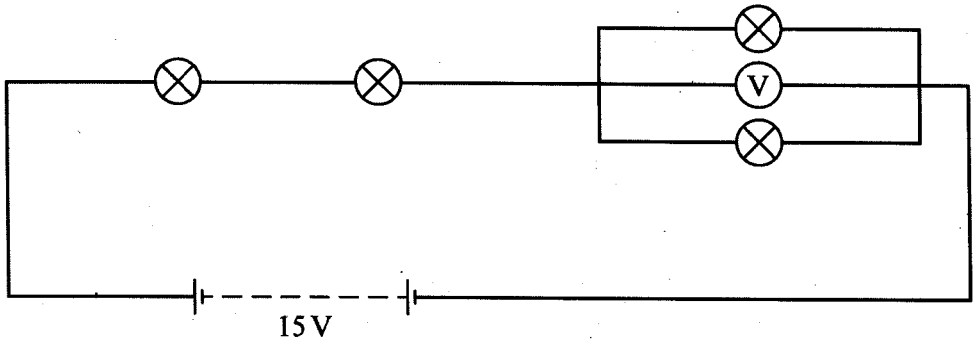


Figure 3

Determine the reading of the voltmeter V. (2 marks)

4 **Figure 4**, shows a negative point charge placed near a positively charged rod.

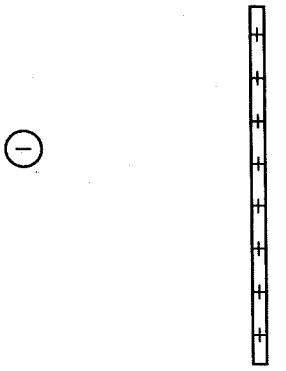


Figure 4

Draw on the diagram, the resulting electric field pattern. (2 marks)

5 **Figure 5**, shows an object 0 at the bottom of a beaker full of a liquid. An observer above the beaker sees its image at point X inside the liquid.

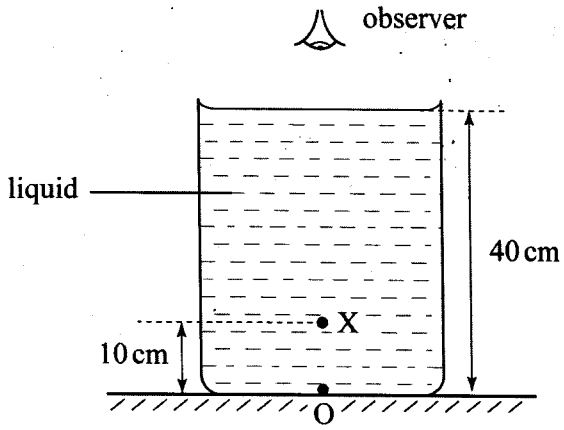


Figure 5

Determine the refractive index of the liquid. (2 marks)

6 **Figure 6**, shows a narrow beam of radiation from a radioactive source, incident to a post card. The emergent radiation passes through a magnetic field which is perpendicular to the plane of the paper, and into the paper. (2 marks)

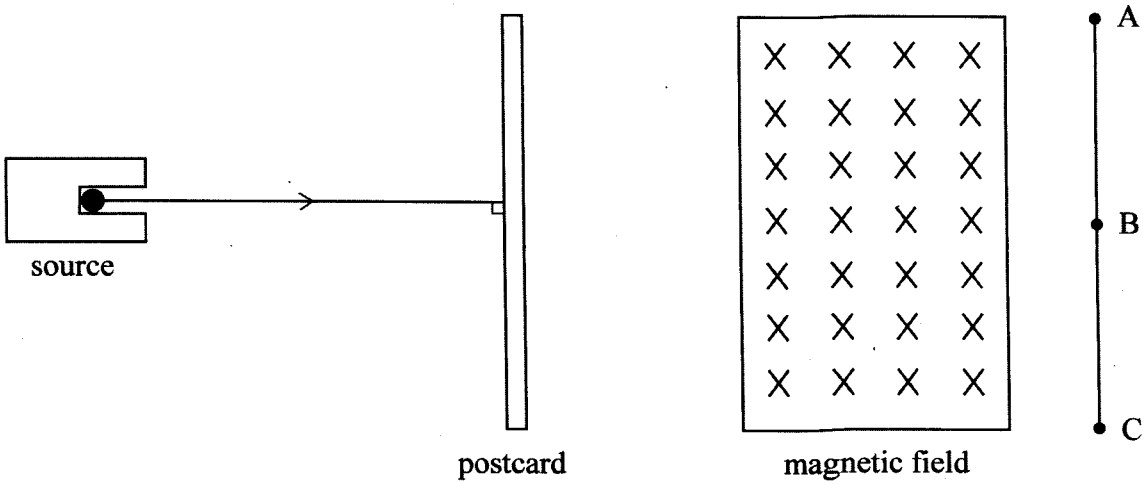


Figure 6

A detector moved along line AC only detects radiations B and C. State the types of radiation detected. (1 mark)

7 **Figure 7**, shows two similar coils P and Q around the end L and M of a piece of soft iron. A steady current passes through the coils.

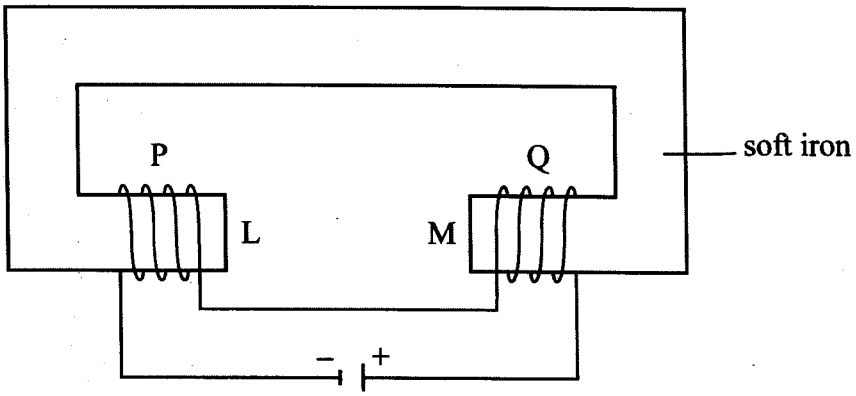


Figure 7

State the polarity of the resulting magnet at end L.

(1 mark)

8 Light from a lamp falls on the cap of a negatively charged electroscope. It is observed that the divergence of the leaf decreases. Explain the observation. (2 marks)

9 **Figure 8,** shows an object O placed infront of a diverging lens whose principal focus is F.

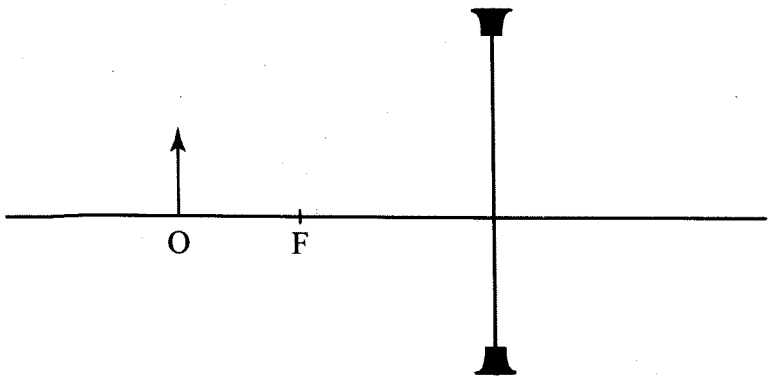


Figure 8

On the figure, draw a ray diagram to locate the image formed. (2 marks)

10 **Figure 9,** shows the cross-section of an optical fibre made of two types of glass A and B. The refractive index of B is lower than that of A.

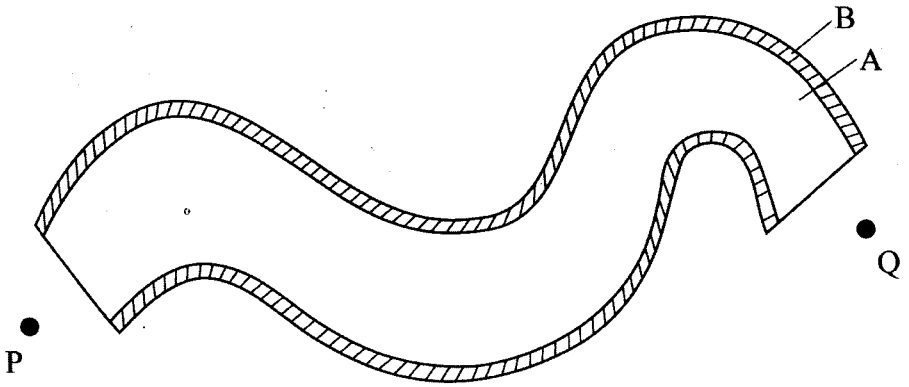


Figure 9

A ray of light enters the optical fibre at P and emerges from Q.

(i) Sketch the path of the ray through the fibre. (1 mark)

(ii) State the reason why light travels through the fibre as in (i) above. (1 mark)

11 **Figure 10**, shows the cross section of a conductor held between two magnets and carrying a current out of the paper.

Figure 10

Indicate with an arrow on the diagram the direction in which the conductor will move when it is released. (1 mark)

12 State why alternating current (a.c) is used for transmitting electricity over long distances.

(1 mark)

13 **Figure 11**, shows an alternating current (a.c) connected across a diode D and a resistor R.

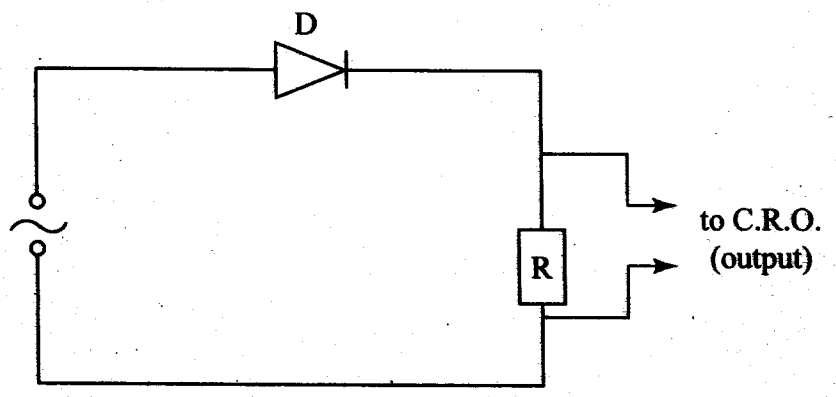
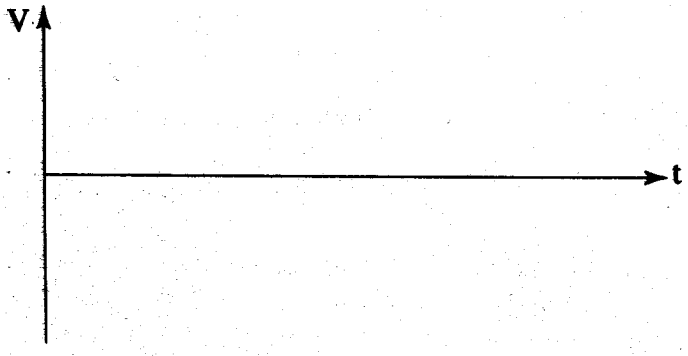


Figure 11

On the axes provided sketch the output as observed in the CRO connected across R.

(1 mark)



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

SECTION B: (55 marks)

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

14 (a) **Figure 12**, shows a displacement - time graph for a progressive wave.

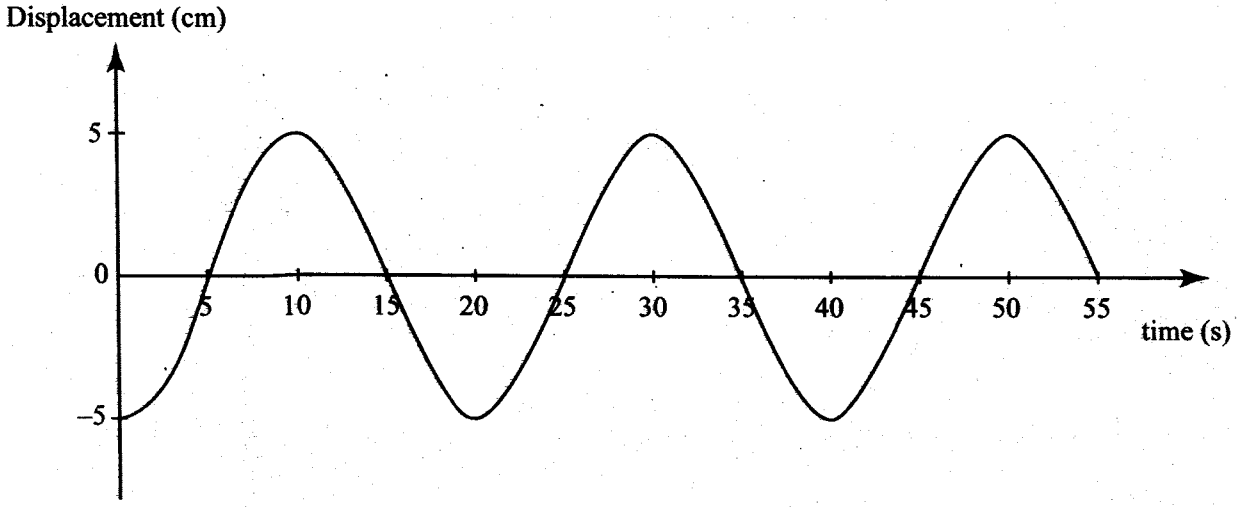


Figure 12

(i) state the amplitude of the wave. **(1 mark)**

(ii) determine the frequency of the wave. **(4 marks)**

(iii) given that the velocity of the wave is $20ms^{-1}$, determine its wavelength. **(3 marks)**

(b) **Figure 13** shows two identical dippers A and B vibrating in water in phase with each other. The dippers have the same constant frequency and amplitude. The waves produced are observed along line MN:

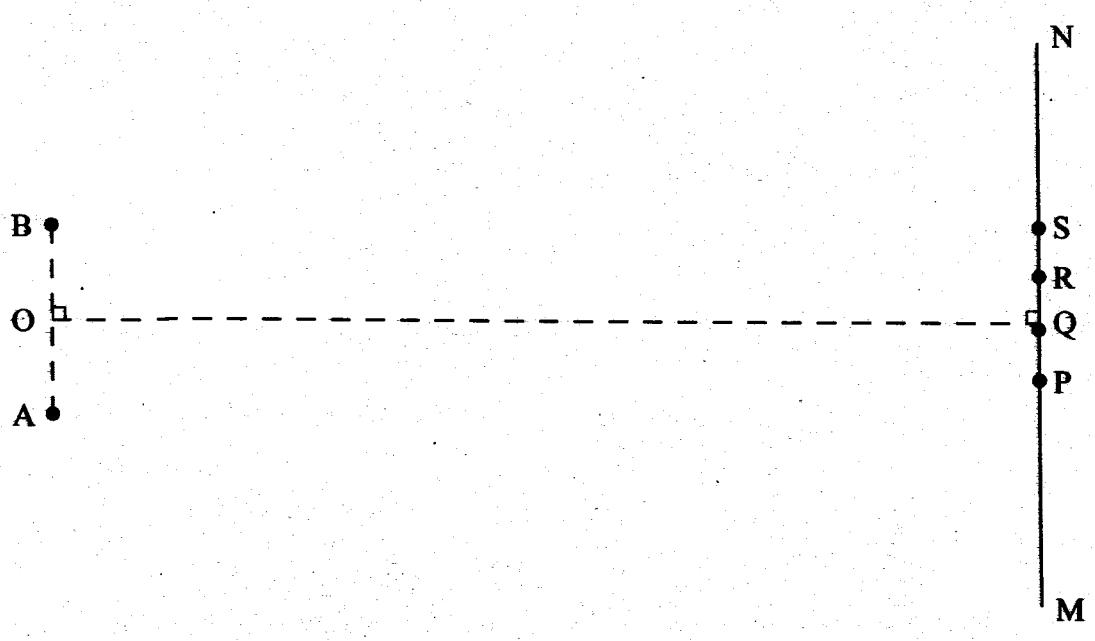


Figure 13

It is observed that the amplitudes are maximum at points Q and S, and minimum at points P and R.

(i) explain why the amplitude is maximum at Q. (2 marks)

(ii) state why the amplitude is minimum at R. (1 mark)

(iii) State what would happen if the two dippers had different frequencies. (1 mark)

15 **Figure 14,** shows a circuit in which a battery, a switch, a bulb, a resistor P, a variable resistor Q, a voltmeter V and two ammeters A_1 and A_2 of negligible resistance are connected.

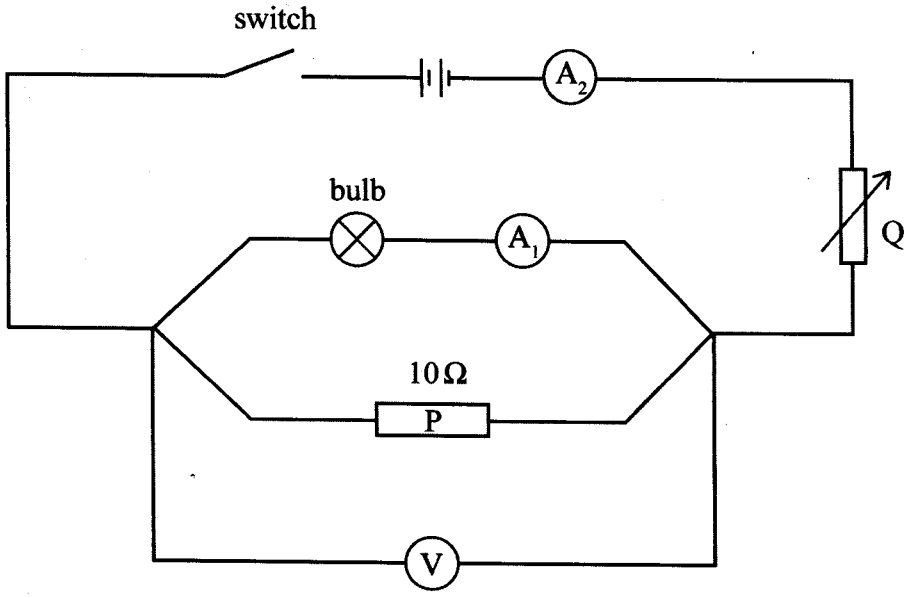


Figure 14

P has a resistance of 10Ω. When the switch is closed A_1 reads 0.10A and the voltmeter reads 1.5V.

(a) Determine;

(i) the current passing through P. (3 marks)

(ii) the resistance of the bulb. (2 marks)

(b) The variable resistor Q is now adjusted so that a larger current flows through A_2.

(i) State how this will affect the resistance of the bulb. (1 mark)

(ii) Explain your answer in b(i). (2 marks)

(c) A house has one 100W bulb, two 60W bulbs and one 30W bulb. Determine the cost of having all the bulbs switched on for 70 hours, given that the cost of electricity is 40 cents per kilo-watt hour. (3 marks)

16 (a) **Figure 15**, shows two coils A and B placed close to each other. A is connected to a steady D.C supply and a switch, B is connected to a sensitive galvanometer.

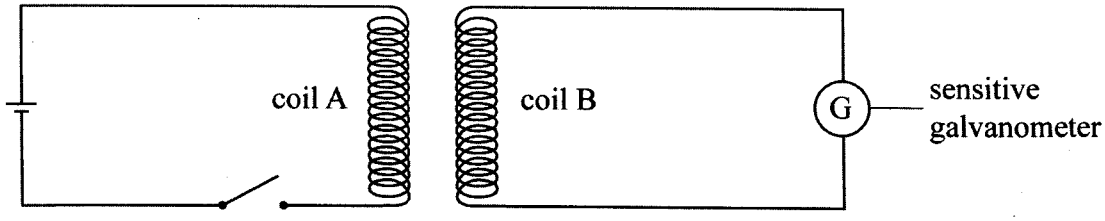


Figure 15

(i) The switch is now closed. State the observation made on the galvanometer. (2 marks)

(ii) Explain what would be observed if the switch is then opened. (2 marks)

(b) The primary coil of a transformer has 1000 turns and the secondary coil has 200 turns. The primary coil is connected to a 240V a.c mains, supply.

(i) Explain how an e.m.f is induced in the secondary coil. (2 marks)

(ii) Determine the secondary voltage. (3 marks)

(iii) Determine the efficiency of the transformer given that the current in the primary coil is 0.20A and in the secondary coil is 0.80A. (3 marks)

17 (a) **Figure 16**, shows a graph of magnification against object distance, for an object placed infront of a lens of focal length 20cm.

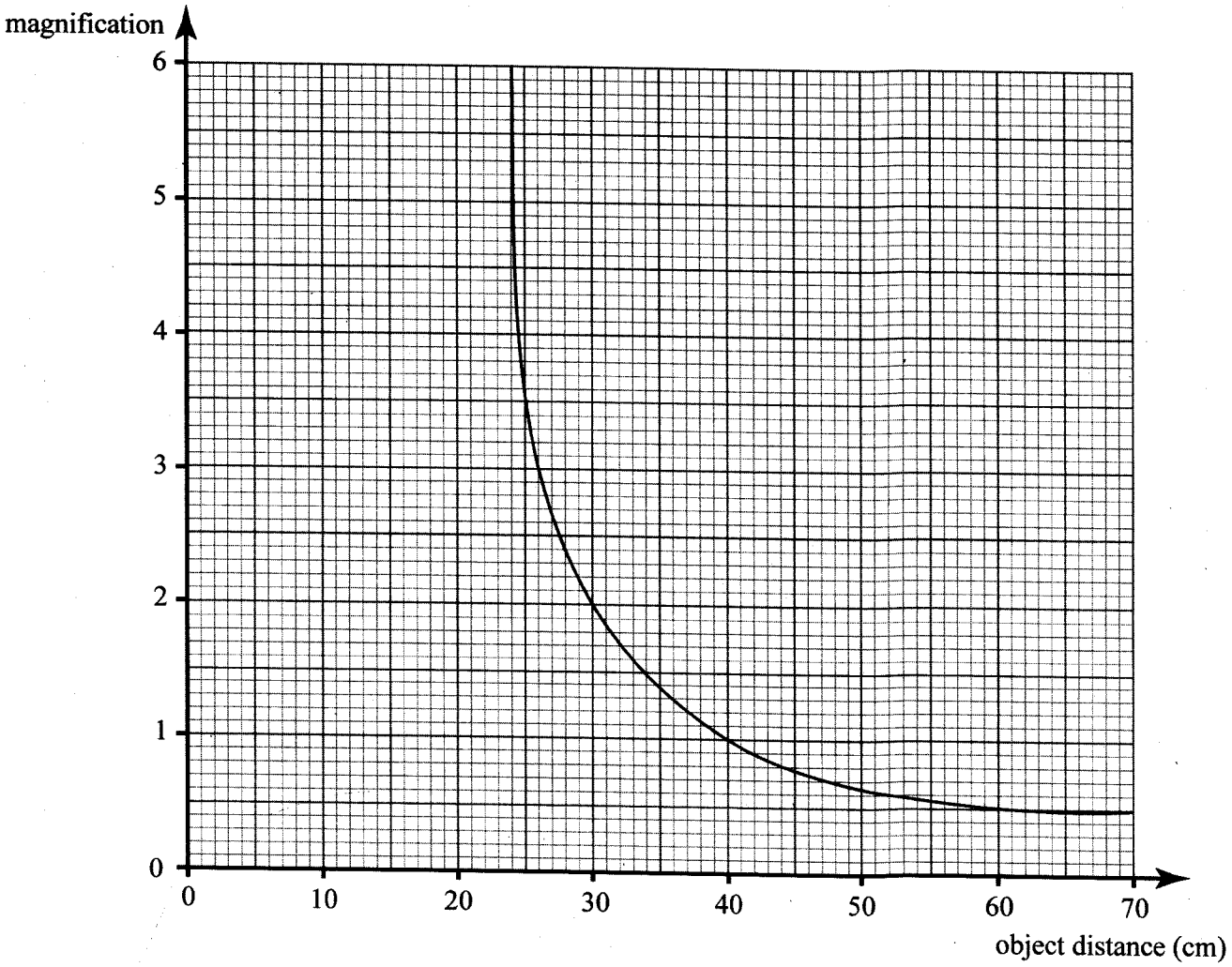


Figure 16

Using the graph;

(i) State the effect on the size of the image as the object distance is increased from 25cm. (1 mark)

(ii) Determine the distance between the object and the lens when the image is the same size as the object. (2 marks)

(iii) Determine the image distance when the object distance is 25 cm. (3 marks)

(b) **Figure 17** shows an object O placed in front of a converging mirror of focal length 15cm.

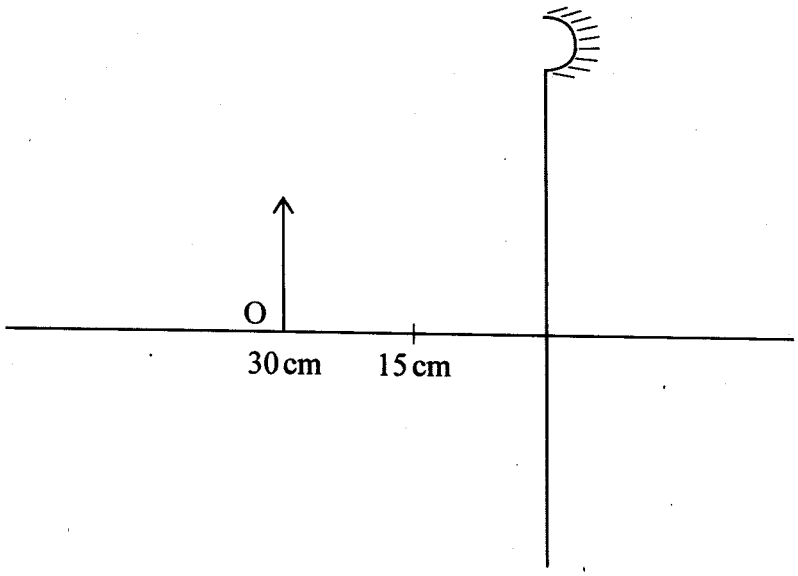


Figure 17

Draw on the figure a ray diagram to locate the image formed. (3 marks)

(c) State why parabolic reflectors are used in car headlights. (1 mark)

18 **Figure 18** shows parts of an x-ray tube.

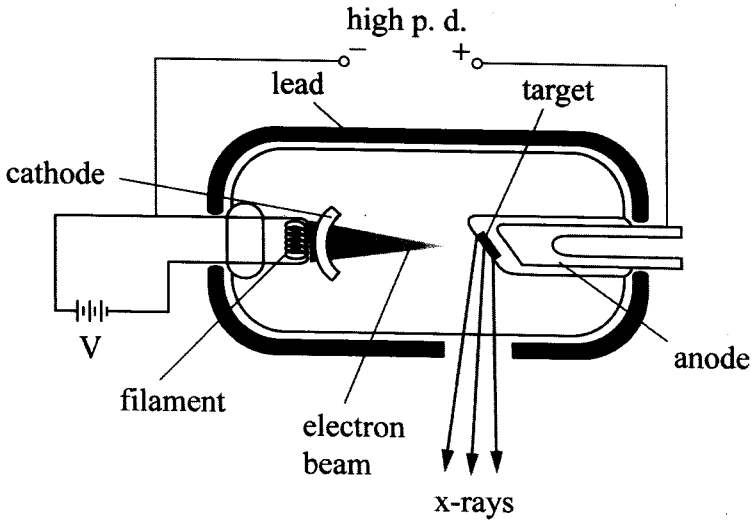


Figure 18

(a) Explain why:

(i) A potential difference is applied to the filament. (2 marks)

(ii) A high potential difference is applied between the cathode and the anode.
(2 marks)

(iii) Most of the tube is surrounded by lead. (1 mark)

(b) State how the resulting x-rays are affected by increasing the potential difference between the anode and the cathode. (1 marks)

(c) Light of frequency 7.5×10^{14} Hz strikes a metal surface whose work function is 4.0×10^{-19}J. Determine the kinetic energy of the emitted photoelectrons.
(take planks constant h = 6.63×10^{-34} Js)
(4 marks)

4.3.3 Physics Paper 3 (232/3)

Question 1

You are provided with the following:

- two biconvex lenses labelled A and B.
- a light source.
- Screen I with a hole and cross wires at its centre.
- Screen II.
- a metre rule.
- a plane mirror.
- a piece of cellotape.
- two lens holders.
- a stand, boss and clamp.

Proceed as follows:

(a) Mount lens A on the lens holder. Fix the plane mirror at the back of the lens using the cellotape provided. Use the stand to hold the light source in line with the crosswires on screen I and lens A with the plane mirror as shown in **figure 1**.

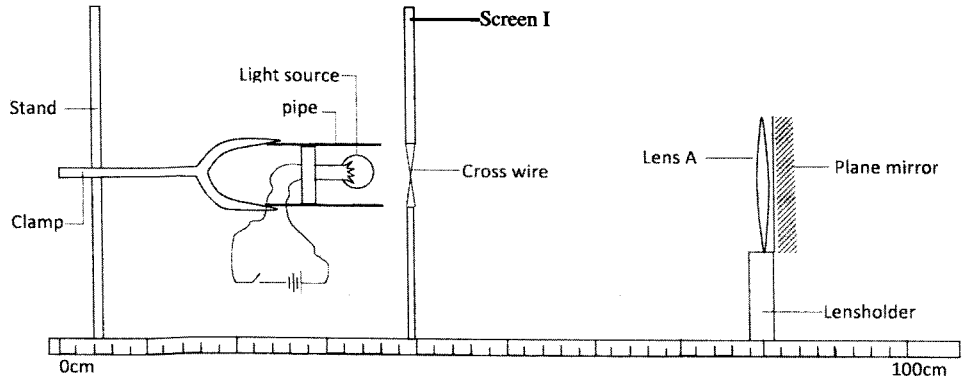


FIG 1

(b) Switch on the lamp. Adjust the position of the lens with the mirror until a sharp image of the crosswires is formed on screen I beside the crosswires. Measure the distance l_1 between the screen and lens A.

l_1 = ... cm. (1 mark)

(c) Replace lens A with lens B. Fix the plane mirror at the back of lens B. Repeat the procedure in (b) above. Measure the distance l_2 between the screen and lens B.

l_2 = ... cm. (1 mark)

(d) Remove the mirror from the lens holder.
Arrange the light source, Screen I (with crosswires), lens A, lens B and screen II in line as shown in **figure 2**.

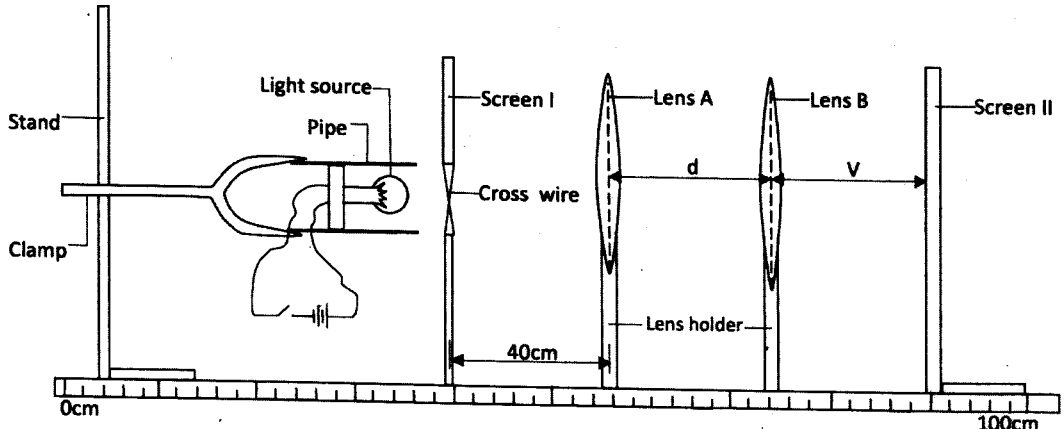


Figure 2

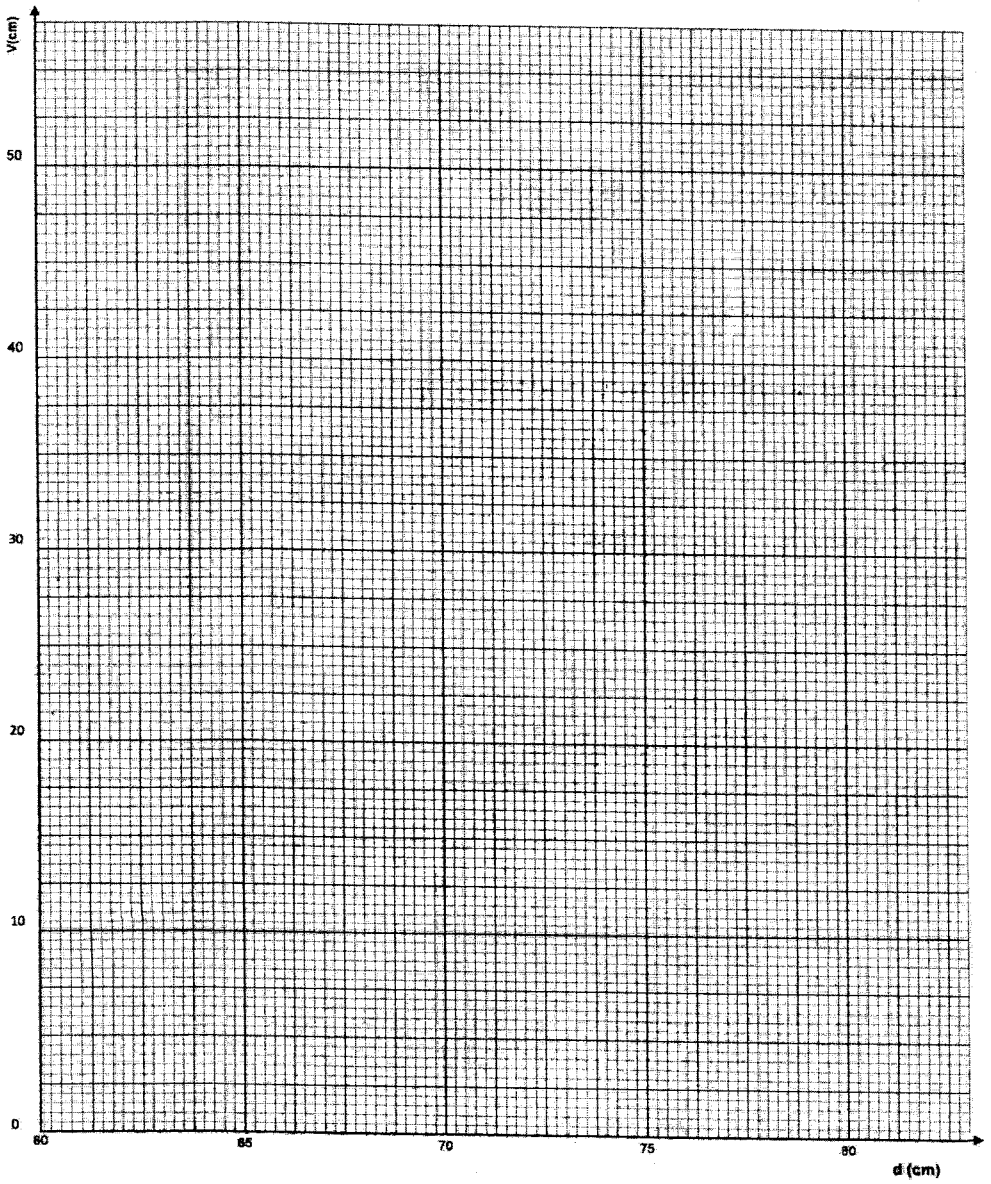
(e) Set the distance between Screen I and lens A to be 40 cm. **Ensure that this distance is maintained throughout the rest of the experiment.**
Set the distance d between lens A and lens B to be 65 cm. Adjust the position of screen II to obtain a sharp image of the cross wires on it. Measure the distance v between lens B and screen II.
Repeat the experiment for other values of d shown in table 1 and complete the table.

Table 1

d(cm)	65	67	69	71	73	77	80
v(cm)							

(7 marks)

(f) On the axes provided below, plot the graph of v(y-axis) against d. (3 marks)



(g) (i) From the graph, at d = 70 cm, determine:

I. the value of v. (1 mark)

II. the slope S of the graph. (3 marks)

(ii) Given that $K = \frac{-225}{(d-55)^2}$

determine the value of K. (2 marks)

(iii) Determine the value of m given that $m = \frac{S}{K}$ (2 marks)

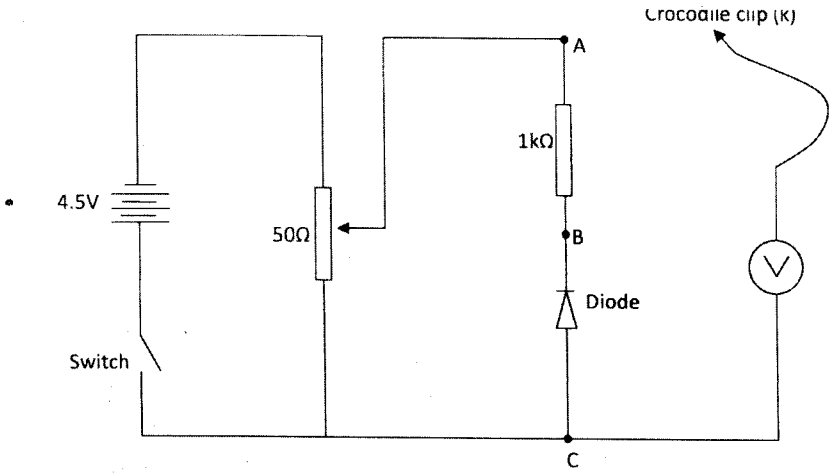
Question 2

You are provided with the following:

- a voltmeter
- a diode with ends labelled B and C
- a 1 kΩ resistor
- a 50 Ω potentiometer
- 3 dry cells and a cell holder
- a switch
- 8 connecting wires (at least 4 with crocodile clips)

Proceed as follows:

(a) Set up the circuit as shown in **figure 3**.



(b) (i) Connect the crocodile clip K to point A. Adjust the potentiometer by turning the knob until the voltmeter reading is maximum.

Maximum voltmeter reading = ... volts. (1 mark)

(ii) Without adjusting the potentiometer, disconnect the crocodile clip K from point A and connect it to point B. Record the voltmeter reading.

Voltmeter reading = ... volts. (1 mark)

(iii) Explain why the voltmeter reading in b(i) is different from that in b(ii). (2 marks)

(c) Disconnect the crocodile clip K from point B and connect it to point A. Adjust the potentiometer so that the voltmeter reading V_A is 1.0 V. Disconnect the crocodile clip K from A and connect it to point B. Record the voltmeter reading V_B.

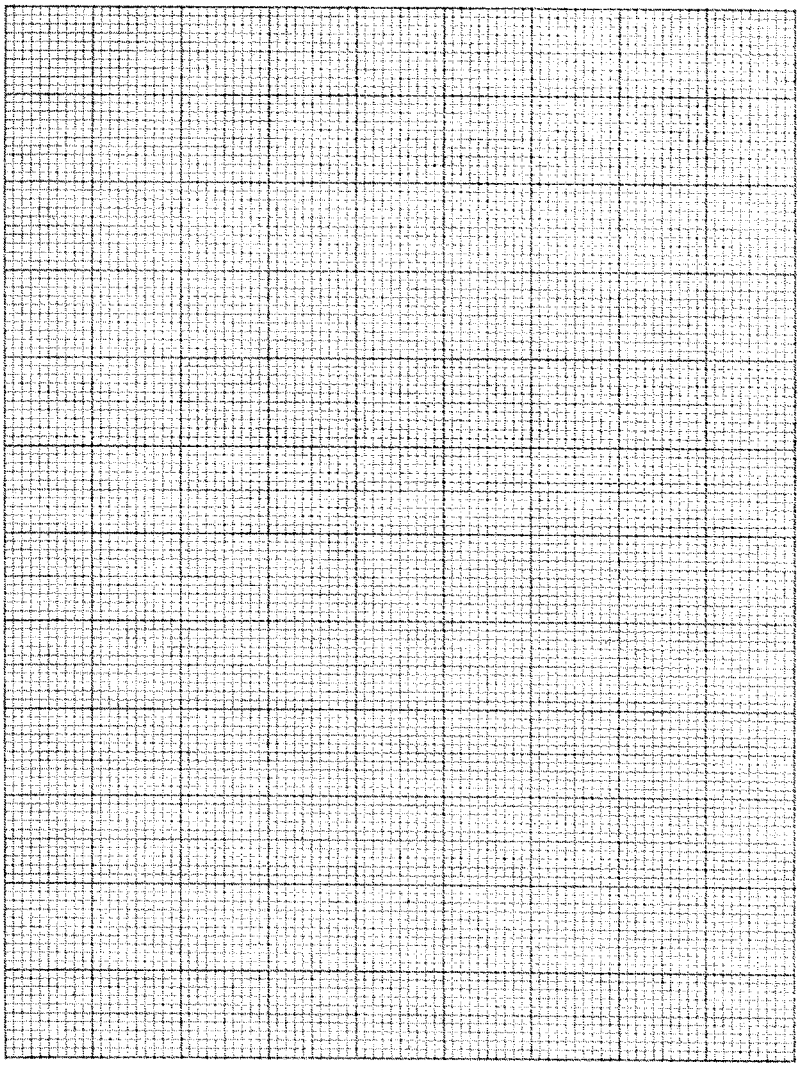
V_B = ... volts. (1 mark)

(d) By adjusting the potentiometer to obtain other values of V_A(when K is at A) shown in **table 2**, repeat the procedure in (c) to obtain the corresponding values of V_B(when K is at B) and complete the table. (7 marks)

Table 2

V_A (V)	V_B (V)	$I = \left(\frac{V_A - V_B}{1000}\right)$(A)
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

(e) On the grid provided, plot a graph of I (y-axis) against V_B. (5 marks)



(f) Use the graph to determine the resistance of the diode when the current is 0.45 mA. (3 marks)

5.3 PHYSICS (232)

5.3.1 Physics Paper 1 (232/1)

SECTION A

1. 7.6+(0.6x3);
   7.6+1.8
   9.4ml; (2 marks)

2. Frictional force is equal to the applied force but in the opposite direction, hence the net applied force is zero; (1 mark)

3. $m = \frac{w}{g}$;
   $= \frac{16.5}{1.7}$;
   $= 9.71kg$; (3 marks)

4. The gas diffuses; from the region of higher concentration to a region of low concentration. (1 mark)

5. Glass is a poor conductor; unequal expansion leads to cracking; (2 marks)

6. Oil film spreads over a large surface of the sea reducing inflow of air needed by the aquatic life;
   - Reduces the light entering
   - Beaches become dirty;
   - Poisons marine animals when taken in;
   (any two correct) (2 marks)

7. Stop rising when upthrust is equal to the weight of the balloon and its contents; (1 mark)

8. Mass of gas must be constant; (1 mark)

9. - The height of it's centre of gravity above the surface is constant;
   - Position of its center of gravity does not change. (1 mark)

10. It is within the elastic limit; because
    - the values of $\frac{F}{e}$ = constant in all the cases $\frac{F}{e}$=5;

    OR

    - a graph of force against extension is straight line through the origin;
    - conclusion from graph; (2 marks)

11. The body's velocity **decreases uniformly** from 20m/s and becomes zero after 5 seconds; the velocity then starts increasing in the **opposite direction** to a maximum value of 20m/s. (2 marks)

12. • Friction between the moving parts of the pulley system;
• Work done against friction;
• Work done lifting the moving parts of the pulley system; (2 marks)

13. (i) OA - heat gained is breaking intermolecular forces of the molecules/melt the ice without change in temperature;

(ii) AB - temperature of the water formed starts to rise until it starts to boil; (2 marks)

14. (a) Air above the plane moves faster than air below it (because of it's shape) creating a region of low pressure above the place hence plane experiences a lift; due to the pressure difference. (1 mark)

(b) At B; because the cross-sectional area is smaller hence the air moves faster in that region; (2 marks)

SECTION B

15. (a) Extrapolation of graph to cut the temperature axis;

absolute zero = 278 ± 2°c; (-272 ± 2°c to -280° ± 2°c; (2 marks)

(b) (i) When tube is horizontal pressure of air is equal to atmospheric pressure; i.e. 76cmHg. (1 mark)

(ii) (I) When vertical,
pressure of air = pressure due to mercury column+atmospheric pressure
= (24+76)cmHg
= 100cmHg; (1 mark)

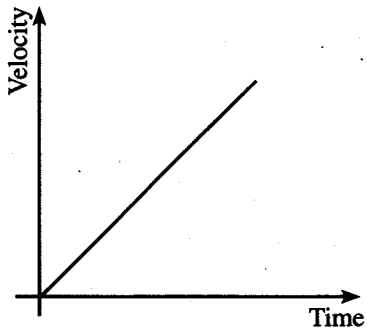
(II) PV = a constant;
76x15=(76+24)l;
$l = \frac{76 \times 15}{100}$
= 11.4cm; (3 marks)

(c) (i) To expel air; (1 mark)

(ii) Pressure of air outside the bottle is greater than the pressure of air inside; (1 mark)

(iii) Cooling causes condensation of vapour;
Creating a partial vacuum; (2 marks)

16. (a) (i)



(straight line not necessarily through the origin but with positive gradient)

acceleration;
constant acceleration; (2 marks)

(ii) Net force on the parachute becomes zero. (Sum of downward forces on it should be equal to sum of upward forces) (1 mark)

(b) (i) Net force = 2+-0.4; =-2.4N; (2 marks)

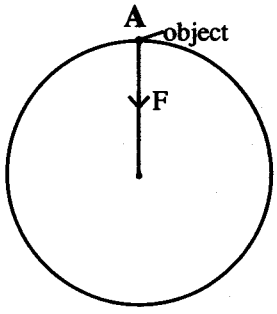
(ii) F=ma;
-2.4 = 0.2a';
$a = -12ms^2$; (3 marks)

(iii) $V^2 = u^2 + 2as$;
$s = \frac{0 - 5^2}{-2 \times 12}$;

$\simeq 1.04m$; (3 marks)

(c) (i) - Weight of object;
- Tension in the string; (2 marks)

(ii)



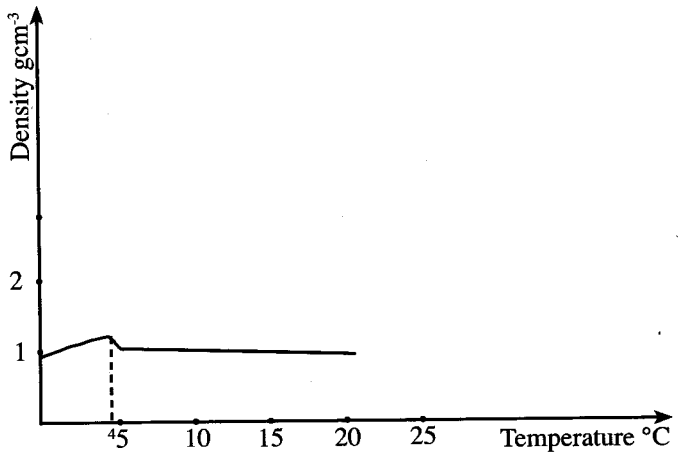
The force should be from point A to the center but not beyond

(1 mark)

17. (a) - Fire heats air around region C which expands and becomes less dense;
- The less dense air rises up the vent and emerges at A;
- Cool (more dense) air moves down the vent at B introducing fresh air into the mine (3 marks)

(b) The flask has double walls which are silverly on both sides the shiny surface is a good reflector of heat; (1 mark)

(c)



(1 mark)

(d) (i) Heat gained by water = power x time;
$= 2.5 \times 10^3 \times 4 \times 60$;
$= 6.0 \times 10^5$J; (3 marks)

(ii) $E = mc\Delta\theta$;

$$\Delta\theta = \frac{2.5 \times 10^3 \times 4 \times 60}{2 \times 4.2 \times 10^3};$$

$= 71.43^oC$; (3 marks)

18. (a) (i) Lengths BC and CD; (1 mark)

(ii) 100 x BC = S x CD;

$$S = \frac{100BC}{CD};$$ (2 marks)

(b) (i) Volume of 10g = $\frac{mass}{density}$;

$$= \frac{20}{800};$$

$= 2.5 \times 10^{-2} m^3$; (3 marks)

(ii) Upthrust = weight of water displaced

$$= \frac{20}{800} \times 100 \times 10;$$

$= 2.5 \times 10^2$N; (2 marks)

(iii) Tension = U-mg;
= 250 - 200
= 50N; (2 marks)

19. (a) (i) Valve B rests under its own weight;
- pressure in the cylinder decreases and water rises into the cylinder pushing the valve open; (2 marks)

(ii) Valve A rests under its own weight and the weight of the water; high pressure is created in the region between valve A and valve B forcing valve B to open; (1 mark)

(b) The water is lifted up by the piston ad comes out through the spout; (1 mark)

(c) $P_w g h_w = P_p g h_p$;

$h_p = \frac{1000 \times 10}{800}$;

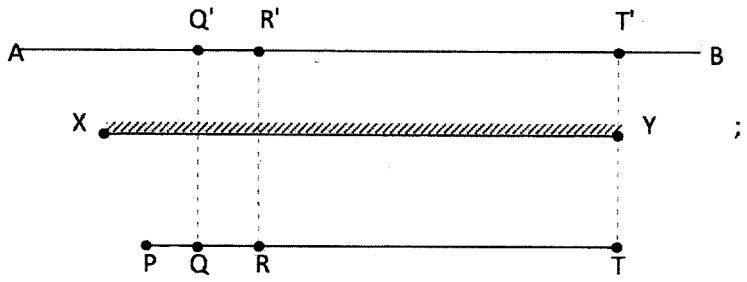
=12.5m; (3 marks)

(d) - Force applied on piston (during downstroke);

- Ability of the parts of the pump to withstand the pressure of the liquid column; (2 marks)

5.3.2 Physics Paper 2 (232/2)

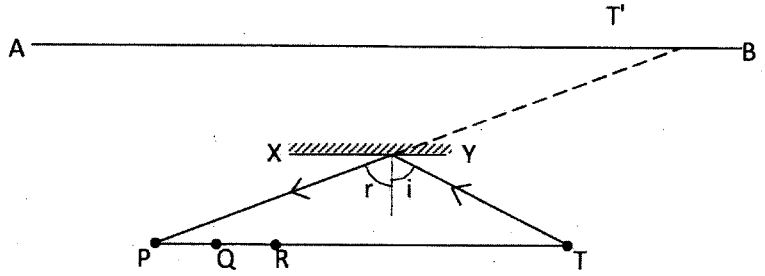
1. (a)



(1 mark)

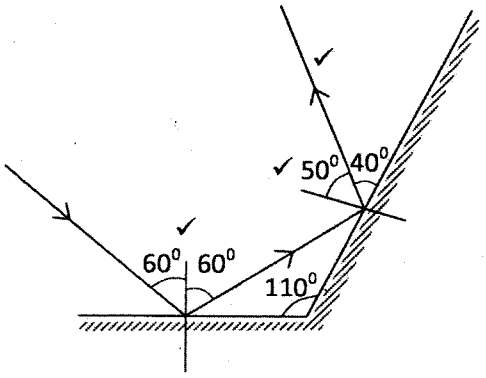
(b) T and R; (1 mark)

(c)



- Reflected ray from T and R moves towards P; (1 mark)

2.



✓- 1st reflection
✓- 2nd reflection
✓- 50⁰ (correct angle)

(3 marks)

3. $V + V + \frac{V}{2} = \frac{5V}{2}$

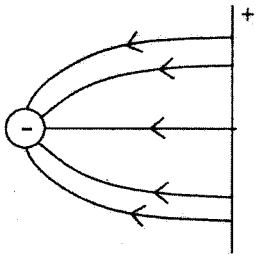
$\frac{5V}{2} = 15\ V\surd$

$V = 6V$

$\therefore \frac{V}{2} = \frac{6}{2} = 3V\surd$

(2 marks)

4.



Check correct direction of field lines. (2 marks)

5. Refractive index = $\frac{\text{real depth}}{\text{apparent depth}}$ √

$= \frac{40}{30}$ √

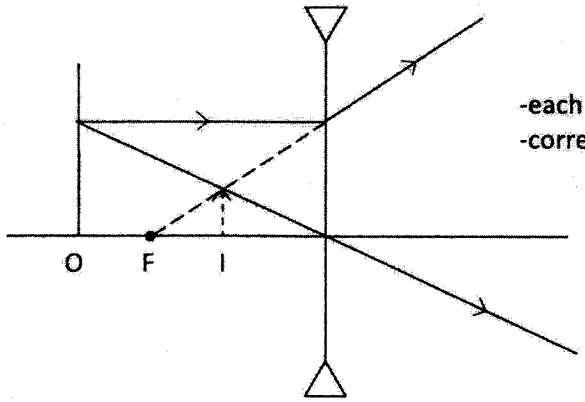
= 1.33 √ (3 marks)

6. β and γ rays; (1 mark)

7. L - south pole; (1 mark)

8. UV light ejects electrons by photo electric;
emission reducing the negative charges; (2 marks)

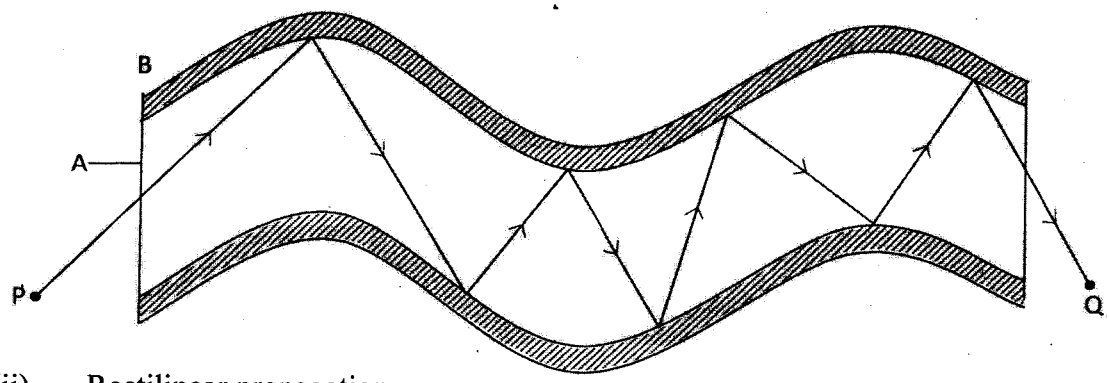
9.



-each array- ✓✓
-correct virtual diminished image ✓

(3 marks)

10. (i)



(ii) Rectilinear propagation.

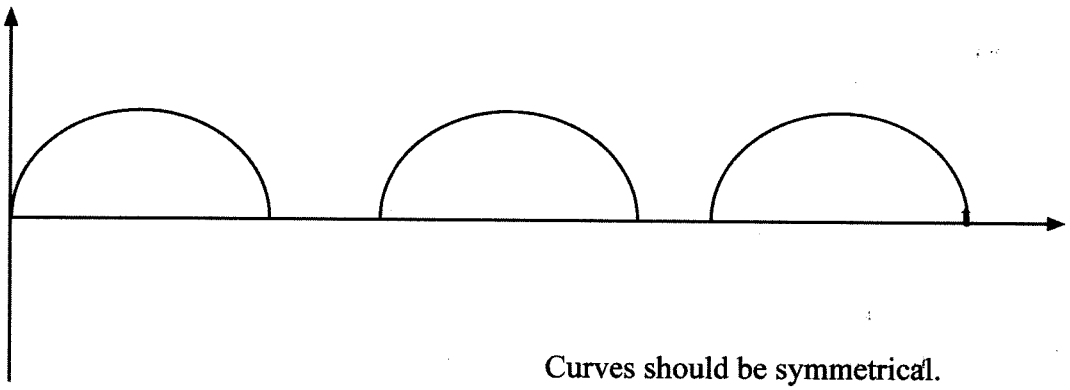
F; correct direction (1 mark)

11.

(1 mark)

12. Alternating current can be stepped up, or enhances reduced power losses; (1 mark)

13.



Curves should be symmetrical. (1 mark)

SECTION B

14. (a) (i) amplitude = 5 cm√ (1 mark)

(ii) T = 20s√

$f = \frac{1}{T}$√

$f = \frac{1}{20} = 0.05\ H_2$√ (4 marks)

(iii) $V = \lambda f$ √

$\lambda = \frac{20}{0.05}$ √

= 400 m √ (3 marks)

(b) (i) Waves at Q are in phase √ so there is constructive interference. √ (2 marks)

(ii) Waves are out of phase hence destructive interference. √ (1 mark)

(iii) Interference pattern would disappear. √ (1 mark)

15. (a) (i) V= IR√
10I = 1.5√
I = 0.15A √ (3 marks)

(ii) bulb = 0.1A√
R×0.1 = 1.5√
R = 15Ω√ (2 marks)

(b) (i) the resistance of the bulb would increase;

(ii) Current is higher hence increases; temperature increased temperature results in increased resistance; (2 marks)

(c) Number of units = (0.1 x 10 + 0.06× 10 + 0.03 ×10)
= 1.9 units;

Cost = 1.9 × 40 × 7;
= Ksh 5.32; (3 marks)

16. (a) (i) Pointer deflects upto a certain;maximum value and then returns to zero; (2 marks)

(ii) There is a deflection in the opposite direction then back to zero; As Flux in A falls, flux in B also falls and causes induced e.m.f in the opposite directions; (2 marks)

(b) (i) Current in the primary is constantly changing its direction;
so that the resulting flux (which link coils) is constantly changing its direction. Therefore alternating e.m.f is induced in the secondary coil;
(2 marks)

(ii) $\frac{Vs}{Vp} = \frac{Ns}{Np}$;

$\frac{Vs}{240} = \frac{200}{1000}$;

Vs = 48V; (3 marks)

(iii) Efficiency $= \frac{\text{Power output}}{\text{Power input}} \times 100\%$;

$= \frac{IsVs}{IpVp} \times 100\%$

$= \frac{0.8 \times 48}{0.2 \times 240} \times 100\%$;

$= 80\%$; (3 marks)

17. (a) (i) The image diminishes (becomes smaller); (1 mark)

(ii) $m = 1 \Longrightarrow \frac{V}{u} = 1$;

$V = u = 40$ cm; (2 marks)

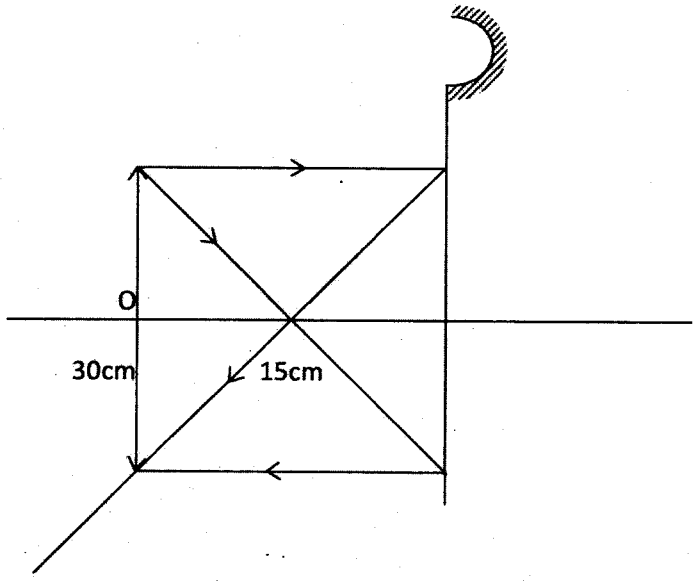
(iii) $u = 25$
$m = 4$;

$m = \frac{v}{u}$

$\frac{v}{25} = 4$;

$V = 100$ cm; (3 marks)

(b)



(3 marks)

(c) A bulb/lamp placed at principal focus will give a wide parallel beam; (1 mark)

18. (a) (i) To produce electrons; by thermionic emission; (2 marks)

(ii) To accelerate the electrons to give them enough K.E. to produce X-rays at the anode;; (2 marks)

(iii) To absorb stray X-rays, thus protecting the operator from those rays; (1 mark)

(b) Increases K.E. of electrons and hence causes X-rays of higher frequency; (1 mark)
OR
- X - ray are more penetrative
- X - rays of shorter wavelength.

(c) $E = hf$;
$= 6.63 \times 10^{-34} \times 7.5 \times 10^{14}$

$= 4.97 \times 10^{-19}$ J;

K.E = 4.97×10^{-19} 4.0×10^{-19};
$= 0.97 \times 10^{-19}$J; (4 marks)

5.3.3 Physics Paper 3 (232/3)

1 (a) $f_1 = 20\,cm \quad \pm 2cm$ (1)

(c) $f_2 = 15cm \quad \pm 2cm$ (1)

(f)

d(cm)	65	67	69	71	73	77	80	
V(cm)	37.5	33.8	31.1	29.1	27.5	25.2	24.0	±2

(6 marks)

(g) (i) Graph (6 correctly plotted points)

Labelling axes (1)
Plot (2 marks)
Curve/line on at least 4 correctly plotted points (1 mark)

(ii) I. Value of V $= 30 \pm 1$ (1 mark)

II. Slope $s = \dfrac{35 - 20}{81.25 - 63.75}$

$= -0.86$

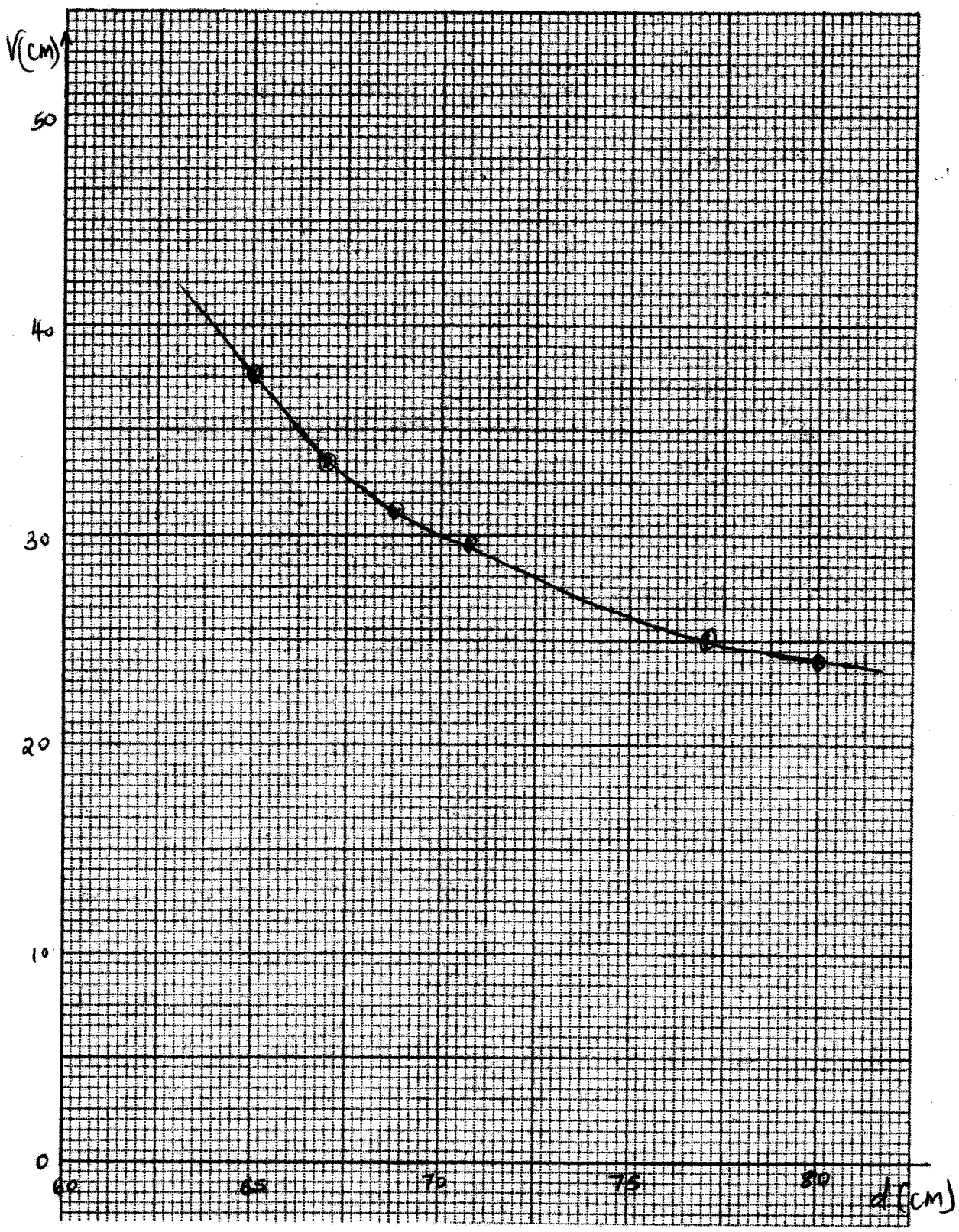
$\simeq -0.9$

No curve/line no slope (3 marks)

(iii) $K = \dfrac{-225}{(d-55)^2} = \dfrac{-225}{225} = -1$ (2 marks)

(iv) $M = \dfrac{S}{K} = \dfrac{-0.9}{-1} = 0.9$ (2 marks)

Graph 1



2. (b) (i) Maximum Voltmeter reading = 4.4 Volts (1 mark)

(ii) Voltmeter reading V_B = 3.7 Volts (1 mark)

(iii) In (i) p.d. measured is across both. (1 mark)
diode and resistor, while in (ii) p.d. is across diode only. (1 marks)

(c) V_B = 0.8 Volts. (1 mark)

(d)

V_A/V	V_B/V	$I = \frac{V_A - V_B}{1000}$ A
1.5	1.2	0.3×10^{-3}
2.0	1.7	0.3×10^{-3}
2.5	2.1	0.4×10^{-3}
3.0	2.5	0.5×10^{-3}
3.5	2.9	0.6×10^{-3}
4.0	3.4	0.6×10^{-3}

Column I = 1 mark

Values of V_B = 5 marks

Total for table = 6 marks

(e)

Axes labelled	1 mark
Scale (simple & uniform)	1 mark
Plotting	3 marks
Curve (line)	1 mark

(5 marks)

(f) I = 0.45mA, V_B = 2.3 volts

$$\therefore R = \frac{V_B}{I} = \frac{2.3}{0.45 \times 10^{-3}}$$

$$= 5.1 \times 10^3$$

$$= 5.1\,k\Omega$$

(3 marks)

GRAPH 2