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.

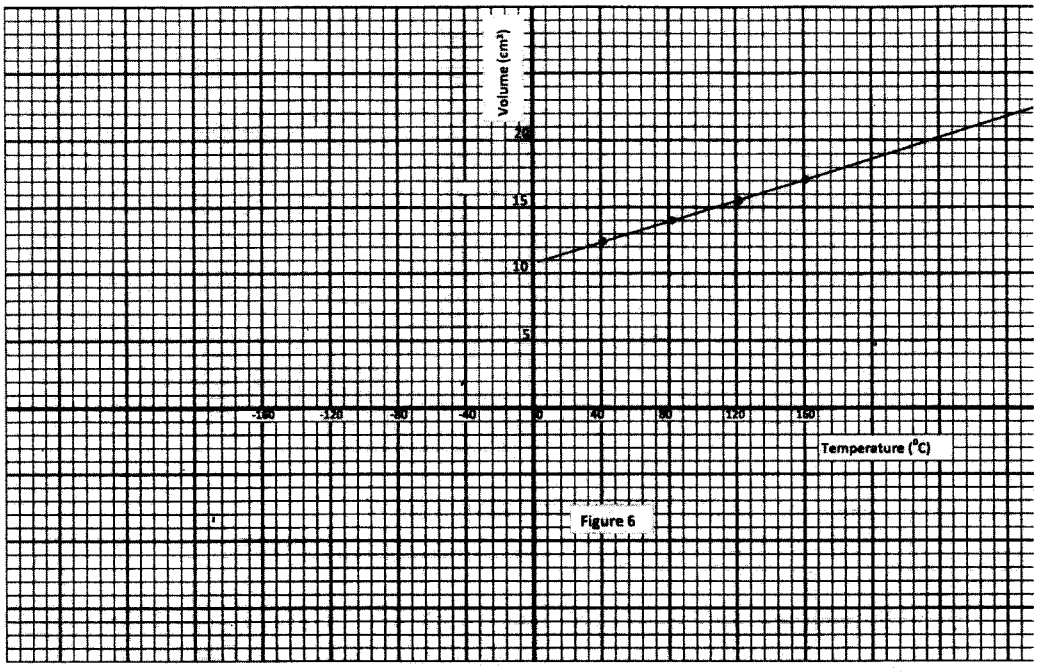


Figure 6

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.

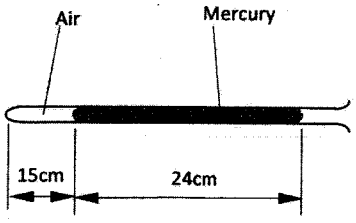


Figure 7

(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**.

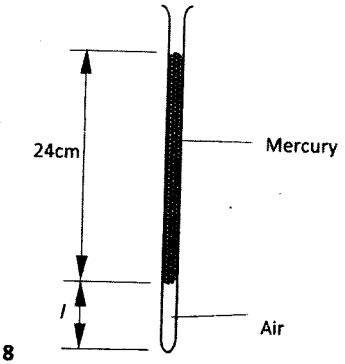


Figure 8

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.

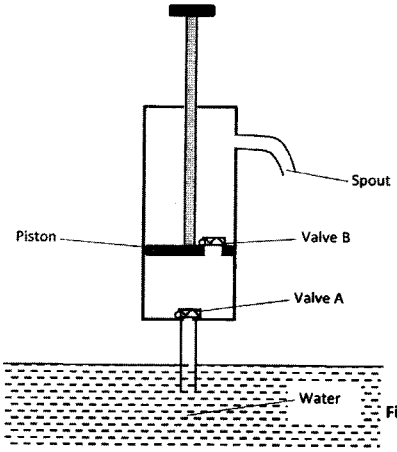


Figure 14

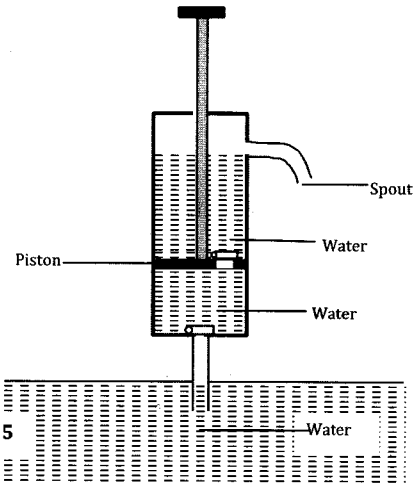


Figure 15 5

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.

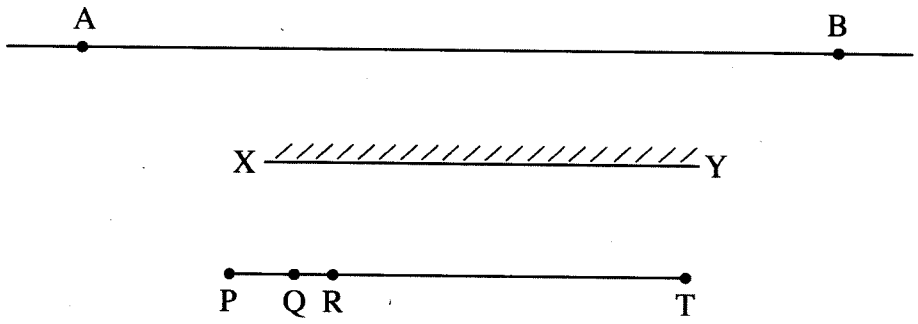


Figure 1

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)

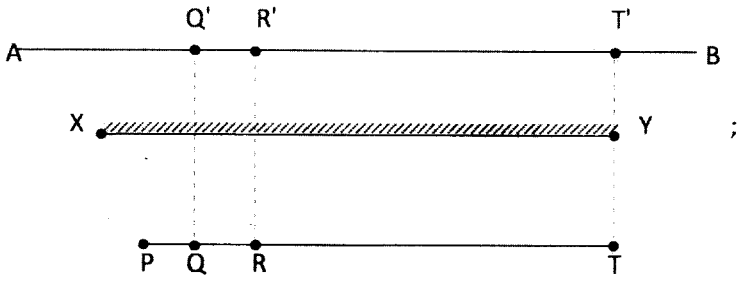
Candidates were required to indicate the positions of images in a plane mirror, state which one of the images was visible from a certain point and draw ray diagrams to illustrate their response.

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

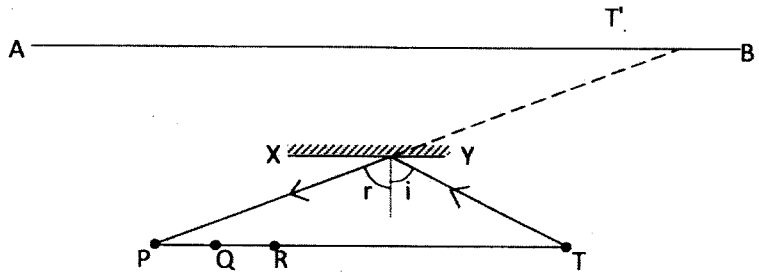
(a)



(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.

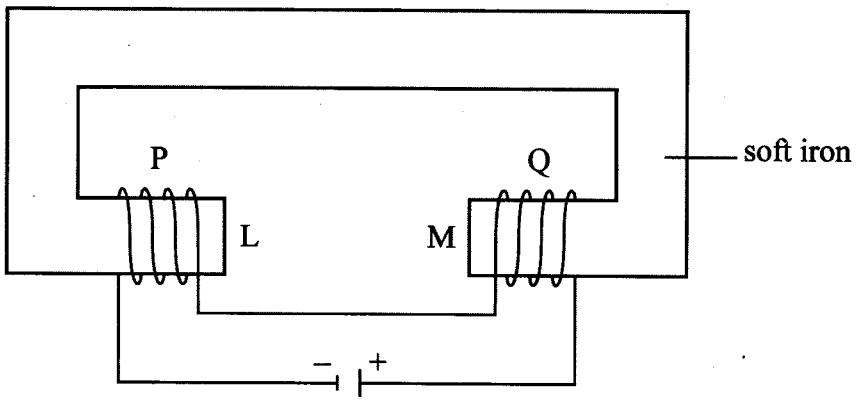


Figure 7

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.

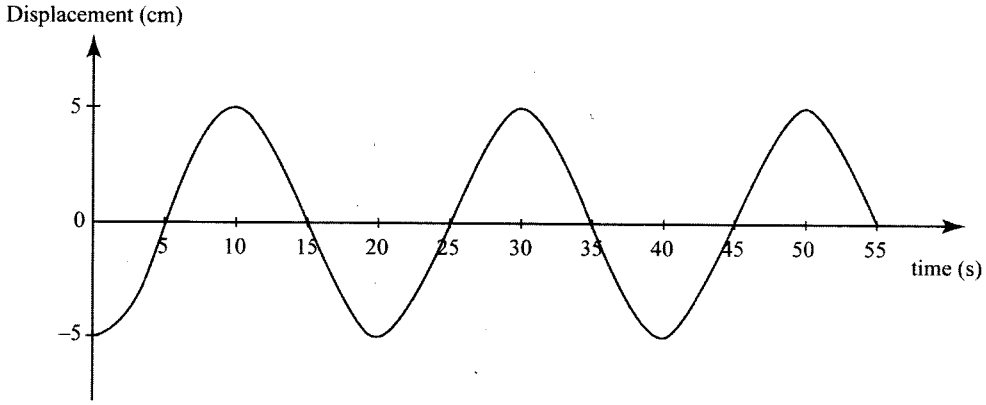


Figure 12

(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:

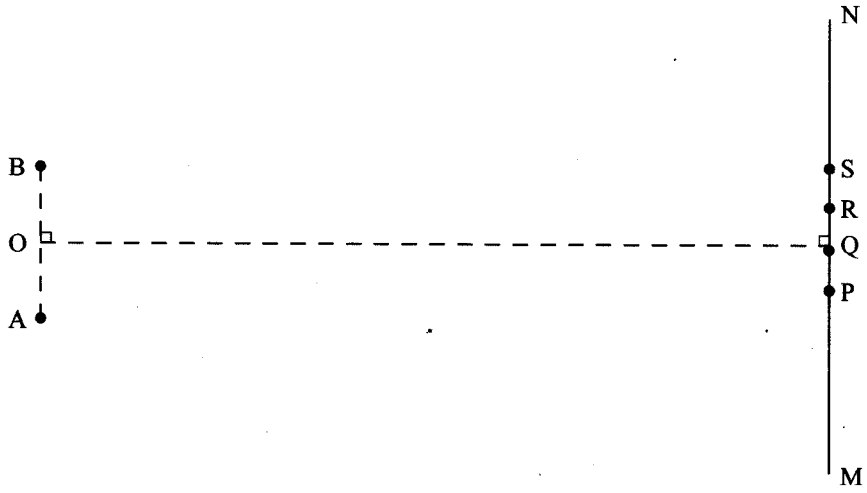


Figure 13

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)

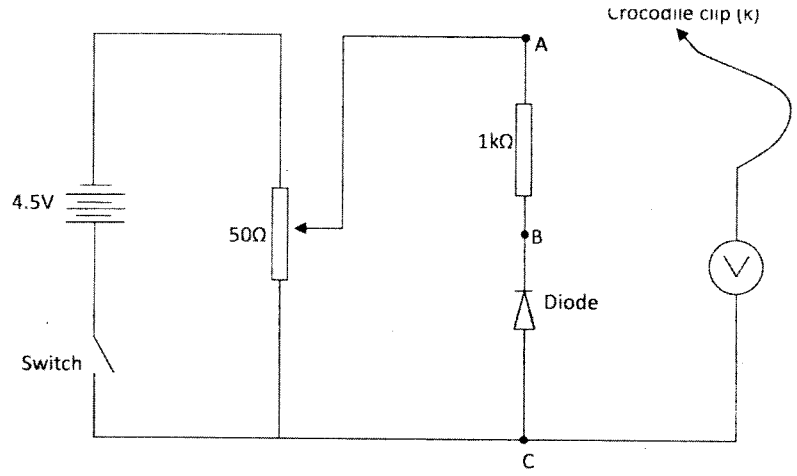
Question2

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.

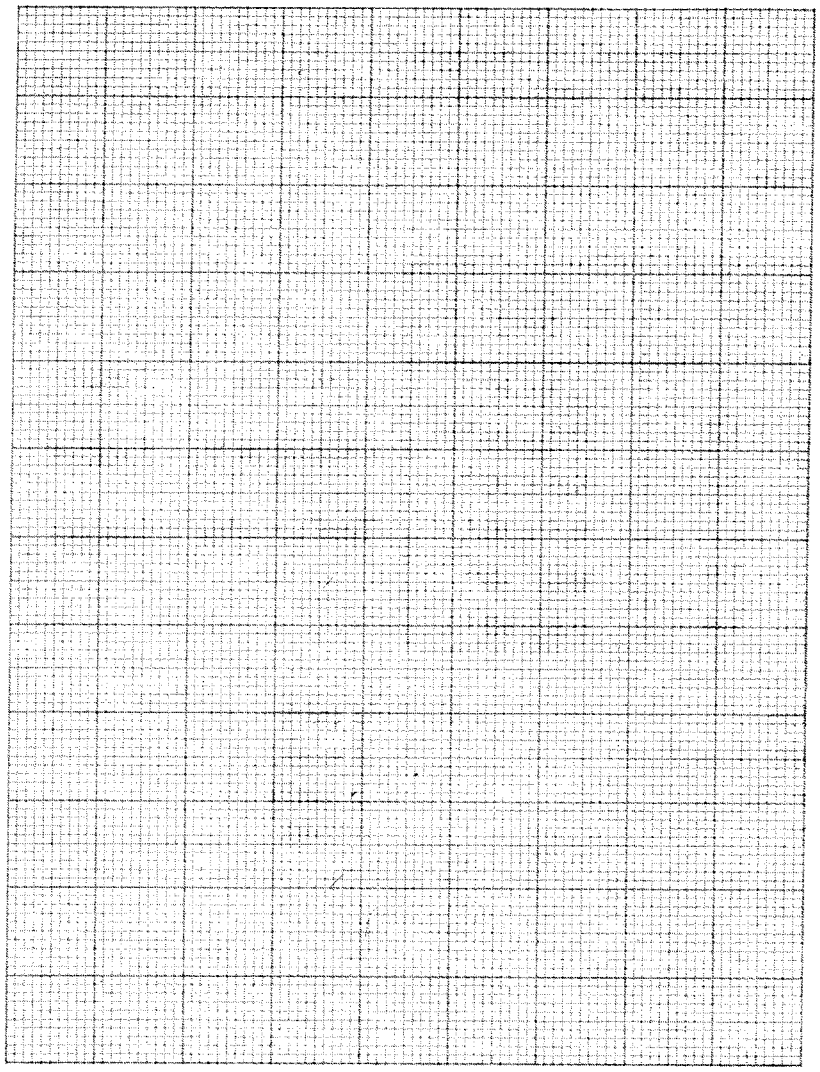
V_B = ... volts. (1 mark)

(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

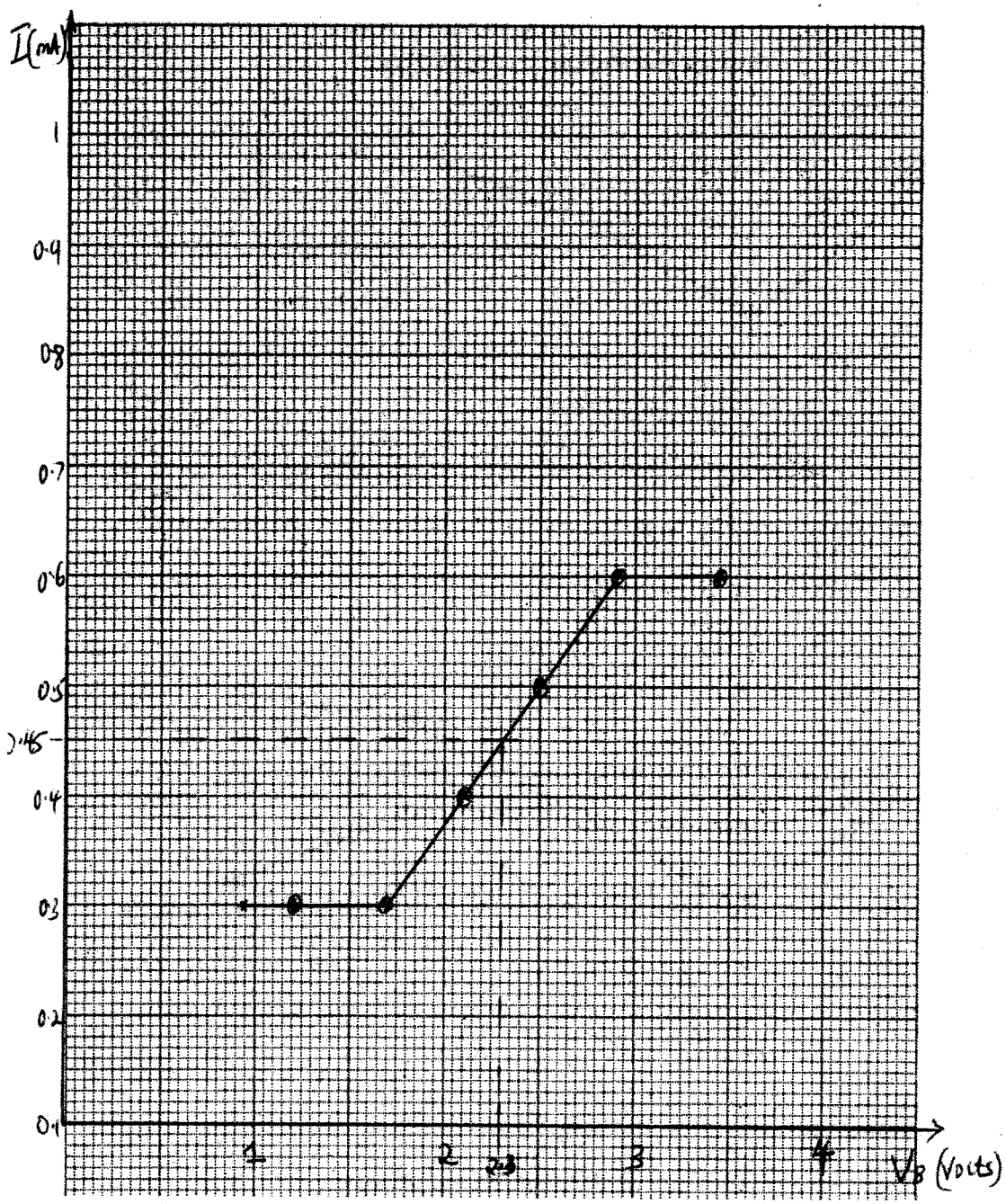
$$\therefore R = \frac{V_B}{1} = \frac{2.3}{0.45 \times 10^{-3}}$$

$$= 5.1 \times 10^3$$

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

(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.