

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 is composed of 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 marks.

CANDIDATES OVERALL PERFORMANCE

The overall performance of candidates in General Science in the years 2010, 2011 and 2012 is as shown in the table below.

Table 13: Candidates overall Performance in the Years 2010, 2011 and 2012

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	1245	100	12.84	10.12
	Paper 2	1245	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

From the table it can be observed that:

- (i) The candidature of General Science increased slightly in 2012 compared to 2010 and 2011 though it was still very low.
- (ii) Paper one performance was fair compared to paper two which is also indicated by an improved standard deviation.
- (iii) There was a slight improvement on overall performance in 2012 when compared to 2011.
- (iv) Generally, the subject was poorly performed since the mean was very low.

The following is a discussion of some of the questions that candidates had difficulties in responding to.

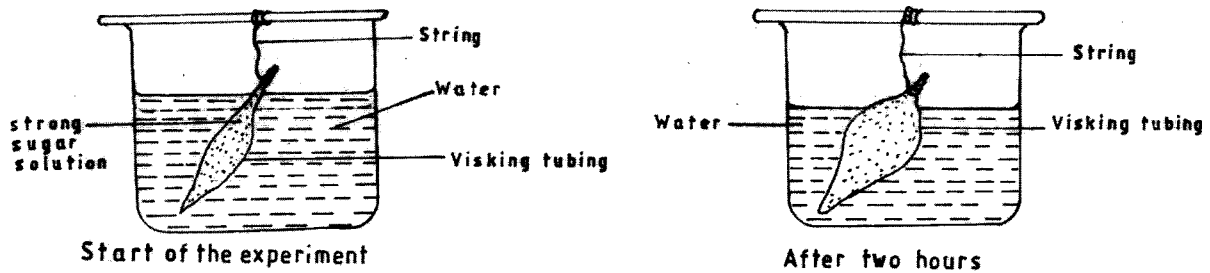
3.6.1 General Science Paper 1 (237/1)

SECTION A: BIOLOGY

In paper one biology section, candidates had difficulties responding to question numbers 3, 4, 6 and 8.

Question 3

The diagrams below illustrate a set-up that form one students used to demonstrate a certain physiological process and the result after two hours.



- (a) Name the physiological process that was being demonstrated. (1 mark)
- (b) Explain the observation made after two hours. (3 marks)

Using diagrams illustrating an experimental set-up, candidates were supposed to identify a physiological process and account for the observation.

Weaknesses

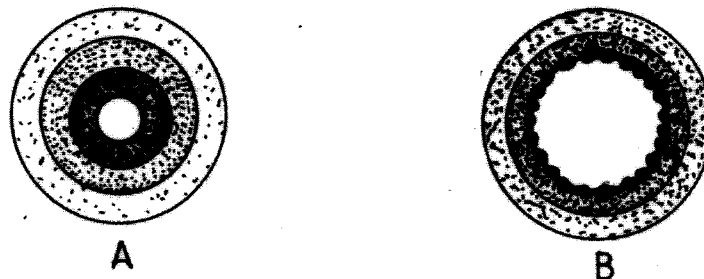
Candidates confused the various physiological processes. They also confused the terms hypertonic and hypotonic solutions.

Expected response

- (a) Osmosis; (1 mark)
- (b) Visking tube bulged because sugar solution is hypertonic; and distilled water is hypotonic; therefore water molecules moved into the visking tube by osmosis; (3 marks)

Question 4

The diagrams below represent cross sections of human blood vessels.



- (a) (i) Name the blood vessel labelled A. (1 mark)
(ii) Give a reason for your answer in (a) (i) above. (1 mark)
- (b) How is the blood vessel labelled B adapted to its function? (2 marks)

From given diagrams, candidates were supposed to identify blood vessels giving reasons. They were also to state the adaptations of a blood vessel to its function.

Weaknesses

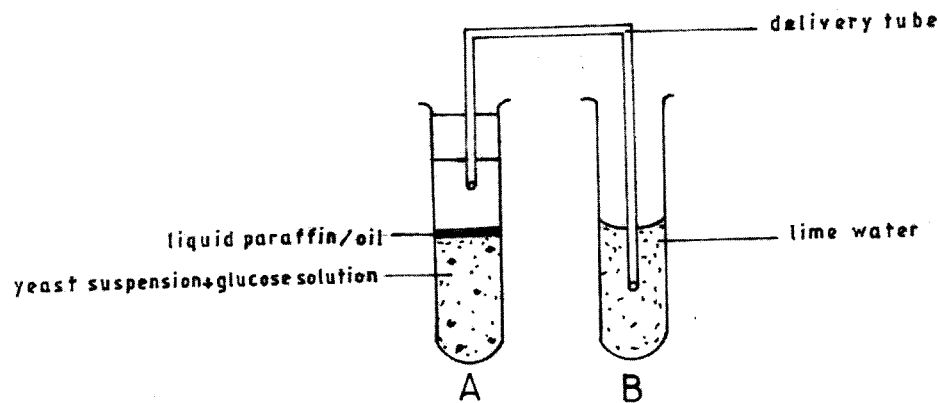
Candidates interchanged the blood vessels and seemed not to know their cross sections. They also didn't bring out the adaptations of vessel asked to its function.

Expected response

- (a) (i) Artery;
(ii) Thick walled/ small lumen; (2 marks)
- (b) Have valves; to prevent backflow of blood;
Has large lumen/ is lined with smooth muscles; to facilitate smooth flow of blood; (2 marks)

Question 6

The diagram below shows an experimental set-up to demonstrate a biological process.



- (a) Name the process being demonstrated. (1 mark)
- (b) State the observations made during the demonstration. (2 marks)

From the diagram, candidates were supposed to identify a certain biological process.

Weaknesses

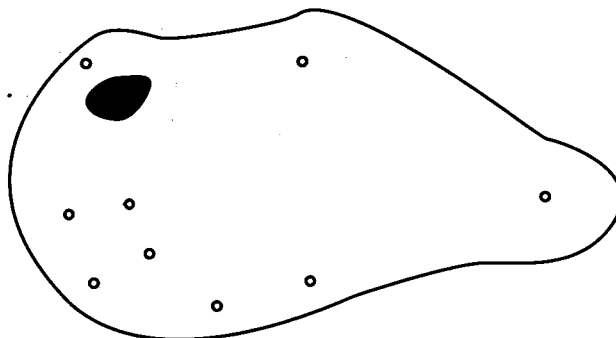
Candidates confused aerobic and anaerobic respiration.

Expected response

- (a) Fermentation/ anaerobic respiration; (1 mark)
- (b) Lime water turns white/ white precipitate is formed; air bubbles produced; (2 marks)

Question 8

Complete and label the drawing below to make it appear like that of a typical plant cell as seen under a light microscope. (3 marks)

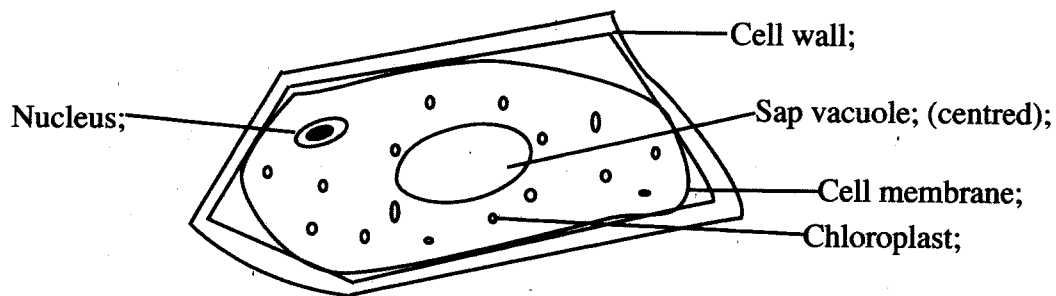


Candidates were supposed to complete and label a drawing to make it appear like a typical plant cell as seen under a light microscope.

Weaknesses

Candidates showed organelles seen under an electron microscope.

Expected response



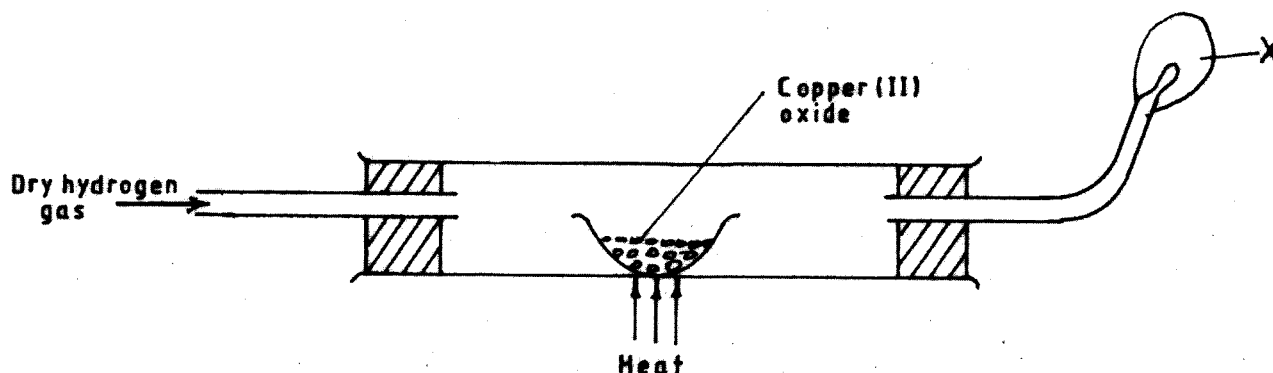
(3 marks)

SECTION B: CHEMISTRY

In paper 1 Chemistry section, the questions that challenged most candidates were numbers 13 (a), 15 (b), 16, 18 and 19.

Question 13 (a)

The diagram below shows a reduction - oxidation process. Study it and answer the questions that follow.



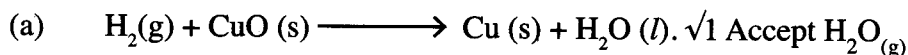
- (a) Write an equation for the reaction between dry hydrogen gas and hot copper (II) oxide. (1 mark)

Candidates were required to write an equation for the reaction of dry hydrogen and hot copper (II) oxide.

Weaknesses

Most candidates wrote a word equation instead of a chemical equation. They were unable to differentiate between **word equations** and **chemical equations**.

Expected response



Question 15 (b)

- (b) Explain why element S is non-reactive. (1 mark)

The question required candidates to explain why element S was non - reactive.

Weaknesses

Most candidates could not identify the group to which element S belongs hence they could not know why it is non - reactive.

Expected responses

- (b) S because its outermost energy level has the maximum number of electrons (octet) hence stable/has the outermost energy level filled. $\sqrt{1}$

Question 16

- (a) Water hardness is classified as either temporary or permanent. What are the causes of permanent hardness in water? (2 marks)
- (b) How is temporary water hardness commonly removed? (1 mark)

Candidates were required to:

- i. State the causes of permanent water hardness;
- ii. State how temporary water hardness is commonly removed.

Weaknesses

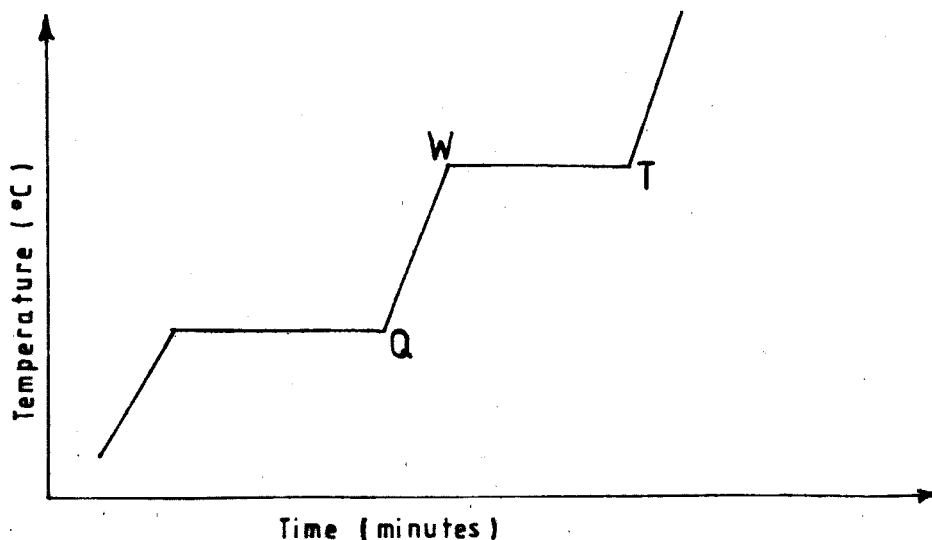
Candidates had no idea on the causes of permanent hardness in water and the common method used to remove temporary water hardness.

Expected Responses

- (a) Mainly caused by sulphates (SO_4^{2-}) of either Mg^{2+} or Ca^{2+} /dissolved MgSO_4 , CaSO_4 or MgCl_2 and CaCl_2 . (2 marks)
- (b) Boiling. (1 mark)

Question 18

The graph below shows variation of temperature when ice is heated over a period of time.



- (a) Using kinetic theory, explain the changes between points:
- (i) Q and W (1½ marks)
- (ii) W and T (1½ marks)
- (b) Name the apparatus that can be used to separate a mixture of water and oil. (1 mark)

Candidates were required to explain using **kinetic theory** the changes between points on a graph of variation of temperature when ice is heated over a period of time.

Weaknesses

Candidates had limited knowledge kinetic theory of matter hence they could not explain the changes.

Expected Responses

- (a) (i) The water molecules absorb heat energy $\sqrt{1/2}$ increasing their kinetic energy $\sqrt{1/2}$ resulting in increased collisions among molecules $\sqrt{1/2}$. (1½ marks)
- (ii) The energy absorbed $1/2$ by the water molecules is used to break the intermolecular forces $\sqrt{1/2}$ making water molecules to change to vapour $\sqrt{1/2}$. (1½ marks)
- (b) Separating funnel/ burette/dropping funnel. (1 mark)

Question 19

- a) Using dot (•) and cross (X) diagram, illustrate the type of bonding in carbon (IV) oxide (Atomic numbers: C = 6; O = 8). (2 marks)
- (b) Give a reason why graphite conducts electricity. (1 mark)

Candidates were required to:

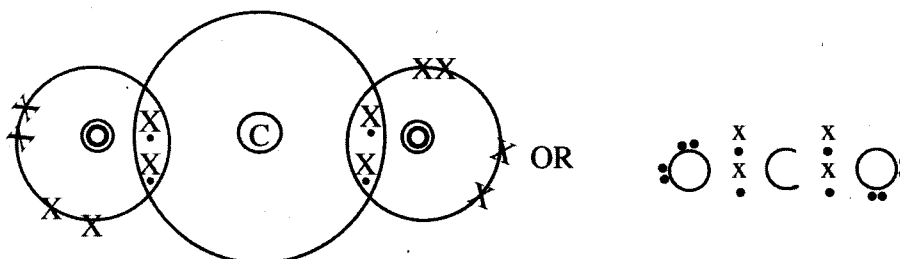
- use dot(.) and cross(x) diagram to illustrate the bonding in carbon (IV) oxide
- Give a reason why graphite conducts electricity.

Weaknesses

Majority of the candidates did not know how to use valency electrons in carbon and oxygen to show the bonding.

Expected Responses

19. (a)



(2 marks)

- (b) Graphite has delocalised electrons/mobile electrons. (1 mark)

SECTION C: PHYSICS

The physics section of general science was poorly performed. Most candidates left the entire section blank, a few who attempted scored very low. This showed a lack of preparedness on the candidates in physics. The questions and marking scheme provided in part II of this report will assist future candidates in preparing for the physics examination, below is a discussion of the questions which were poorly performed.

Question 26

When one end of a metal is heated, the other end gets hot. Explain this observation. (2 marks)

Candidates were required to explain why when one end of a metal is heated the other end gets hot.

Weakness

Most candidates lacked knowledge on transfer of heat through metals.

Expected response

Heated molecules vibrate faster and make the neighbouring molecules to also vibrate faster. (2 marks)
Vibration is relayed to other molecules in the solid hence conduction of heat.

Question 29

Figure 6 shows a graph of force against extension for a spring.

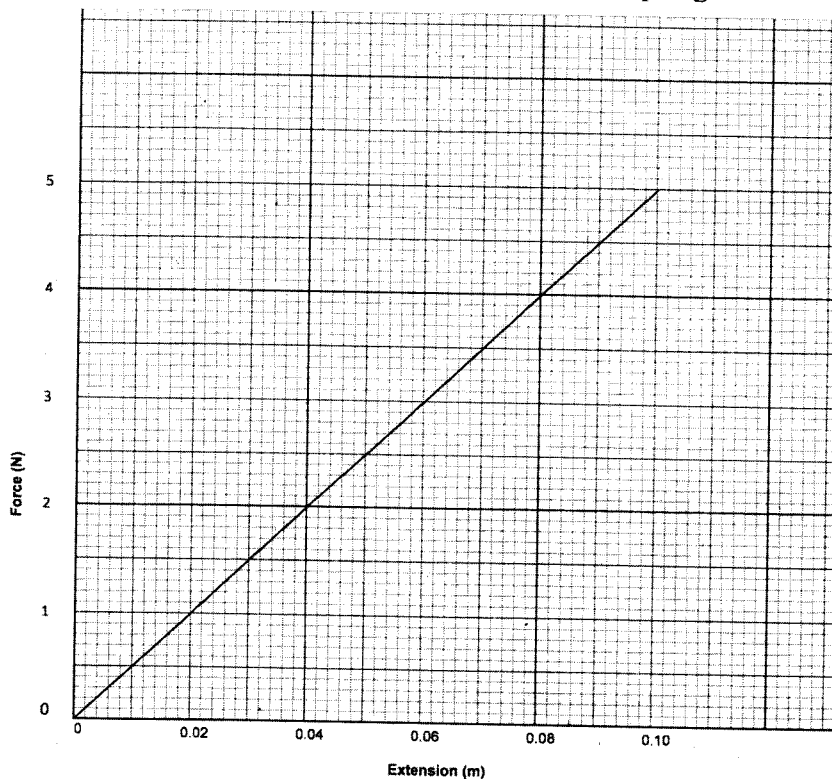


FIGURE 6

Use the graph to determine the spring constant.

(3 marks)

Candidates were required to use a graph to determine the spring constant for a given spring.

Weakness

Most candidates were unable to use the graph to determine the spring constant.

Expected response.

Spring constant = slope;

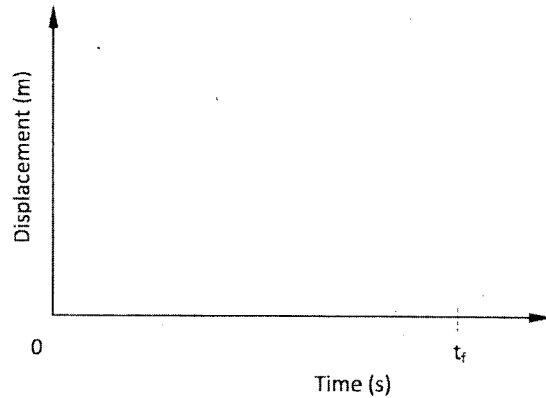
$$\begin{aligned} &= \frac{(5 - 0)\text{N}}{(0.10 - 0)\text{M}} ; \text{substitution} \\ &= 50 \text{ N/m.} \end{aligned}$$

(3 marks)

Question 30

A stone is thrown vertically upwards. On the axes provided sketch the displacement-time graph for the motion of the stone from the time it is thrown to the time, t_f , when it reaches the maximum height.

(2 marks)

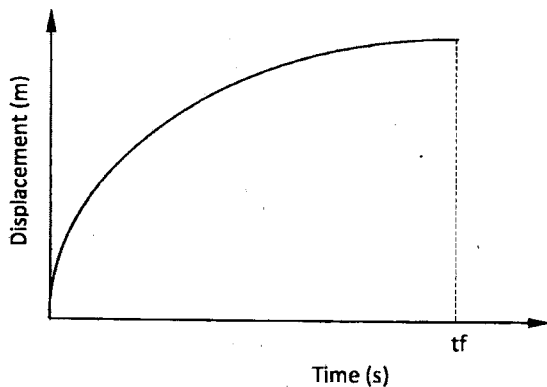


Candidates were required to sketch the displacement time graph for a stone thrown vertically upwards.

Weakness

Candidates left the question blank hence lacked knowledge on motion graphs.

Expected response.



- curve of decreasing gradient;
- gradient of curve is zero at point t_f .

(2 marks)

3.6.2 General Science Paper 2 (237/2)

SECTION A: BIOLOGY

In paper two Biology section, candidates had difficulties in answering question numbers 2, 5, 6, 7 and 8.

Question 2

- (a) State **one** function of each of the following structures in the human reproductive system:
- (i) ovary; (1 mark)
 - (ii) epididymis. (1 mark)
- (b) What is gestation period? (1 mark)

Candidates were required to state functions of parts of reproductive system.

Weaknesses

Students confused production of ova with storage, storage of sperms with production of sperms.

Expected response

- (a) (i) Produce ova; produce hormones; (1 mark)
- (ii) Temporary storage of sperms;
place where sperms develop motility; (1 mark)
- (b) The time between fertilization and birth. (1 mark)

Question 5

- (a) (i) What is natural selection? (1 mark)
- (ii) Give **one** example of natural selection. (1 mark)
- (b) State **one** adaptation of *Ascaris lumbricoides* that enables them survive the digestive enzymes of their host. (1 mark)

Candidates were supposed to state the meaning and examples of natural selection and state adaptation of *Ascaris lumbricoides* that enable them survive the digestive enzymes of their host.

Weaknesses

Candidates were leaving out the aspect of transmission of characteristics in natural selection.

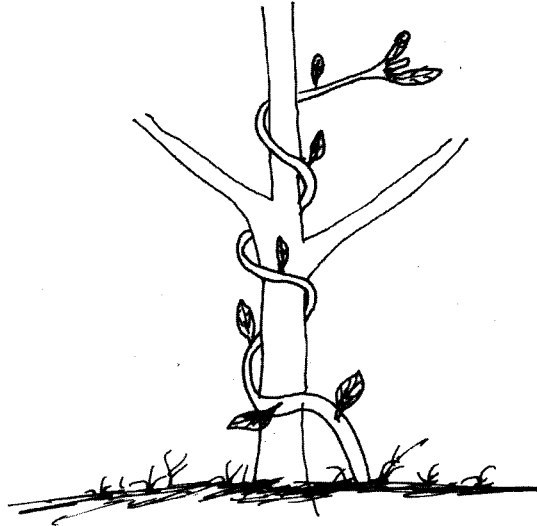
Expected response

- (a) (i) Organisms with favourable variations survive and reproduce while those with unfavourable variations reduce in numbers/become extinct; (1 mark)

- (ii) Industrial melanism/peppered moth;
Resistance to drugs/pesticides/antibiotics; (1 mark)
- (b) Thick cuticle; secretion of anti-enzymes/mucus; (1 mark)

QUESTION 6

The diagram below illustrates a certain tropic response.



- (a) Name the tropic response illustrated in the diagram. (1 mark)
- (b) Give **two** survival values of the tropic response shown above to the plant. (2 marks)

Candidates were supposed to identify the type of tropic response that was shown by a diagram and its survival values to the plant.

Weaknesses

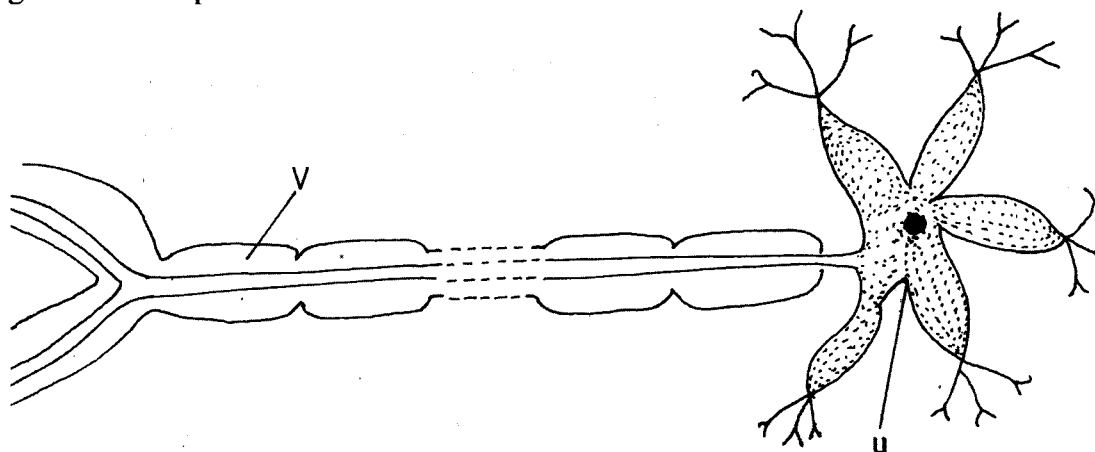
Candidates confused trophic for tropic.

Expected response

- (a) Thigmotropism/Haptotropism; (1 mark)
- (b) Support; exposure to light; (2 marks)

Question 7

The diagram below represents a neurone.



- (a) (i) Name the part labelled V. (1 mark)
(ii) State **one** adaptation of the part labelled U to its function. (1 mark)
- (b) Name the part of the ear that is responsible for balancing. (1 mark)

Candidates were given a drawing of a neurone and were supposed to use it to name and state adaptations of parts of the neurone that were marked.

Weaknesses

Candidates could not identify parts of the neurone.

Expected response

- (a) (i) Myelin sheath; (1 mark)
(ii) U-has dendrites which receive impulses from other neurones; (1 mark)
- (b) Semi-circular canals; (1 mark)

Question 8

- (a) Name **two** types of movable joints in human beings. (2 marks)
- (b) State **one** function of the parenchyma tissue in young plants. (1 mark)

Candidates were supposed to name types of movable joints in human beings and state a function of parenchyma tissue in young plants.

Weaknesses

Candidates confused types and examples of joints.

Expected response

- (a) hinge joints; ball and socket joints; gliding joints; pivot joint; (2 marks)
- (b) Packing; mechanical support; (1 mark)

Advice to Biology teachers

Emphasis should be made on

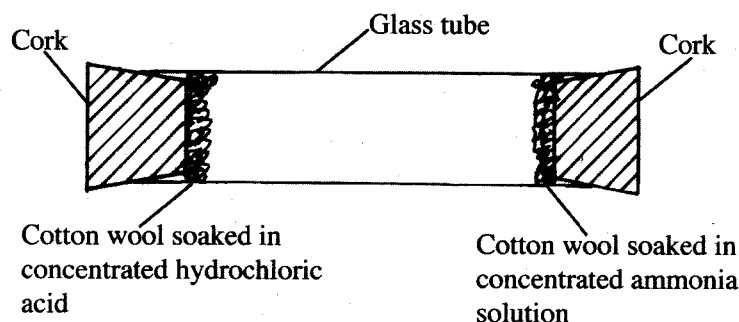
- Teaching all that is indicated by the syllabus and in good time.
- Doing more hands-on activities/practicals to facilitate retention.
- Correct spelling of technical biological terms.
- Drawing skills of biological diagrams.

SECTION B: CHEMISTRY

In paper 2 Chemistry section, the questions that challenged most candidates were question numbers 11, 14, 18 and 19.

Question 11

The set-up shown below was used to investigate the rate of diffusion of ammonia and hydrogen chloride gases. Study it and answer the questions that follow.



- (a) State the observation made in the glass tube. (1 mark)
- (b) (i) On the diagram, indicate with a cross (X) the likely position where the above observation is made. (1 mark)
- (ii) Explain your answer in b(i) above. (1 mark)

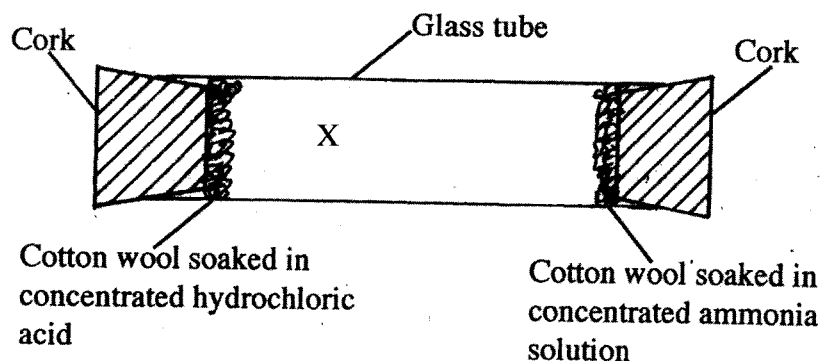
Candidates were required to state the observation made in the glass tube, indicate on the diagram where the observation is made and to explain why the observation is made there.

Weaknesses

Most candidates seem to know the observation made, forgot to show on the diagram where the observation is made and had no idea on the name of the reactants and the product

Expected responses

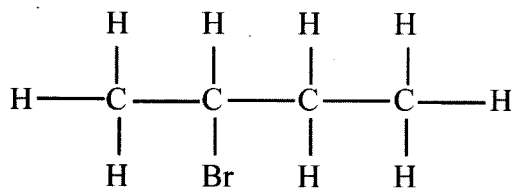
- (a) A white ring is formed in the glass tube. (1 mark)
- (b) (i) The cross (X) should be nearer to the source HCl (g). (1 mark)



- (ii) Since ammonia (RMM = 17) is less dense than HCl gas (RMM = 36.5), it will diffuse faster than HCl. (1 mark)

Question 14

- (a) (i) Name the compound whose structure is given below: (1 mark)



- (ii) Draw the structure of pent-2-ene. (1 mark)

- (b) Describe a chemical test that can be used to distinguish between butane and but-1-ene. (2 marks)

The question required candidates to:

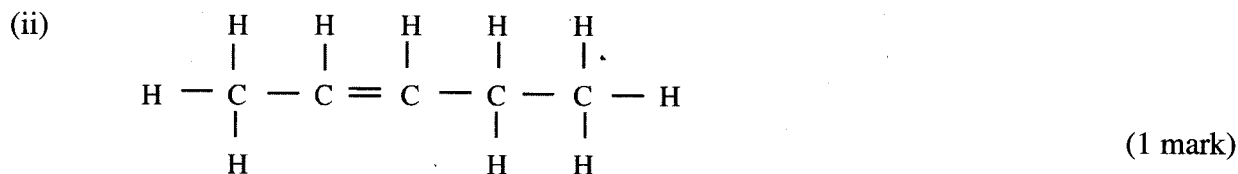
- Name an organic compound
- draw the structure of pent - 2- ene

Weaknesses

Most candidates could not name nor draw the structure of the given organic compounds.

Expected responses

- (a) (i) 2 - bromobutane (1 mark)



- (b) Place acidified potassium manganate (VII)/bromine water in separate test tubes. Bubble the gases separately through the solutions. With but-1-ene, the two solutions will be decolourised while butane will not decolourise both solutions. (2 marks)

Question 18

142g of sodium sulphate were dissolved in 200 cm³ of distilled water. More water was added to make up to 500 cm³ of solution.

- (a) Calculate the molarity of the solution formed (Na = 23.0; S = 32.0; O = 16.0). (2 marks)
- (b) What volume of the solution is required to make a litre of solution of 0.5M. (2 marks)

Candidates were required to:

- Calculate **molarity** of a solution;
- Determine the volume of the given solution required to prepare a litre of **0.5 M** solution.

Weaknesses

Candidates had no idea on how to do the calculations.

Expected Responses

(a) Na_2SO_4 RFM = $(23 \times 2) + 32 + (16 \times 4)$
 $= 46 + 32 + 64 = 142 \sqrt{1/2}$
 $= \frac{142}{142} = 1 \text{ mole } \sqrt{1/2}$

500cm³ contains 1 mole
 1000cm³ would contain ?

$$\frac{1000}{500} \times 1 \sqrt{1/2} = 2 \text{ M } \sqrt{1/2} \quad (2 \text{ marks})$$

(b) $M_1 V_1 = M_2 V_2$
 $2 \times V_1 = 0.5 \times 1000 \sqrt{1/2}$

$$V_1 = \frac{0.5 \times 1000 \sqrt{1/2}}{2} = 250 \text{ cm}^3 \sqrt{1/2} \quad (2 \text{ marks})$$

Question 19

- (a) The raw materials used in the extraction of iron are iron ore, calcium carbonate, coke and air.
- Write an equation for a reduction process in the blast furnace if the ore used was iron (III) oxide. (1 mark)
 - What is the purpose of the calcium carbonate? (1 mark)
 - Explain how the silica impurities are removed from the blast furnace. (2 marks)
- (b) Give **one** alloy that contains iron. (1 mark)

Candidates were required to:

- i. Write an equation for the reaction between iron (III) oxide and carbon (II) oxide;
- ii. State the purpose of calcium carbonate;
- iii. Explain how silica impurities are removed;
- iv. Name an alloy that contains iron.

Weaknesses

Candidates had limited knowledge on the process of extraction of iron metal by reduction method, the raw materials used and the alloys of iron.

Expected Responses

- (a) (i) $\text{Fe}_2\text{O}_{3(s)} + 3\text{CO}_{(g)} \longrightarrow 2\text{Fe}_{(l)} + 3\text{CO}_{2(g)}$ (1 mark)
- (ii) Decomposes to give carbon (IV) oxide and calcium oxide which are both used in the process. (1 mark)
- (iii) Calcium oxide react with silica to give calcium silicate (slug) which form a liquid layer on top of liquid iron as it flows away. (2 marks)
- (b) Steel (1 mark)

Advice to Chemistry teachers

Emphasis should be made on:

- More practice on the topics that involve calculations e.g The Mole ;
- More practice in drawing and naming of organic compounds;
- Adopt practical approach to teaching;
- Where materials are scarce ,improvise and have hands on activities
- Syllabus should be covered in time to allow time for thorough revision

SECTION C: PHYSICS

The performance in the physics section was very poor. Most candidates were not able to give correct responses to the questions. Many candidates were not able to attempt the questions in section C. Candidates are advised to look at the questions and marking scheme provided in part II of this report for future preparation. Below is a discussion of the questions which were poorly performed.

Question 24

Figure 2 shows a block of wood floating in water.

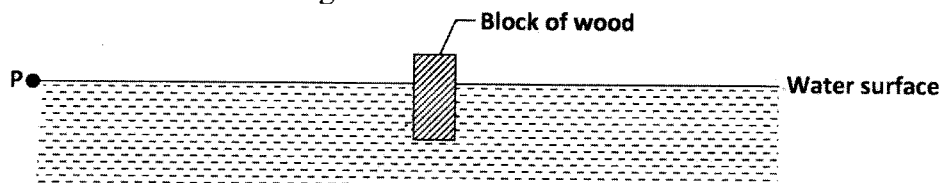


Figure 2

A wave is generated at point P. After some time the block of wood is seen to move up and down. State, with a reason the type of wave formed in the water. (2 marks)

Candidates were supposed to explain the type of wave formed when a block of wood floats on the surface of water after a wave is generated at a point.

Weakness

Candidates left the question blank. They lacked knowledge on water waves.

Expected response

- Transverse wave;
- Movement of the block is perpendicular to the direction of the wave motion; (2 marks)

Question 27

Figure 6 shows a circuit in which a coil of wire is connected in series with a variable resistor, a battery and a switch.

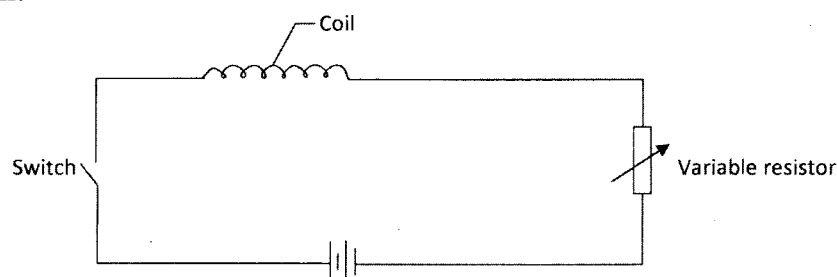


Figure 6

The coil gets heated when the switch is put on. The resistance in the circuit is then reduced using the variable resistor. State, with a reason the effect on the heat produced in the coil. (2 marks)

Candidates were expected to explain the effect of resistance on the heating.

Weakness

Most candidates confused the reducing resistance to reducing amount of current.

Expected response

- Heat will increase;
- Reducing resistance increases the current; (2 marks)

Question 29

Figure 8 shows an object O in front of a diverging lens. The principal focus of the lens is marked F.

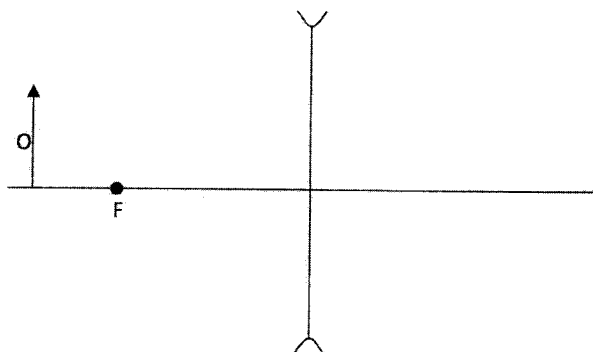


Figure 8

On the figure, draw a ray diagram to locate the image.

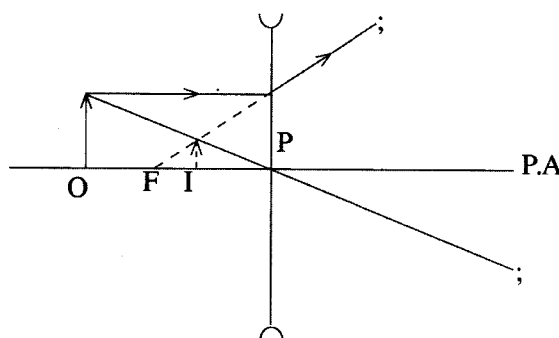
(3 marks)

Candidates were expected to draw ray diagram to locate the image in a diverging lens.

Weakness

Most candidates were drawing lines instead of rays, and confused the lens with a curved mirror.

Expected response



Ray from O parallel to PA then from lens;
Ray from O through pole P;
Image erect virtual at intersection of they rays;

(3 marks)

Advice to teachers and candidates

Teachers and candidates of general science are advised to study the subject topics outlined in the syllabus to be adequately prepared for the examination.

Emphasis should be made on:

- Drawing ray diagrams with arrows to indicate the direction.
- Application of knowledge in different situations.
- Mastery of formulae in all topics.
- Proper mastery of content by giving practice.
- A practical approach to abstract concepts.