

10.0 GENERAL SCIENCE (237)

General science was tested for a second time in the year 2011. It had two theory papers, Paper one (237/1) and paper two (237/2). Each paper had three sections A, B and C. Section A had biology questions with 34 marks, section B had Chemistry questions with 33 and section C had physics questions with 33 marks. Each of the papers was marked out of 100.

CANDIDATES OVERALL PERFORMANCE

The overall performance of candidates in general science in the year 2010 and 2011 was as shown in the table below.

Table 21: candidates overall performance in the year 2010 and 2011

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	1,245	200	22.42	17.29

From the table it can be observed that:

The candidature of general science is still very low, although it slightly increased by **34 students**.

The performance in both papers of general science is very poor.

The overall performance dropped from a mean of **25.44** in **2010** to a mean of **22.42** in **2011**.

There was some improvement in paper 1. Paper 2 registered a drop of 2.29 in the mean.

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

10.1 Paper 1 237/1

SECTION A: BIOLOGY

In paper 1 Biology section, candidates had difficulties in answering questions 2, 3 7 and 10.

Question 2

- (a) Name the organelles observed under the light microscope in plant cells but not in animal cells. (2 marks)
- (b) State **two** precautions that should be taken when placing a microscope on a table for use. (2 marks)

Candidates required to name organelles in plants that are not found in animals and state precautions when handling a microscope

Weaknesses

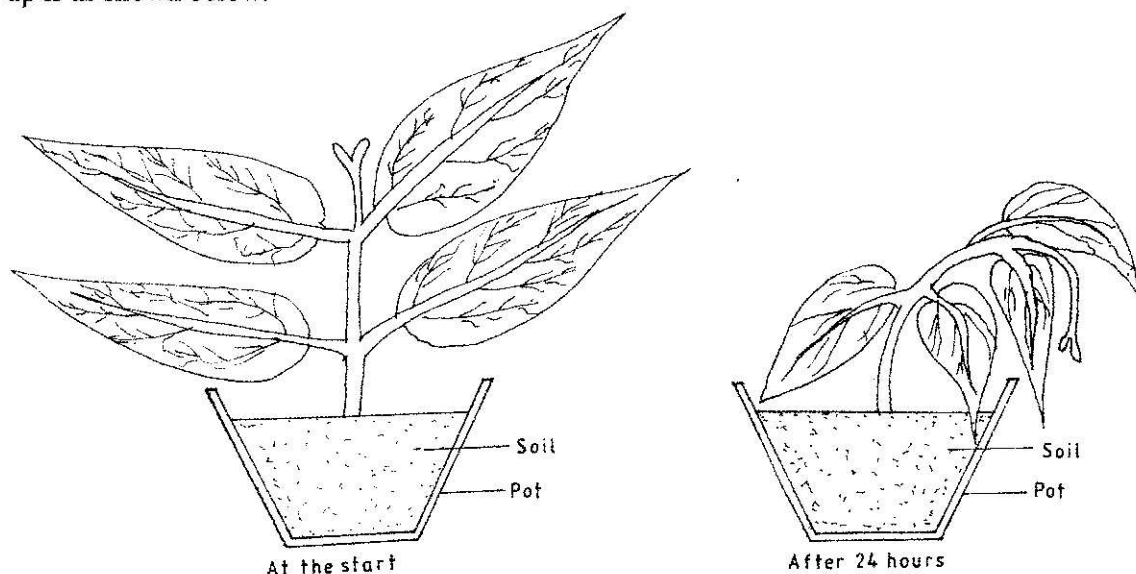
Most candidates were not able to name the organelles. Some didn't know the importance of using both hands when handling a microscope.

Expected response

- (a) Cell wall; chloroplasts; sap vacuole
- (b) Hold the microscope firmly with both hands
(one hand at the arm and the other at the base);
Place the microscope away from the edge of the table.

Question 3

In an experiment a solution was poured around a potted plant and left for 24 hours. The set up is as shown below.



- (a) State the nature of the solution. (1 mark)
-
- (b) Explain the observations made after the 24 hours. (2 marks)

Candidates required to name nature of the solution used in an experiment where a solution was poured round a potted plant and left for 24 hours. Candidates expected to explain the observations made.

Weaknesses

Most candidates lacked knowledge in osmosis process and hypertonic solutions as used in the experiment

Expected response

- (a) Hypertonic;
Solution of high concentration.
- (b) Through osmosis, the plant lost water to the soil environment; this caused the plant to droop/cells became flaccid leading o drooping/wlting;

Question 7

- (a) Name the causative agent of pneumonia. (1 mark)
- (b) State **two** characteristics of an efficient respiratory surface which are absent in an amoeba. (2 marks)
- (c) How is anaerobic respiration applied in the baking industry? (1 mark)

Candidates were required to state characteristics of an efficient respiratory surface in amoeba and state applications of anaerobic respiration in baking industry.

Weaknesses

Most candidates unable to answer the question though it was a recall one.

Expected response

- a) *Pneumococcus/Diplococcus pneumoniae/streptococcus pneumoniae/staphylococcusall*
- (b) High vascularization; ventilation mechanism;
- (c) Produce carbon (IV) oxide that raises dough;

Question 10

State the effects of vasodilation. (2 marks)

Candidates were required to state the effects of vasodilation.

Weaknesses

Most Candidates did not understand what vasodilation means.

Expected response

More blood flows closer to the skin;
More heat is lost, cooling occurs;

SECTION B: CHEMISTRY

In paper 1 Chemistry section, the questions that challenged most candidates were question numbers 11, 13(d), 14, 16,17,18,21

Question 11

What is meant by the following terms?

Valency.

(1 mark)

Electron affinity.

(1 mark)

Candidates confused oxidation state with valency hence they could not give the proper meanings. They were also unable to define electron affinity because they could not figure out the type of energy it is.

Expected responses

Valency - combining power of an element/radical; or number of electron gained or lost by an atom.

Electron affinity - energy released when an atom acquires an electron.

Question 13 (d)

Carbon (IV) oxide does not support burning yet a piece of burning magnesium ribbon continues to burn in a gas jar full of carbon (IV) oxide. Explain. (1 mark)

The question required candidates to explain why burning magnesium continues to burn in a gas jar of carbon (IV) oxide.

Weaknesses

Most candidates could not recall reactivity series of elements hence they lacked knowledge on why burning of magnesium ribbon continues to burn in carbon (IV) oxide which is a non supporter of combustion.

Expected responses

Magnesium has high affinity for the combined oxygen; heat produced by burning magnesium, decomposes carbon (IV) oxide to carbon and oxygen hence the oxygen continues to support the burning.

Question 14

- (a) Using dots (•) and crosses (x) to represent electrons, draw the structure of sodium chloride. (Na = 11.0, Cl = 17.0). (2 marks)
- (b) Name the type of bond in diamond. (1 mark)

Candidates were required to:

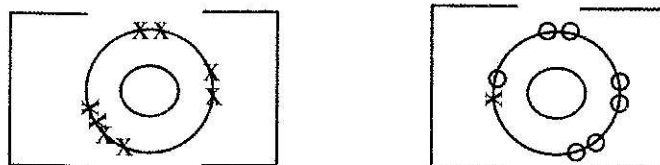
- draw the structure of sodium chloride using dots (•) and crosses (x) given the atomic numbers of the elements
- name the bond type in diamond.

Weaknesses

Candidates confused ionic bond with covalent bond. They were unable to recall what they have learned and apply the knowledge

Expected Responses

(a)



(b) Covalent bond;

Question 16

- (a) State the purpose of P^H scale. (1 mark)
- (b) Hydrochloric acid is a strong acid. Explain the meaning of a strong acid. (1 mark)
- (c) Dilute hydrochloric acid was reacted with solid calcium carbonate in a test tube. Write a balanced chemical equation for the reaction. (1 mark)
- (d) Give **two** disadvantages of washing clothes in hard water using soapy detergents. (2 marks)

Candidates were required to:

- state the purpose of pH scale;
- define a strong acid;
- write a chemical equation of the reaction;
- give disadvantages of using hard water in washing with soaps/detergents.

Weaknesses

Candidates had difficulties in stating the use of the pH scale, defining a strong acid, writing of chemical equation and stating disadvantages of hard water when used with soapless detergents in washing clothes.

- (a) To measure the acidity and alkalinity of a solution or measure the strengths of acids and Bases.
- (b) Strong acid is one that dissociates fully to give more hydrogen ions;
- (c) $2\text{HCl} + \text{CaCO}_3(\text{s}) \longrightarrow \text{CaCl}_2(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l});$
- (d) Waste of soap;/not economical formation of scum stains on clothes

Question 17

- (a) Describe a test that can be used to show presence of water in a substance. (2 marks)
- (b) Magnesium ribbon reacts slowly with water to form a solution that turns red litmus paper blue. Name the solution formed. (1 mark)

Candidates were required to:

- i) describe one test for water;
- ii) name the solution formed by a reaction of magnesium ribbon with water.

Weaknesses

Majority of the candidates were able to name a substance that can be used to taste for water but could not explain the colour changes of the substance. A number of them were unable to name the solution formed from a reaction of magnesium with water.

Expected Responses

- (a) Use anhydrous Copper (II) Sulphate; if it changes form white to blue when in contact with the substance then water is present; /blue anhydrous cobalt chloride paper of cobalt sulphate to pink
- (b) Magnesium hydroxide;

Question 18

State how the following substances conduct electricity.

- (a) Molten calcium chloride. (1 mark)
- (b) Graphite. (1 mark)

Candidates were required state how molten calcium chloride and graphite conduct electricity.

Weaknesses

Candidates confused mobile ions for delocalized electrons and used them interchangeably.

Expected Responses

- (a) Mobile ions;
- (b) Delocalised electrons;

Question 21

- (a) Name the type of reaction that occurs when a solution of lead (II) nitrate is added to a solution of sodium sulphate (in a boiling tube). (1 mark)
- (b) Write a balanced equation for the reaction that occurs when crystals of sodium nitrate are heated in a test tube. (1 mark)
- (c) Give the meaning of an acid salt. (1 mark)

Candidates were required to;

- i) name type of reaction given the reagents;
- ii) write a chemical equation;
- iii) define an acid salt.

Weaknesses

Candidates were unable to name reaction type, write the equation and to define an acid salt.

Expected Response

- (a) double decomposition/precipitation;
- (b) $2\text{NaNO}_3(\text{s}) \xrightarrow{\text{heat}} 2\text{NaNO}_2(\text{s}) + \text{O}_2(\text{g})$;
- (c) Salt that contains replaceable hydrogen atoms;

SECTION C: PHYSICS

In the physics section of paper 1 candidates had difficulties in questions 28, 30,32and 33.

Question 28

Figure 6, shows a ball bearing resting on a flat surface.



Figure 6

- (a) Name the state of equilibrium of the ball bearing. (1 mark)
- (b) State the reason for the answer in (a) above. (2 marks)

Expected Response

Neutral

When the ball bearing is slightly tilted, the position of centre of gravity remains unchanged

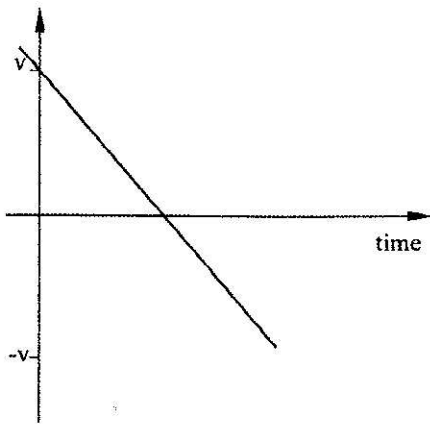
Weaknesses

Candidates were unable to state the reason for their choice of state of equilibrium.

Question 30

A stone is thrown vertically upwards. Sketch a velocity - time graph for the motion of the stone from the time it is thrown until it comes back to the ground. (2 marks)

Expected Response



Weaknesses

Candidates did not comprehend positive and negative velocity and acceleration.

Question 32

Figure 7, shows a pulley being used to raise a load.

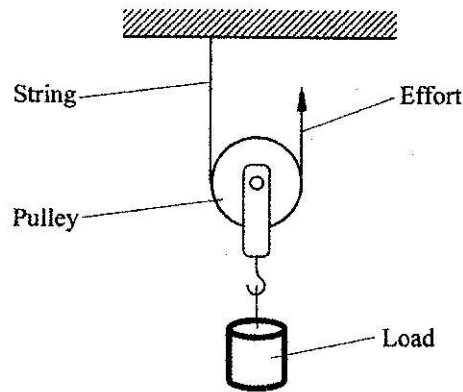


Figure 7

- (a) State the velocity ratio of this machine. (1 mark)
- (b) State **two** factors that reduce the efficiency of this machine. (2 marks)

Expected Response

- (a) 2.
- (b) - weight of the pulley
- amount of friction between the pulley and the string.

Weaknesses

Most candidates confused single fixed pulley with single movable pulley. The students could not appreciate the weight of the pulley as a factor to the reduction of efficiency of the pulley system.

Question 33

- (a) State the law of floatation. (1 mark)
- (b) A ship is made of steel. Explain why the ship is able to float on water whose density is less than the density of steel. (2 marks)

Expected Response

- (a) A floating body displaces its own weight of the fluid in which it floats.
- (b) The ship is "hollow" and therefore its average density is less than that of water.

Weaknesses

Most candidates were not able to state the law of floatation fully and were not able to attribute upthrust concept or hollowness to the floating of the ship

10.2 Paper 2 237/2

SECTION A: BIOLOGY

In the Biology section of paper 2, questions that candidates encountered difficulties in answering were questions 1, 2,4,8,9 and 10.

Question 1

- (a) Name **two** abiotic factors in a soil ecosystem. (2 mark)
- (b) Give an example of parasitism in wood-land ecosystem. (2 marks)

Candidates were required to name a biotic factors in soil ecosystem and give an example of parasitism in wood-land ecosystem.

Weaknesses

A number of candidates did not understand the requirements of part (b) of the question.

Expected response

- (a) Air; moisture; salinity; P^H ; temperature; any two.
- (b) Ticks on buffaloes/tse-tse flies on water bucks/ fleas on monkeys; accept any other correct relationship.

Question 2

- (a) State **two** reasons for sexual reproduction in animals. (2 marks)

- (b) Distinguish between fertilization and ovulation. (1 mark)

Candidates were expected to state reasons for sexual reproduction in animals, name hormone responsible for growth of beards and distinguish between fertilization and ovulation.

Weaknesses

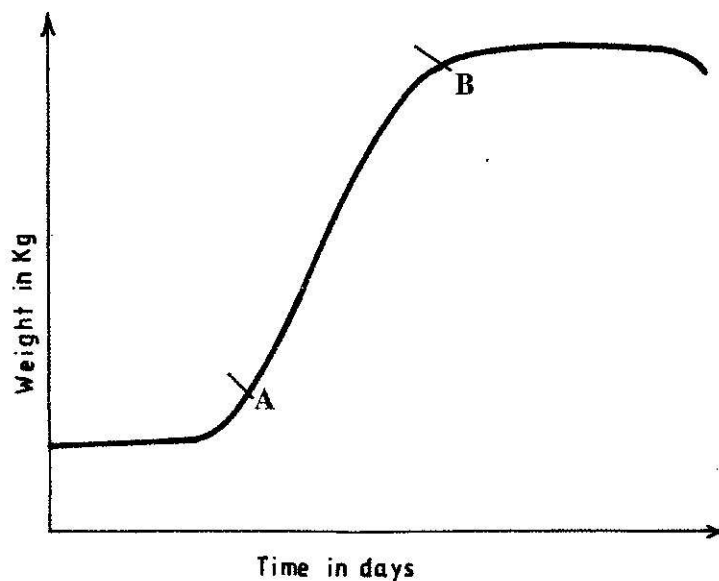
Part (a) and (b) were well answered by most candidates. Part (c) was not answered well since most did not know the name of the hormone.

Expected response

- (a) Pass hereditary characteristics to future generations;
Perpetuate the species/survival;
Continuation of life
Natural selection/enhances variations; any two.
- (b) Fertilization - fusion of sperm and egg to form zygote while ovulation is the release of the ovum from the ovary (into the fallopian tube); (mark as a whole)
- (c) Testosterone;

Question 4

The graph below illustrates growth in an animal.



- (a) Explain what happens between points A and B. (2 marks)
- (b) What is meant by the term seed dormancy? (1 mark)
- (c) Explain what happens when the shoot apex of a plant is removed. (2 marks)

Candidates expected to explain from a graph what happens between two stages of animal growth, state meaning of dormancy and explain what happens when a shoot apex of a plant is removed.

Weaknesses

Most candidates were unable to interpret the graph hence not able to explain it. A sizable number were unable to explain dormancy and what happens when a shoot apex is cut.

Expected response

- (a) Fast/rapid/exponential growth; many cells are dividing/optimum environmental conditions;
- (b) A period during which a viable seed undergoes no growth;
- (c) Lateral buds sprout; due to reduced supply of auxins;
- (d) A period during which a seed does not germinate even if in favourable conditions.

Question 8

- (a) Name **two** supportive tissues in dicotyledonous plants. (1 marks)
- (b) Give an example of a hinge joint in humans. (1 mark)

Candidates were expected to name supportive tissues in dicotyledonous plants and give an example of a hinge joint in humans.

Weaknesses

Most candidates were not able to give names of the supporting tissues and even those who tried, spelling was a challenge

Expected response

- (a) Parenchyma/ sclerenchyma/
Xylem/ collenchyma;/
(b) Knee joint/elbow joint;

Question 9

- (a) State **two** differences between the endocrine and the nervous systems. (2 marks)
- (b) State **one** function for each of the following structures in the mammalian ear.
 - (i) pinna (1 mark)
 - (ii) ossicles (1 mark)

Candidates were expected to state two differences between endocrine and the nervous system, state one function of pinna and ossicles in mammalian ear.

Weaknesses

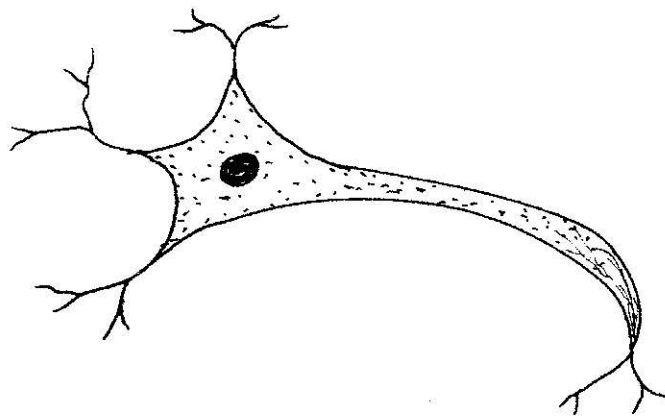
The question was poorly done. Candidates lacked knowledge of functions of pinna and ossicles and differences between nervous and endocrine system.

Expected response

- | | | |
|-----|---|--|
| (a) | Nervous system
Message as electrical impulses
Transmitted within nerves
Rapid
Effects specific | Endocrine system
- message in form of chemicals
- transmitted in blood
- slow
- effects generalised/diffused. |
|-----|---|--|
- (b) (i) pinna: collect sound waves/direct sound waves into the external auditory canal;
(ii) ossicles: Amplify sound vibrations/transmit sound vibrations to the inner ears;

Question 10

The diagram below represents a type of neurone found in animals.



- (a) Name the neurone. (1 mark)
- (b) Give the reason for your answer in (a) above. (1 mark)

Candidates were expected to name the neurone shown in a diagram giving a reason for the answer.

Weaknesses

Most candidates didn't know the name of the neurone and therefore gave no reason for the answer which they didn't have.

Expected response

- (a) Relay/connect/intermediate neurone;
- (b) Presence of many dendrites from the cell body in all directions/has no myelin sheath;

Advice to teachers

Teachers should ensure that they exhaustively cover the syllabus early enough

Teachers should emphasise on the correct spelling of biological terms

Teachers should use practical approach when teaching. When not possible they should use demonstrations to enable students understand science concepts.

SECTION B: CHEMISTRY

In paper 2 chemistry section, some of the questions that were most challenging to candidates were question numbers 13, 15, 16, 17 and 19.

Question 13

One of the methods used for large scale production of ethanol is by fermentation of cane sugar.

- (a) What is meant by fermentation? (2 marks)
- (b) The ethanol obtained is about 4 - 8% concentrated. How can this concentration be increased? (1 mark)
- (c) Other than being used as an alcoholic beverage, state one use of ethanol. (1 mark)

Candidates were required to:

- (i) define fermentation;
- (ii) explain how the concentration of ethanol can be increased;
- (iii) State one other use of ethanol.

Weaknesses

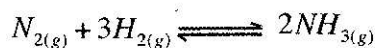
Most of the candidates were unable to define fermentation, explain how concentration can be increased and even state the any other use of ethanol other than as an alcoholic beverage.

Expected responses

- (a) Fermentation is a process in which cane sugar substances is converted into ethanol and carbon (IV) oxide (1) in absence of oxygen. (1)
- (b) Distillation. (1)
- (c) - Fuel
- Solvent,
- Pharmaceutical,
- Chromatography,
- Cosmetics. (1)
- Preparation of Esters, Ethene, Ethanoic
- As an antiseptic

Question 15

In the manufacture of ammonia using the haber process, nitrogen and hydrogen gases react as shown in the equation below.



- (a) State the source of hydrogen gas. (1 mark)
- (b) Explain the effect of increasing pressure on the yield of ammonia. (2 marks)
- (c) Give **one** use of nitrogen (IV) oxide. (1 mark)

Candidates were required to:

- i) state the source of hydrogen;
- ii) explain effect of increase in pressure to the yield of ammonia;
- iii) give one use of nitrogen (IV) Oxide

Weaknesses

Majority of the candidates could:

- i) not state the source of hydrogen ;
- ii) comprehend the Le chatelier's principle;
- iii) give the uses of nitrogen (IV) oxide.

These weaknesses can only be associated with inadequate preparation by the candidates during revision.

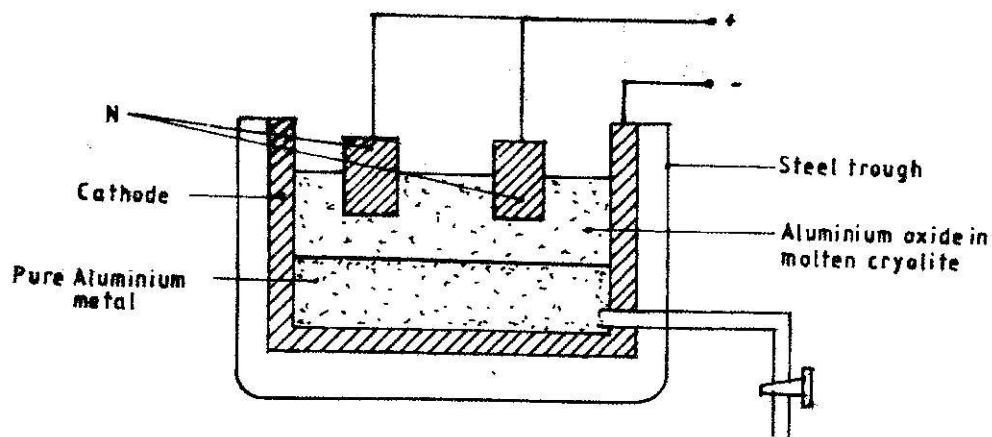
Expected responses

Add water to the mixture, warm and stir, sugar will dissolve;

Filter the mixture to obtain sand as a residue;

Question 16

The diagram below represents electrolytic production of aluminium metal. Study it and answer the questions that follows.



- (a) Why is aluminium extracted by electrolysis and not reduction? (1 mark)
-
- (b) Why is N replaced regularly? (1 mark)
-
- (c) State **one** use of the molten cryolite in the above process. (1 mark)
-
- (d) State **two** properties that makes aluminium metal to be widely used in electric cables. (2 marks)

Candidates were to:

- i) explain electrolytic extraction of aluminium metal as opposed to reduction;
- ii) explain why electrode N is replaced from time to time;
- iii) state the purpose of molten cryolite;
- iv) state two properties that make aluminium to be used in electric cables.

Weaknesses

Inability to apply learned knowledge in the question which could be associated with inadequate revision on the topic of extraction of metals. Candidates were unable to figure out what electrode N could have been made of.

Expected responses

- (a) Aluminium is a reactive metal. (1)
- (b) N is made from carbon electrodes which react with oxygen evolved, forming CO₂, (1)
Hence requires to be replaced regularly.
- (c) Lower the melting point of bauxite. (1)
- (d) - It has a low density (1)
- Is a good conductor of electricity.(1)

Question 17

- (a) What is meant by the term molar solution? (1 mark)
- (b) Calculate the molarity of a solution containing 6.24g of hydrated copper (II) sulphate crystals in 250cm³ of solution. (R.F.M CuSO₄.5H₂O = 249.5). (2 marks)

Candidates were required to:

- (i) define a molar solution;
- (ii) calculate the molarity of copper (II) sulphate solution.

Weaknesses

Most candidates could not define molarity and even work out the molarity.

Expected responses

- (a) Is a solution that contains one mole of a substance per litre. (1)

- (b) 6.24g of CuSO₄.5H₂O contains $\frac{6.24}{249.5} = 0.025$ moles
250cm³ of solution contains 0.025mole
 \therefore 1000 cm³ contains $\frac{1000}{250} \times 0.025$
= 4 × 0.025
= 0.1 moles

Molarity of the solution is 0.1M

Question 19

State Graham's law of diffusion.

(1 mark)

Candidates were required to state Graham's law of diffusion.

Weaknesses

Inability to state the law. Most students just used a collection of words which could not sufficiently state the law.

Expected responses

Under the same conditions of temperature and pressure, the rate of diffusion of a gas is inversely proportional to the square root of its density. (1)

Advice to chemistry teachers

From the above discussion, it can be seen clearly that the performance of the chemistry section was not encouraging. The following steps if observed strictly can help the learners to perform better in future:

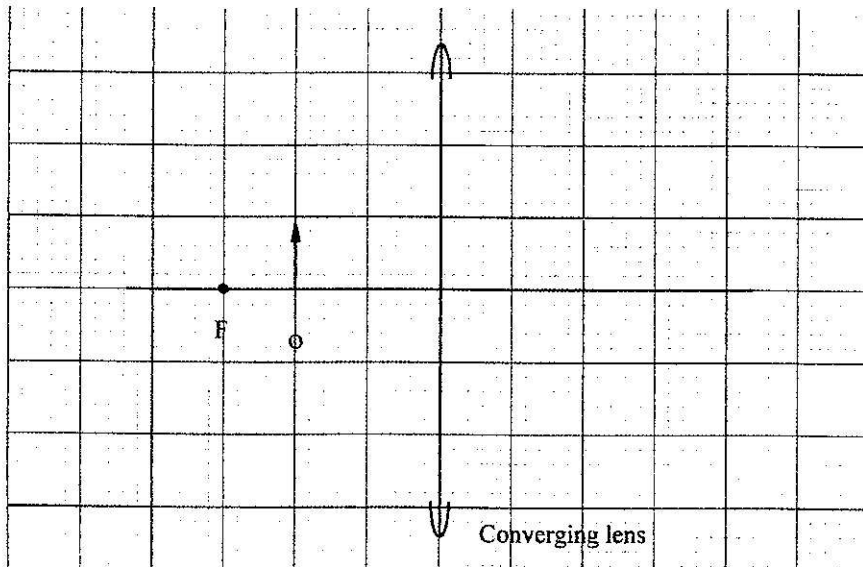
- using practical approach in teaching the subject where possible;
- giving students a lot of practice at the end of every topic;
- giving more practice to weak students especially in topics that involve calculations;
- emphasis should be made on ;
 - (i) writing of equations;
 - (ii) calculations in the topic of Mole;
 - (iii) factors affecting chemical equilibrium.

SECTION C: PHYSICS

In the physics section of paper 2 candidates had difficulties in questions 30,31,32,33 and 35.

Question 30

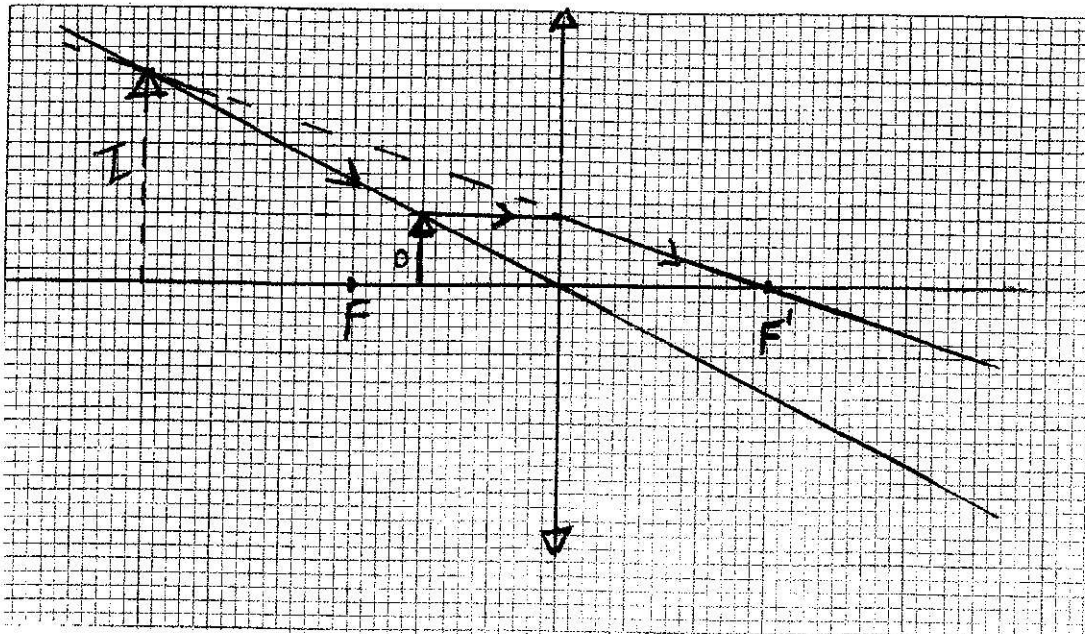
Figure 6 shows an object O placed in front of a converging lens whose principal focus is F.



Draw a ray diagram to locate the image formed.

(3 marks)

Expected Response



Weaknesses

Most candidates lacked knowledge of refraction of light through thin lenses and were not able to accurately draw rays to locate images formed by the lens.

Question 31

An electric cooker has a resistance of 20Ω . Determine the power it dissipates when connected to a 240V mains supply. (3 marks)

Expected Response

$$P = VI$$

$$= \frac{V^2}{R};$$

$$= \frac{240 \times 240}{20};$$

$$= 2880 \text{ watts}$$

Weaknesses

Candidates were unable to relate power to current and voltage as in ohm's law.

Question 32

(a) State the purpose of creating a vacuum in a cathode ray tube. (1 mark)

(b) **Figure 7** shows a horizontal cathode ray entering an electric field between two, charged plates.

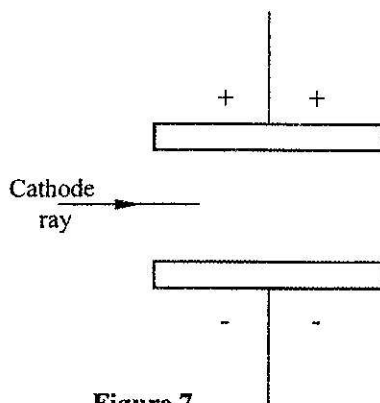
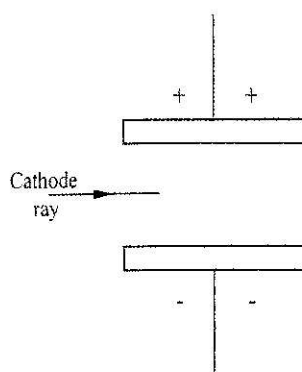


Figure 7

Complete the diagram to show the path of the ray in the electric field. (1 mark)

Expected Response

- (a) to minimize collisions between cathode rays and air molecules;
to minimise reduction of KE of the cathode rays;
to reduce ionization of air molecules.



Weaknesses

Candidates were unable to see cathode rays as electrons that obey the law of charges. They were however able to tell why the tube is evacuated.

Question 33

State how the produced X-rays change, when the anode potential of the X-ray tube is increased. (1 mark)

Expected Response

Higher frequency x - rays are produced more penetrating x-rays/hard x-rays/Higher energy/x-rays/High quality x-rays.

Weaknesses

Candidates did not understand the term anode potential. They did not understand the functioning of an X ray tube.

Question 35

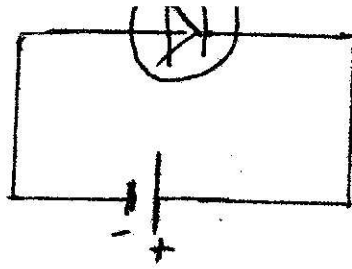
(a) State **one** difference between a semiconductor and a conductor. (1 mark)

(b) Draw a circuit diagram to show a diode connected in the reverse bias mode (1 mark)

Expected Response

(a) conduction in semiconductors is by electrons and holes while in conductors it is by electrons. conductivity of a semiconductor increases with increase in temperature while that of a conductor decreases with increase in temperature.

(b)



Weaknesses

Part (a) was poorly done because candidates could not differentiate a semi conductor from an insulator. In part (b) they could not distinguish between forward and reverse bias.

Advice to teachers

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.