



EXAMINATIONS COUNCIL OF ESWATINI

Junior Certificate Examination

**Science (414)
Examination Report for 2024**

Paper 414/02

General comments

This paper aims at assessing the ability of candidates to confidently apply knowledge of scientific concepts with understanding, handling given information and show skills in problem solving. Candidates are also expected to be able to display science process skills such as carrying out investigations correctly, interpret and evaluate experimental observations and data. The paper seemed well balanced, having both lower order (simple recall) and higher order (application) questions which were assessing all three themes of the syllabus (Physical properties of matter, Chemical behavior of substances and Maintenance and Continuity of Life).

About 16 000 candidates sat for the examination. A majority of candidates fell within the range of 10- scored less than 35 marks and a few were able to obtain marks above 60. There were fewer single digit scores as compared to the previous year. Almost all candidates attempted all questions as required even though full understanding of concepts such as osmosis seemed to be lacking. The overall performance seemed to be better than the previous year.

Examiners noted that candidates had fewer challenges with the rubric compared to previous years and this is applauded. Inappropriate use of grammar had a negative impact to responses given eventually changing the scientific understanding of the concept and this put candidates at a disadvantage. Other common problems include the writing of complete formula in calculations and writing of correct units. Questions that seemed easy were Question 1 (b)(i), Question 2 (c), Question 3 (c), Question 4 (b)(iii) and (iv), Question 5 (b) and (e), Question 6 (c), Question 7 (b)(i) and (iii), Question 8 (b). The most challenging questions were Question 3 (c), Question 4 (b)(iv), Question 5(b), Question 6(c).

Comments on specific Questions

Section A

Question 1

This question was generally well answered, with most candidates being able to score at least 4 marks.

- (a) (i) Candidates were required to state the class of flowering plants to which a maize plant shown on Fig. 1.1 belongs. A majority of candidates were able to identify the flowering plant as monocotyledonous. Common incorrect responses were maize, dicotyledon, class 1 or 2.

Expected response: monocotyledon;

- (ii) In this question, candidates were asked to state **one visible** characteristic they used to classify the plant shown on Fig. 1.1. A majority of candidates were able to give characteristics of monocotyledonous plants. Some candidates had a challenge in writing the correct spelling for fibrous writing it as “fibre” which bring a different meaning to what was required. Another commonly noted error was description of leaves as well as leaf veins e.g. parallel leaves, narrow veins which was incorrect.

Expected response: long narrow leaves;

fibrous/ adventitious roots;

parallel leaf veins;

- (b) Candidates were told that maize is a common source of the nutrient called carbohydrate.

- (i) This part of the question proved to be challenging and most candidates giving the definition of nutrition yet they were required to define the term *nutrient*.

Expected response: chemical obtained from food substances;

required by living organisms to sustain life;

- (ii) Candidates were asked to state the basic unit of carbohydrates.

Expected response: glucose;

- (c) Candidates were required to name the vitamin found in oranges and state its function. The first requirement of the question which was naming the vitamin was well done and most candidates could not clearly state the function. Common incorrect functions for vitamin C were “fights against infections or protects the body” and these could not be awarded a mark.

Expected response:

name: vitamin C/ ascorbic acid;

function: forms collagen/ connective tissues/ walls of blood vessels/ ligaments/ tendons;

maintains healthy skin/ gums/ absorption of iron/ reduce uric acid levels in blood;

Question 2

This question was fairly done. A majority of candidates were able to score at least half of the total marks.

- (a) Candidates were required to complete an equation describing the reaction between vinegar and calcium carbonate. Salt was given as one of the products and candidates had to give the other two products.

Expected response: water;
carbon dioxide;

- (b) Candidates were asked to state **one** physical property of vinegar that shows that it is an acid. A majority of candidates gave the expected response even though some just recalled general properties of acids like “being corrosive” which is not the case with vinegar.

Expected response: sour/ turns blue litmus paper red;

- (c) Candidates were asked to describe how they can use a named indicator to find the pH of vinegar. A majority could not describe how but simply said “use” while some did not give the name of the indicator. Another commonly noted error was failure to describe how the pH is then determined based on the colour change.

Expected response: dip/immerse/ put universal indicator paper/ add drops of universal indicator solution;
match colour formed with colours of pH chart

- (d) Candidates were required to explain why farmers add a base to the soil. Common incorrect responses that could not be awarded a mark include “improve soil fertility/ soil structure”.

Expected response: reduce acid in the soil;

Question 3

The entire question was challenging to most candidates with part (c) being the most challenging.

- (a) Candidates were asked to state the name of the instrument shown on Fig. 3.1. Common incorrect names given included six's thermometer, clinical thermometer.

Expected response: (laboratory) thermometer;

- (b) Most candidates were able to name the parts labelled **A** and **B** on Fig. 3.1 correctly. This demonstrates candidates good knowledge of apparatus.

Expected response: **A** – bulb;
B – mercury/ alcohol (thread);

- (c) Candidates were required to state and explain the observation made on the thermometer when the water in the beaker is heated. The most common incorrect observation given was “temperature increases” yet they were supposed to state that the liquid goes up which implies that there's temperature increase.

Expected response: observation – liquid/ mercury/ alcohol rises/goes up/ mercury thread becomes longer/ volume of liquid in thermometer increases;
thermal expansion of liquid;

Question 4

This question was challenging as well with most candidates scoring less than half of the allocated marks.

- (a) The question required candidates to name an instrument that is used by scientists to magnify a cell. Even though a majority of candidates recalled the name, spelling was the main challenge. Common spellings that could not be awarded included macroscope, micoscope.

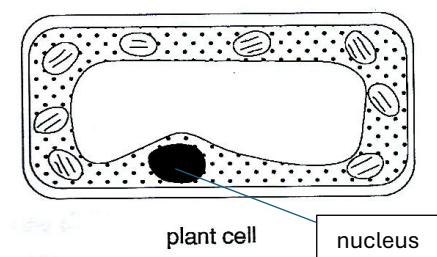
Expected response: microscope;

- (b) (i) Some candidates could identify the name of the plant cell correctly. A few candidates could not write the correct spelling even though a majority seemed to know the name of the plant cell on Fig. 4.1. common wrong spellings included palaside, palisade, palised, palicede.

Expected response: palisade cell;

- (ii) Candidates were required to use a label line to show the nucleus in the plant cell shown in Fig. 4.1.

Expected response:



- (iv) Candidates were expected to explain why a leaf is an organ. A majority gave the general definition of an organ and they missed the second marking point which required that they give the specific function carried out by a leaf.

Expected response: made up of a group of different/ several tissues working together;
to carry out photosynthesis/manufacture simple sugar

- (v) This question required candidates to describe and explain the effect of leaving the animal cell shown in Fig. 4.1 in the concentrated salt solution for 15 minutes.

Expected response: observation – cell shrinks/ becomes smaller/ decrease in size;
explanation - water molecules diffuse out of the cell/ water molecules move out of the cell by osmosis;

Question 5

This question was fairly done with a majority of candidates obtaining at least half of the marks allocated.

- (a) This question required candidates to use a label line to identify a tripod stand in Fig. 5.1. most candidates got this one correct.

Expected response: label line to the tripod stand

- (b) A majority of candidates could not give the required response to this part of the question. Candidates were required to describe the process that takes place in the condenser in Fig. 5.1 in terms of the kinetic particle theory. Most had responses that described the evaporation taking place in the distillation flask.

Expected response: particles lose kinetic energy;
come closer together/ forces of attraction pull particles closer together;

- (c) A few candidates were able to give the name of the apparatus where solid copper sulfate is formed. Most candidates referred to the apparatus as an evaporating flask which was incorrect.

Expected response: distillation flask;

- (d) This question seemed accessible to a majority of candidates. The question required candidates to explain why evaporation is a physical change.

Expected response: reversible/ no new substance is formed;

- (e) Candidates were required to state two physical properties of the distillate formed in Fig. 5.1. Most of them were able to deduce that the distillate is water thus giving the physical properties of water. The most common mistake candidates committed was failure to put units next to the boiling/ melting point leaving these as 100 or 0.

Expected response: boiling point is 100 °C / melting point is 0 °C.
density is 1 g/cm³;

Question 6

This question was fairly done by most candidates. Candidates were mostly challenged by part (c).

- (a) Candidates were expected to state the units used to measure the mass and the height of the elephant shown on Fig. 6.1 and a majority responded well to this question.

Expected response: mass – kilogram/ kg;
height – metres/ m;

- (b) (i) This question required candidates to state what is meant by the term weight.

Expected response: the force of gravity acting on an object/ pull of the earth on an object/ gravitational pull acting on an object;

- (ii) Candidates were required to calculate the pressure exerted by the elephant on the ground. Some candidates missed marks due to failure to write the correct formula or writing the symbols in an incorrect format.

Expected response: $P = \frac{F}{A}$ or $P = \frac{40000}{0.125}$;

320 000;

Pa;

- (c) The question was challenging to most candidates. Candidates could not apply their knowledge on stability to explain why the elephant shown in Fig. 6.2 is unstable.

Expected response: higher centre of mass/ centre of mass is raised/ centre of mass outside the base;
narrower base/ base area has decreased;

Question 7

The question was challenging to most candidates.

- (a) This question required candidates to state the function of the part labelled **D** on FIG. 7.1. A majority of candidates that were able to identify the part as a sperm duct gave the name instead of giving the function. Those that responded by giving what the question required missed the part of stating where it transports the sperms from. Common responses which were incomplete included, “transports sperms, transports sperms from the testis, transports sperms to the penis” and these could not attain the mark.

Expected response: transports/ carries sperms from the testis to the urethra;

- (b) (i) Candidates were asked to describe the term *fertilisation*. Most candidates were able to get the first mark. Common errors was lack of reference to the required terms used when referring to the male and female gametes. Another common error was in this question was the use of and using terms like join, meet, enter for fusion.

Expected response: fusion of nuclei of the male gamete/sperm and the female gamete/ ovum;
resulting in the formation of a zygote;

- (ii) This was the most accessible part in this question and was answered correctly by a large number of candidates. Candidates were asked to describe one method of preventing pregnancy.

Expected response: use a condom/ abstain;

- (iii) Candidates were asked to describe how engaging in unprotected sexual intercourse increases the risk of HIV infection. It was common for candidates to use “sleeping” when referring to sexual intercourse as even though sexual intercourse was given in the question, and this did not earn marks. Candidates could not describe the need for exchange of body fluids in order to transmit the virus.

Expected response: promotes exchange of body fluids/ blood;
between infected and uninfected sexual partner;

Question 8

The question was fairly answered. A majority of candidates were able to score at least 4 of the 7 marks allocated in this question.

- (a) Candidates were asked to state the chemical name of the white solid formed when magnesium ribbon burns in oxygen. Even though a majority could identify the chemical name correctly, a few referred to the solid as ash and this could not be awarded a mark.

Expected response: magnesium oxide;

- (b) The question required candidates to explain why oxygen, O₂, is a molecule. Candidates seemed to have a better recall of the definition, and this was observed with the good responses which referred to 'chemically combined/ bonded'.

Expected response: (made up) two oxygen atoms;

chemically combined/ bonded;

- (c) Candidates were required to complete a table by describing the use of aluminium that relates to the property of having a low density. Also, the property of copper that makes it suitable for making electrical wiring.

Expected response: use of aluminium – manufacture of aircraft bodies;

property of copper – good/excellent conductor of electricity;

- (d) This question was accessible to a majority of candidates. They were required to state two elements used to make mild steel.

Expected response: iron;

carbon;

Question 9

This question was generally well answered.

- (a) (i) This part of the question required candidates to describe the relationship between resistance and the thickness of a conductor.

Expected response: the larger the cross-sectional area, the smaller/lower the resistance/ (or reverse argument)

- (ii) Most candidates were able to state another factor that affects the resistance of a conductor.

Expected response: length/ type of material/ temperature;

- (b) (i) Candidates were required to describe one difference between a conductor and an insulator of electricity. Strong responses showed evidence of comparisons. Some candidates lost marks as a result of referring to either a conductor or an insulator.

Expected response: conductor allows flow of electric charge/ electric current while an insulator does not;

- (ii) Candidates were required to state one example of a conductor and an insulator.

Expected response: conductor – metal wires/ graphite/ graphene;

insulators – non metals except for graphite/ graphene;

- (c) Candidates were asked to calculate combined resistance in a series circuit. Strong responses included the use of correct formula. There was evidence that some candidates continue to write expressions ' $R_1 + R_2$ ' without the subject of the formula.

Expected response: $R = R_1 + R_2 / 5 + 7$;

12;

Section B

Question 10

This question proved to be challenging to many candidates. Some candidates did not attempt this question. The question tested understanding of concepts on the process of photosynthesis.

- (a) Candidates had to describe how the student de-starches the plants in this investigation described. Marks were missed by candidates who referred to less than 24hrs which is not enough for completely destarch most plants. Some could not state the required duration.

Expected response: place the plants in the dark for at least 48 – 72 hrs;

- (b) (i) Most candidates were able to state the hazard that is prevented by placing the test tube with alcohol in a hot water bath.

Expected response: to prevent alcohol from catching fire/ alcohol easily catches fire/
alcohol is flammable;

- (ii) Candidates were asked to explain the importance of boiling the leaf in alcohol. Strong responses referred to both decolourising and ease of observing colour change. Some candidates referred to chlorophyll as chloroplast and this was not credited.

Expected response: to remove chlorophyll/ decolourise leaf;
to make it easier to see colour change;

- (c) The question required candidates to describe observations made leaves from the different plants were tested for starch.

Expected response:

	leaf from potted plant E	leaf from potted plant F
observation	blue black	brown;
explanation	starch is present/ photosynthesis took place;	there is no starch/ photosynthesis does not take place;

Question 11

This question was seemed challenging and there was a common failure to follow instructions in the question.

- (a) Candidates had to describe how they would use the provided material to measure the volume of the guava. A majority of candidates described the process using other apparatus that were not given in the question e.g. displacement can. Candidates demonstrated understanding of the displacement method but skill such as recording of reading were lacking in their descriptions.

Expected response: half fill the measuring cylinder with water and record its initial volume;

gently lower the guava into the water until fully immersed;
record the final/ new volume of the guava and water;
volume of the guava = final volume – initial volume;

- (b) Most candidates were able to read the mass of the guava on the balance but did not write the unit for mass. Some gave the mass in kilograms which resulted to no mark.

Expected response: 20 g;

- (c) Candidates were required to calculate the density of the guava. The most common mistakes were the writing expression (mass volume) excluding the subject of the formula, and inaccurate rounding off of the answer.

Expected response: $\text{density} = \frac{\text{mass}}{\text{volume}} = \frac{20}{15};$
1.33;

Question 12

Question was fairly done. A large number of candidates seemed to be familiar with the preparation of oxygen.

- (a) Candidates were required to name substance **G** and apparatus **H** in Fig. 12.1. Most candidates gave the correct names. Common errors were basin or for trough and incorrect spelling of permanganate.

Expected response: **G** – potassium permanganate;

H – trough;

- (b) Candidates were asked to state **one** property of oxygen that make it possible for it to be collected using the downward displacement method. Generally, most candidates gave the expected response even though some compared the density of oxygen to that of air instead of water.

Expected response: slightly soluble in water/ less dense than water;

- (c) Candidates were asked to describe the test for oxygen stating the result. Many candidates displayed familiarity with the test. Some lost marks for stating instead of describing e.g use a glowing splint.

Expected response: test: put/ insert a glowing splint into the test tube;

result: relights/ burns brighter/ re-ignites;

- (d) The question required candidates to describe the observation made when burning coal is introduced in the test tube with oxygen. A common wrong response was ‘the coal continues to burn’

Expected response: coal burns brighter;