

3.6 GENERAL SCIENCE (237)

General science was tested for the first time in the year 2010. It is composed of two theory papers; Paper one and paper two. Each paper has three sections A, B and C. Section A has Biology questions with 34 marks, section B Chemistry questions with 33 marks and section C Physics questions with 33 marks. Each of the papers is marked out of 100. This subject is mostly done by private and non-formal centers that usually have no qualified science teachers.

3.6.1 CANDIDATES OVERALL PERFORMANCE

The overall performance of candidates in General science since the year 2010 is as shown in the table below.

Table 14: Candidates overall Performance of candidates between 2010 and 2014

year	paper	candidature	Maximum score	Mean score	Standard Deviation
2010	Paper 1	1211	100	13.77	25.44
	Paper 2	1211	100	11.97	08.87
	overall	1211	200	25.44	16.94
2011	Paper 1	1242	100	12.84	10.12
	Paper 2	1237	100	9.68	7.91
	Overall	1245	200	22.42	17.29
2012	Paper 1	1285	100	13.93	10.61
	Paper 2	1285	100	9.46	8.92
	Overall	1285	200	23.34	18.71
2013	Paper 1	1100	100	12.33	10.99
	Paper 2	1100	100	7.22	6.64
	Overall	1100	200	19.46	16.92
2014	Paper 1	1100	100	9.73	9.30
	Paper 2	1100	100	8.69	8.91
	Overall	1384	200	18.34	17.18

From the table it can be observed that:

- (i) Candidature for the subject increased from 1100 in 2013 to 1384 in 2014 (25.18% increase).
- (ii) The mean for paper 2 in all the years has been lower than that of paper 1. This may be due to the fact that majority of candidates taking this subject are from private/non-formal centers who may not have teachers. This makes it hard for them to cover and conceptualize concepts in forms 3 & 4 which are mainly tested in paper 2.
- (iii) There was a drop in the overall mean from **19.46** in 2013 to **18.34** in 2014.

The following is a discussion on some of the questions that were poorly performed.

3.6.1 General Science Paper 1 (237/1)

SECTION A: BIOLOGY

Questions that appeared to have given candidates a great challenge include numbers 3, 4 and 8. These questions are briefly discussed below.

Question 3

A strip of raw pawpaw measuring 3 cm in length was immersed in a beaker of water. After 30 minutes the strip measured 3.2 cm.

- (a) Explain the change in length. (2 marks)
- (b) State **one** other observation that was made on the raw pawpaw strip at the end of the experiment. (1 mark)

This was a practical based question where a piece of paw paw was immersed in beaker with water and increased in length after 30 minutes. Candidates were required to explain the observation and state another observation made on the paw paw.

Weaknesses

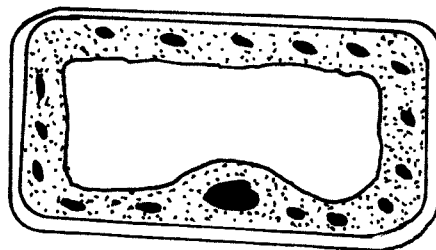
Majority of candidates were not able to explain the change in length and state another observation made on the raw paw paw. This showed lack of practical approaches to teaching by teachers.

Expected response

- (a) There was movement of water molecules from the beaker into the strip of pawpaw by osmosis; because the strip tissue fluid was hypertonic / water in the beaker was hypotonic;
- (b) The strip became rigid / hard / stiff / turgid / firm; The strip bent / curved;

Question 4

The diagram below represents a plant cell as seen under high power of the light microscope.



- (a) Based on observations of the diagram, give **three** reasons why it is a plant cell. (3 marks)
- (b) Name the organelle that carries out autotrophic nutrition in plants. (1 mark)

Candidates were given a diagram of a plant cell as seen under high power of the light microscope. They were supposed to give reasons based on the diagram why it is a plant cell.

Weaknesses

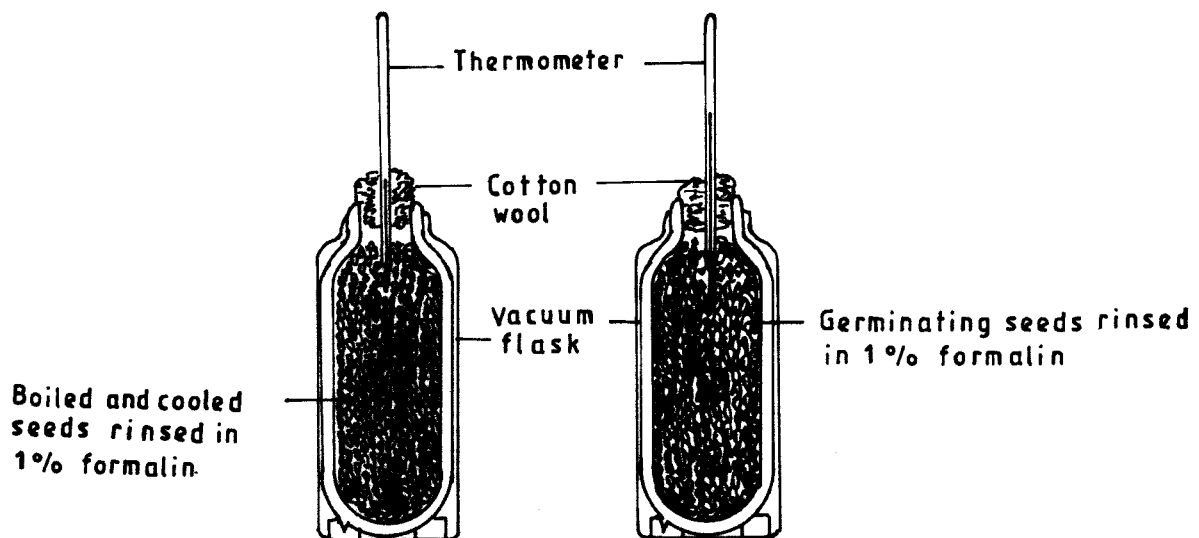
Some Candidates did not know the names of organelles in plant cells and this made them not to score when answering the question.

Expected response

- (a) Peripheral nucleus; Large central vacuole;
Cell wall present; Has regular shape ; chloroplast present
- (b) Chloroplast;

Question 8

- (a) The diagrams below represents an experimental set-up that was used to investigate the process of respiration.



- (i) State the aim of the investigation. (1 mark)
- (ii) State the purpose of rinsing the seeds in 1% formalin. (1 mark)
- (b) Name **two** end products of digestion of a meal consisting of boiled rice and beans without oil. (2 marks)

This was also a practical based question on respiration. From the set-ups given on the diagrams, candidates were supposed to state the aim of investigation and the purpose of rinsing the seeds in formalin. There was also a question on the end products of digestion.

Weaknesses

Most candidates were not able to answer the question correctly. They showed lack of exposure to practicals in respiration and critical thinking.

Expected response

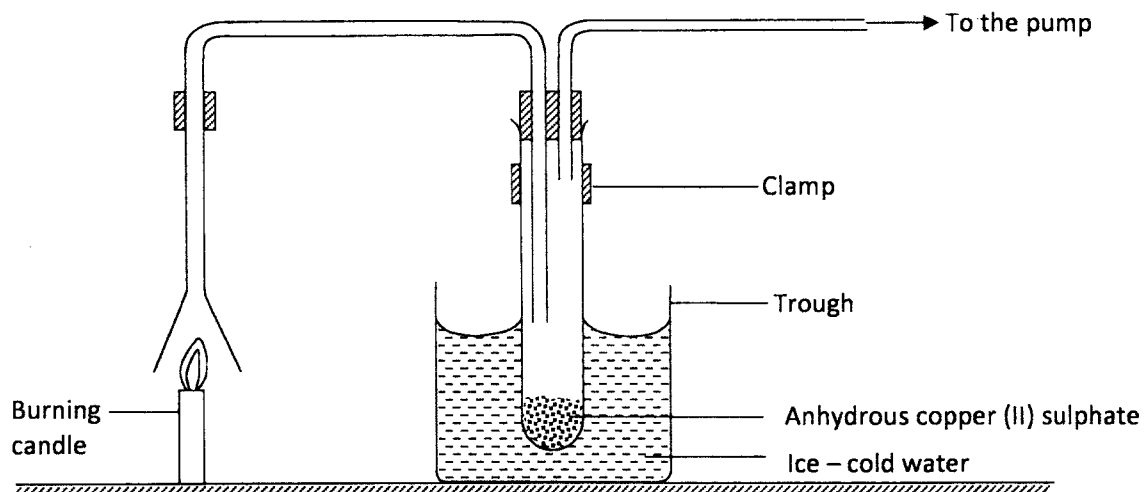
- (a) (i) To find out if heat is produced by germinating seeds; as they respire.
(ii) To kill bacteria that would respire producing heat;
- (b) Glucose; Amino acids;

SECTION B: CHEMISTRY

The following questions were a challenge to the candidates: number 11, 15, 16, 18 and 20.

Question 11

An experiment was set up to investigate the products of a burning candle as shown in the diagram below.



- (a) (i) State an observation made on the anhydrous copper (II) sulphate. (1 mark)
(ii) Explain the observation made in a(i) above. (1 mark)
- (b) What effect does the other product of burning candle have on the environment? (1 mark)

Candidates were required to state and explain the observation on anhydrous copper (II) sulphate and the effect of the other product other than water of burning a hydrocarbon on the environment.

Weaknesses

Candidates were unable to state and explain the effect of water on anhydrous copper (II) sulphate. Majority of the candidates were unable to identify the products of a burning candle hence they could not state and explain the observation on anhydrous copper (II) sulphate.

Expected response

- (a) (i) White anhydrous copper (II) Sulphate turns blue
- (ii) Anhydrous copper (II) Sulphate combines with the water produced to form blue hydrated copper (II) Sulphate. / anhydrous Copper (II) Sulphate becomes hydrated.
- (b) It causes global warming / greenhouse effect.

Advice to Teachers

Teachers should adopt practical approach to teaching when dealing with confirmatory tests for water.

Question 16

- (a) Hard water is healthy for drinking. Explain. (1 mark)
- (b) Explain how ion-exchange is used to remove hardness in water. (2 marks)

Candidates were required to explain why hard water is healthy for drinking and how ion-exchange is used to remove hardness in water.

Weaknesses

Candidates were unable to explain how ion - exchange is used to remove water hardness. Majority of the candidates could explain others methods of removing water hardness such as use of chemicals and boiling.

Expected response

- (a) It provides calcium and magnesium ions used by animals in formation of strong bones, teeth and shells.
- (b) Hard water is passed through a column packed with a compound of sodium permuttit which exchanges Ca^{2+} and Mg^{2+} ions for Na^+ ions.

Advice to Teachers

Teachers should explicitly explain the advantages of hard water and the various methods of removing water hardness.

Question 19

- (a) What is meant by the term “ionization energy”? (1 mark)
- (b) Study the following table and use it to answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	P	Q	R	S	T	U	V	W
Electronic configuration	2.8.1	2.8.2	2.8.3	2.8.4	2.8.5	2.8.6	2.8.7	2.8.8
1st ionization energy (kJ mol ⁻¹)	494	736	576	787	1017	1000	1255	1519

- (i) From the table, ionization energies increase generally from element P to element W. Explain. (2 marks)
- (ii) What types of oxides are formed by elements:
- (I) R($\frac{1}{2}$ mark)
- (II) U($\frac{1}{2}$ mark)

Candidates were required to define **ionization energy** and to explain why ionization energy increases generally across a period. They were also to name the types of oxides formed by some given elements.

Weaknesses

Candidates were unable to give clear definition and the increase in ionization energy across period three elements.

Expected response

- (a) Ionization energy is the minimum energy required to completely remove the outermost electron from an atom in the gaseous state. (w.t.t.e)
- (b) (i) The atomic size decrease from P to W because of increase in the effective nuclear charge hence the removal of the outermost electron across the period requires more energy as the atomic size decreases.
- (ii) (I) R - Amphoteric oxide
- (II) U - Acidic oxide

Question 21

- (a) Identify the types of bonds in carbon (II) oxide molecule. (1 mark)
- (b) Explain why graphite is used as a lubricant. (2 marks)

Candidates were required to identify the types of bonds in a carbon (II) oxide molecule and to explain why graphite is used as a lubricant.

Weaknesses

Candidates were unable to identify the types of bonds correctly and to give a clear explanation why graphite is used as a lubricant.

Expected response

- (a) - Covalent bonds
- Coordinate / dative bond
- (b) Graphite exist in hexagonal layers which are held together by weak van der waals forces of attraction. These layers slip/slide over each other when compressed hence this makes it a good lubricant.

SECTION C: PHYSICS

Like in the previous years, candidates find the Physics section very challenging. Many candidates don't attempt this section at all. They are advised to utilize the past reports to enhance their knowledge in Physics. The following are some of the questions that were found most challenging.

Question 24

An object is found to have a weight of 12.5 N at a place where the acceleration due to gravity is 10 ms^{-2} . Determine the mass of the object. (3 marks)

Candidates were expected to determine the mass of an object given its weight at a place where $g = 10 \text{ ms}^{-1}$.

Weaknesses

Most candidates were unable to determine the mass and lacked knowledge of the formula for weight.

Expected response

$$\begin{aligned} W &= mg \\ 12.5 &= m \times 10 \\ m &= 1.25 \text{ kg} \end{aligned}$$

Question 29

Figure 2 shows a uniform metre rule pivoted at the 20 cm mark and balanced by a weight of 4.5 N.

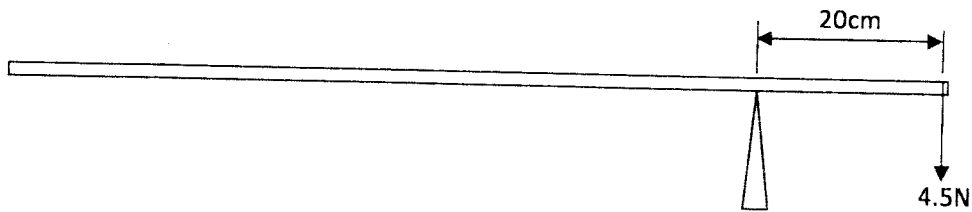


Figure 2

Determine the weight of the rule.

(3 marks)

Candidates were expected to determine the weight of a meter rule using the principle of moments.

Weaknesses

Most candidates failed to realize that the weight of the meter rule was the force acting at its center of gravity, 50 cm since the rule was uniform. They did not apply the principle sum of clockwise moments is equal to the sum of anti-clockwise moments.

Expected response

Sum of anticlockwise moments = Sum of clockwise moments/ $F_1d_1 = F_2d_2$

Let weight of rule be x ;

$$x \times 30 = 20 \times 4.5 ;$$

$$x = \frac{20 \times 4.5}{30}$$

$$= 3 \text{ N}$$

NB. Most of the candidates' responses lacked an understanding of the principles of physics.

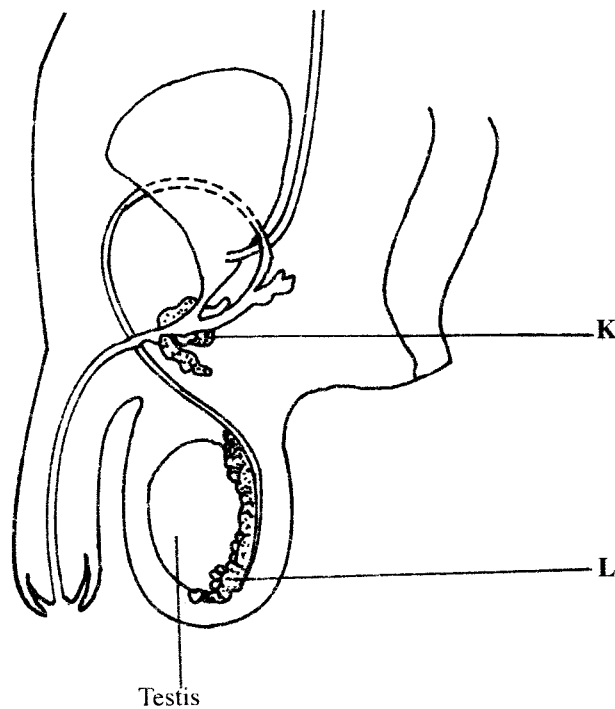
3.6.2 General Science Paper 2 (237/2)

SECTION A: BIOLOGY

Questions that were most challenging to the candidates are numbers 3, 7 and 9 which are briefly discussed below.

Question 3

The diagram below represents the human male reproductive system.



- (a) (i) Name the parts labelled **K** and **L**.
K; (1 mark)
L. (1 mark)
- (ii) State the role of the hormone produced by the testis. (1 mark)
- (b) What is meant by the term mitosis? (1 mark)

Candidates were given a drawing of human male reproductive system and asked to name specific parts and the role of hormone produced by testis. They were also to state meaning of the term mitosis.

Weaknesses

Majority of candidates were not able to name the parts correctly showing lack of knowledge in the area. They also did not know role of the hormone produced by the testis and definition of mitosis.

Expected response

- (a) (i) K - Prostate gland; L - Epididymis;
- (ii) Controls development of secondary sexual characteristics;
leads to formation of spermatozoa/sperms;
- (b) It is a type of cell division giving rise to two identical diploid daughter cells;

Question 7

- (a) What is chemical evolution? (2 marks)
- (b) State **two** ways in which meiosis is important in sexual reproduction. (2 marks)

Candidates were required to define chemical evolution and state ways in which meiosis is important in sexual reproduction

Weaknesses

Most candidates were not able to give a correct definition chemical evolution. They showed complete lack of knowledge in the area from their responses. They were also not able to say how meiosis is important in sexual reproduction.

Expected response

- (a) It is a theory on the origin of life; that suggests that life began from simple elements through complex compounds;
- (b) Meiosis leads to the formation of the gametes which are haploid;
Meiosis ensures that the chromosomal constitution of offspring is the same as that of parents;

Question 9

Name **three** structures of the human ear that are involved in balance and posture. (3 marks)

Candidates were expected to name structures of the human ear that are involved in balance and posture. Most candidates did not give the correct structures while others left the question blank without attempting it. A few gave the names of structures with wrong spellings.

Weaknesses

Candidates appeared not to have covered the topic from their responses and since others did not attempt the question. Spelling for a few who had the idea was the issue.

Expected response

Semicircular canals;
Utriculus;
Sacculus;

SECTION B: CHEMISTRY

The following questions challenged the learners: **15, 16, 17** and **18**.

Question 15

- (a) Name **one** natural polymer and state its use. (1 mark)

Natural polymer.

Use.

- (b) State **one** advantage and **one** disadvantage of synthetic polymers. (1 mark)

Advantage

Disadvantage

Candidates were required to name natural polymers and their uses, advantages and disadvantages.

Weaknesses

Majority of the candidates were unable to name natural polymers, state their uses, give advantages and disadvantages.

Expected response

- (a) Natural polymers
Cellulose / proteins / natural rubber/silk/wool.

Uses

Used for paper manufacturing, textiles

- Rubber used in tyres, tubes
- Proteins / cellulose in textiles.

- (b) Advantages of synthetic polymer

- Cheap / long lasting / moulded into many shapes.
- Prevent / safe destruction of plants and animals.
- Some are heat resistant / good insulators / non corrosive to acids / alkalis.

Disadvantage of synthetic polymer

- Pollutants to the environment
- Non-biodegradable
- Costly to recycle
- Burn producing poisonous gases.

Question 16

(a) Iron metal exists naturally in different ores. Other than haematite, name another common ore of iron. (1 mark)

(b) During the extraction of iron metal, one of the reactions in the blast furnace is:



(i) Name the raw material that is used to produce carbon (II) oxide. (1 mark)

(ii) Iron metal produced in the reaction is in liquid state. Explain. (1 mark)

(c) State with a reason, **one** use of stainless steel. (2 marks)

Use:

Reason:

Candidates were required to name another common ore of iron other than haematite, name the raw material used to produce carbon (II) oxide, explain why the iron produced is in liquid state and to state giving reasons the uses of steel.

Weaknesses

Majority of the candidates could not understand the production of iron from Fe_2O_3 by reduction process of They could also not name another ore of iron neither could they explain why the iron produced in the blast furnace is in liquid state.

Expected response

(a) Magnetite / Pyrite. ✓(1)

OR

FeCO_3 / FeS

(b) (i) Coke /Carbon

(ii) Temperatures at the blast furnace are higher than the melting point of iron metal.

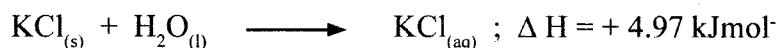
(c) Use of stainless steel

- Construction of bridges
- In ships
- Pipes, padlocks
- Nails
- Cutlery.

Reason: Stainless steel does not rust /is resistant to corrosion.

Question 18

When Potassium chloride was dissolved in water, the following change occurred.



- (a) (i) State the type of energy change in the above reaction. (1 mark)
- (ii) The above experiment was done in a boiling tube. State the observation that was made. (1 mark)
- (iii) Name the type of reaction in a(ii) above. (1 mark)
- (b) Name **two** factors considered when choosing a fuel. (2 marks)

Candidates were required to identify the type of energy change in a given reaction and the observation made on the boiling tube and hence name the type of reaction represented in the equation.

Weaknesses

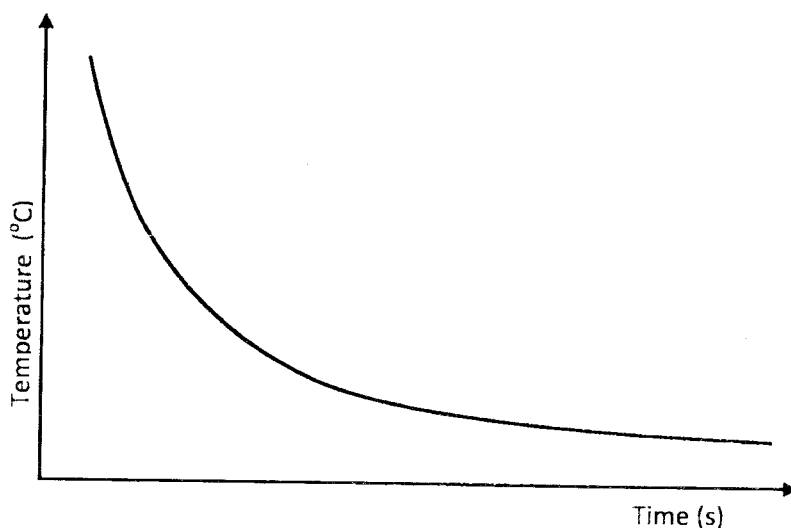
Candidates could not identify the type of energy change from the reaction equation, state the observation on the boiling tube and give the name the type of the reaction.

Expected response

- (a) (i) Heat / enthalpy of solution.
- (ii) The temperature would drop / boiling tube becomes cold.
- (iii) Endothermic reaction.
- (b)
- Heat value
 - Cost of fuel
 - Availability
 - Environmentally friendly/less pollution
 - Cost of transporting the fuel/toxicity of fuel

Question 20

0.1M hydrochloric acid was reacted with sodium thiosulphate solution. The time taken for the cross to disappear was recorded at different temperatures as shown on the graph.



- (a) Explain the shape of the curve. (1 mark)
- (b) What conclusion would be made from the curve? (1 mark)
- (c) Sketch another curve on the same axis that would be obtained when the concentration of hydrochloric acid is doubled. (1 mark)

Candidates were required to visualize the effect of temperature change on rate of reaction and effect of doubling concentration on rate of reaction.

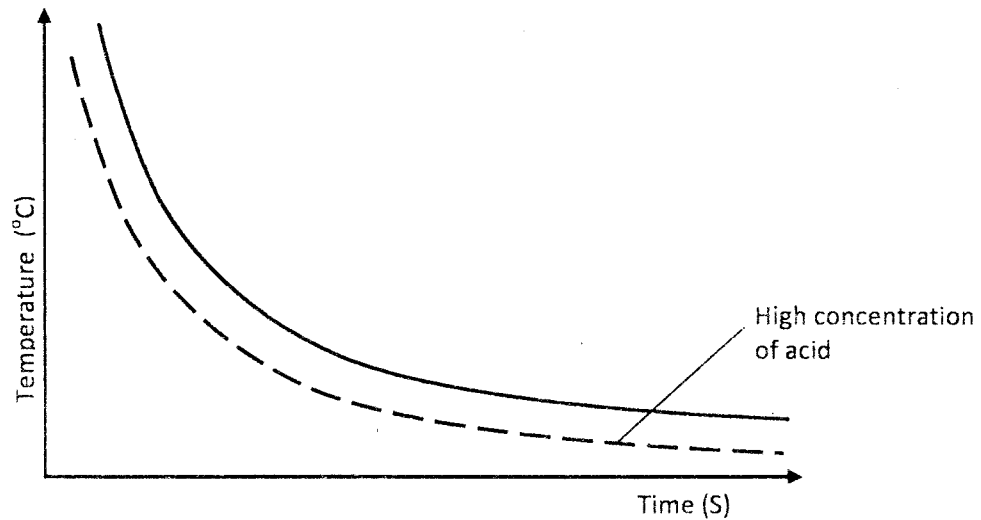
Weaknesses

Candidates could not relate temperature with rate of reaction neither could they relate concentration with rate of reaction.

Expected response

- (a) As the temperature rises, the time taken for the cross to disappear decreases.
OR
as the temperature decreases, the time taken for the cross to disappear increases.
- (b) The rate of reaction increases with rise in temperature.
OR
The rate of reaction decreases with decrease in temperature.

(c) Diagram.



SECTION C: PHYSICS

Question 21

Figure 1, shows an image I formed when an object O is placed in front of a convex mirror.

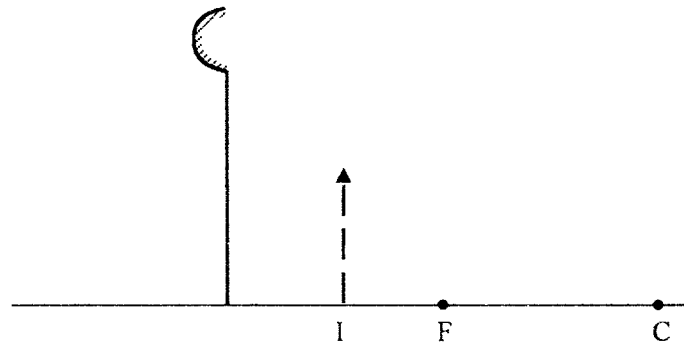


Figure 1

Complete the ray diagram to show the position of object O.

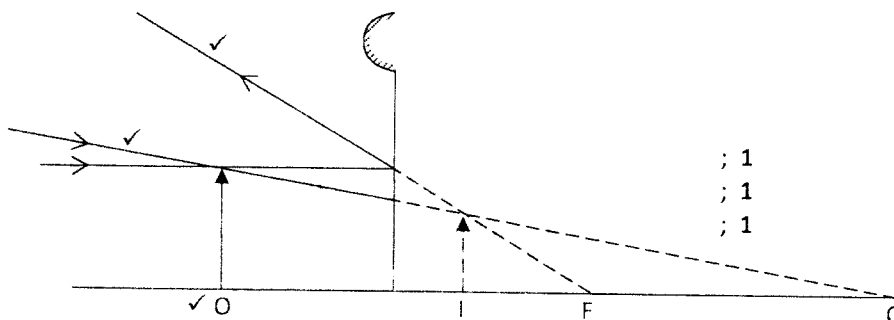
(3 marks)

Candidates were expected complete a ray diagram to show the position of an object placed in front of a convex mirror given the position of the image formed.

Weaknesses

Most candidates treated the given image as the object instead of treating it as the image. They failed to trace the rays backwards after reflection to locate the object.

Expected response



Question 28

Figure 4, shows two circuits X and Y in which two identical coils are used to heat two equal amounts of water. The two circuits are switched on at the same time.

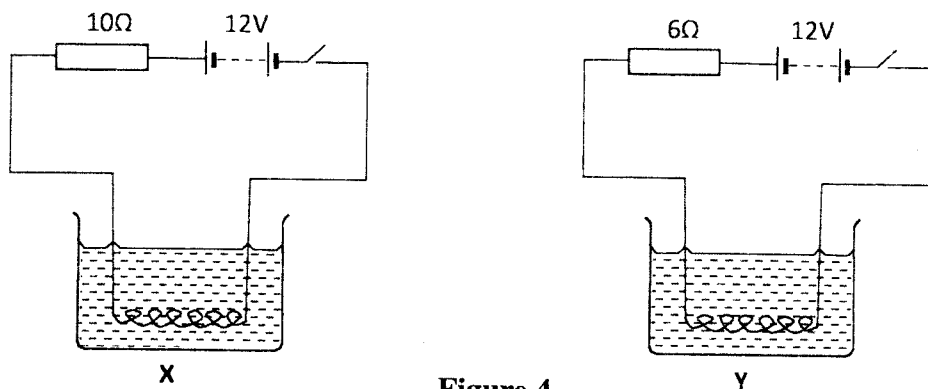


Figure 4

- (a) State the circuit in which the water boils first. (1 mark)
- (b) Explain the answer in (a) above. (2 marks)

Candidates were expected to explain in which of the circuits the water boiled first.

Weaknesses

Most candidates lacked knowledge of factors affecting the heating effect of current. They failed to explain how resistance depends determines the heating effect.

Expected response

- (a) Circuit Y;
- (b) More current is flowing due to less; resistance in the circuit hence a greater heating effect;

Question 34

State **two** ways in which the conductivity of a semiconductor can be increased. (2 marks)

Candidates were expected to state two ways of increasing the conductivity of a semiconductor.

Weaknesses

Most candidates left the question blank sine they lacked knowledge of the topic electronics.

Expected response

- By raising the temperature of the semiconductor;
- By doping the semiconductor ;

Advice to Teachers

Emphasis should be made on:

- Application of knowledge to different situations.
- Proper mastery of content by giving practice.
- Though this is general science, teachers should strive to expose students to many experiments and if this is not possible, carry out demonstrations with them.
- Teachers should strive to ensure that the students grasp the concepts being taught by using creative approaches in presentation of content in class.
- The candidates should seek tuition from practicing teachers as they prepare to sit for examination. This is because majority of candidates taking this paper are private candidates who in most cases don't get qualified teachers to prepare them.