

**EXAMINATIONS COUNCIL OF
ESWATINI**

JC

EXAMINATION REPORT

FOR

SCIENCE

YEAR

2021

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 23 000 candidates sat for this examination, which was a great increase from the previous years. Only about 1% of candidates managed to get 60 marks and above, with a majority falling within the range of 10 – 30 marks. Most of the questions proved to be generally challenging to the candidates. A majority left some questions unanswered (blank answer spaces) and this displayed inadequate preparation for the examination. This may have been caused by the disturbances experienced due to Covid-19. Only a few candidates managed to obtain more than half of the overall marks on offer, and this affected the overall performance greatly.

It was noted with concern that the use of English Language in expressing and presenting concepts still remain a challenge to most candidates especially in descriptive questions. Inappropriate use of grammar had a negative impact to responses given eventually changing the scientific understanding of the concept and that put candidates at a disadvantage. Other common problems included the writing of complete formula in calculations and writing of correct units.

Questions that seemed easy were **Question 3 (a)**, **Question 7 (b) (i) and (iii)**, **Question 8 (a)** and **Question 12 (b) (ii)**. The most challenging questions were **Question 9 (b) (iii)**, **Question 11 (a) (i) and (ii)** and **Question 12 (c)**.

Comments on Specific Questions

Section A

Question 1

This was a fair question and was fairly done, with most candidates being able to score more than half of the marks on offer.

(a) Candidates were asked to state **one visible** characteristic of the cheetah in Fig. 1.1 that showed that it is a mammal. Only a few candidates were able to give the correct response which was “skin covered with fur/hair” and they had a challenge in writing the correct spelling of fur.

Some candidates were giving other characteristics of mammals such as having mammary glands. These were not awarded any marks because the question required that they state only those that were visible in the given figure.

(b) This part was fairly done as well. Most candidates were able to describe two characteristics of living things shown in Fig 1.1 as movement and sensitivity. There were only a few candidates that gave other characteristics such as excretion, growth, reproduction, and these were not awarded any marks because they were not shown in the given figure. Some were giving responses such as running, chasing instead of movement.

Teachers are encouraged to make emphasis on the use of terms given in the syllabus in describing characteristics of living things.

(c) Most candidates displayed understanding on the feeding relationships between organisms in a food chain. This was noted in their ability to arrange the organisms in the correct order. The main problem that caused poor performance in this question included failure to use arrows in separating organisms to show the correct direction of flow of energy in the chain. Some of those who remembered to use arrows drew them in the wrong direction for example:

grass ← buck ← cheetah
 or cheetah → buck → grass

Such responses were not awarded any marks because it was scientifically incorrect. Some candidates were starting their food chains with “Sun” instead of starting with a producer. Other common mistakes noted were the use of commas to separate organisms or using dash line (-). Candidates are encouraged to refer to given diagrams in such questions instead of being general. This was a concern as some candidates were constructing food chains using organisms that were not shown in the question.

Expected response: grass → buck → cheetah

- (d) This question proved to be easy to most candidates. They showed understanding that some energy gets lost as it is transferred from one organism to another. A majority were able to state that the cheetah gets the least amount of energy.

Question 2

This question was poorly done, most candidates failed to obtain more than half of the allocated marks. Quite a number of them were scoring zeros in this question.

- (a) Candidates were required to calculate the volume of a regularly shaped concrete block given its dimensions. It was noted that candidates not writing formulas first when doing calculations. This was seen in most scripts where candidates were simply multiplying the dimensions given to get the volume without first indicating the formula used. Those who attempted to write the formula were only giving the last part without indicating the subject. Another mistake candidates committed was writing the correct value with wrong units e.g., 1cm^3 or 1m^2 , forfeiting some marks in the process. Proper indication of used formula is encouraged when doing calculations.

Expected response: $V = l \times b \times h$
 $= 2.0\text{mm} \times 1.0\text{mm} \times 0.5\text{mm}$
 $= \underline{1\text{m}^3}$

- (b) (i) This part was also poorly done. Most candidates who attempted this question failed to give the proper definition of *weight*. Most were defining weight as the measure of how heavy an object is, which is scientifically incorrect. This was a common misconception from a majority, and examiners' assumption was that candidates are used to the everyday use of a bathroom scale being said to measure weight of an individual instead of mass. Some of those who related weight to gravitational force were not indicating clearly the effect of the gravity on the object e.g. pulling or exerted or acting.

Expected response: weight is the amount of gravitational force acting/exerted on an object.

- (ii) This question was well done. Quite a number of candidates scored all 2 marks allocated. They were able to name the instruments used for measuring the two quantities. Mass being measured using a triple beam balance and weight measured using a spring balance. A few were swapping the two instruments by giving a triple beam balance for weight and a spring balance for mass or even giving spring balance for both quantities. In such cases, candidates

lost the mark for the mass. Other candidates were writing incomplete names e.g., triple beam, top pan, lever arm etc.

- (iii) This question was not well done. Only a few candidates were able to recall the formula for calculating pressure as $P = F \div A$.

Most candidates were calculating the weight by dividing the given mass in the stem of the question (2600kg) by the area (2m^2) giving 1300 Pa which was incorrect.

Correct calculation: Pressure = Force \div Area

$$= 26\,000\text{N} \div 2\text{m}^2$$

$$= \underline{13\,000\text{ Pa}}$$

- (iv) This part was also not well attempted. Candidates were unable to show the relationship between pressure exerted and the area. Most were explaining the effect of changing the base on the stability of the block e.g. base will be small making the block to be less stable.

Expected response: the base becomes smaller
 resulting in an increase in pressure

Question 3

This question was fairly done. Many candidates were able to score 3 out of 5 of the marks offered.

- (a) The correct response was sublimation. The most common challenge was writing incorrect spellings. Only a few candidates gave the wrong process which was evaporation. It was assumed that the candidates might have missed the part that required them to state that iodine was changing from solid. Otherwise, the question was well done.

- (b) Most candidates were getting half the total marks allocated in this question due to drawing many particles causing them to be too close to each other or failing to draw particles of equal size representing one pure substance.

Expected response: - particles should be of the same size
 - large spaces between particles (one particle should be able to pass between two others)

Note: particles of a gas should be randomly arranged with no regular pattern

- (c) Candidates failed to relate the ability of a substance to flow to movement of particles from place to place. As a result, their explanation was based on the concept of solids having a fixed shape therefore

not able to flow and liquids taking the shape of any container. This was not awarded any mark because the explanation was not based on the required scientific concept in terms of the kinetic particle theory.

Expected response: liquids can flow because particles can move from one place to another while solid particles vibrate in fixed positions.

Question 4

The most common mistake in this question was the use of food sources not given in the meal that was provided. This resulted in a loss of marks which eventually affected the overall performance.

(a) Candidates were giving their own food sources for provision of the given nutrients. Some went to the extent of stating deficiency symptoms as functions of nutrients. This is highly discouraged. Otherwise, this question was fairly done.

Expected response:

nutrient	source in the meal	function in the body
fats	peanut butter	for energy
proteins	peanut butter/ milk	for growth and repair of tissues
calcium	milk	for strong bones and teeth

(b) This question was attempted by almost all candidates, unfortunately candidates were describing the physical digestion that takes place in the mouth which applies to all food substances instead of chemical digestion. Candidates were required to be specific on digestion of starch.

Expected response: starch digested by salivary amylase to maltose

(c) This question was well done. A majority of candidates failed to identify the part of the alimentary canal where absorption of glucose takes place. Most were general, stating that glucose is absorbed in the intestines yet intestines are separated into the small and large intestines. Only a few were able to name the process by which glucose is absorbed.

Expected response: glucose absorbed in the small intestines/ ileum by the process of diffusion (into blood capillaries)

Question 5

This question was fairly done. Most candidates were able to get average marks of 3 out of 6.

Candidates were asked to state any two renewable sources of energy other than water. Most were able to state biomass, geothermal, wind or solar.

A few candidates were giving examples of biomass which were taken from their textbooks e.g. wood, dung and bagasse. In such cases, candidates were awarded only one mark because responses belong to the same category.

(b) (i) This was a fair question and about half the candidates were able to name the power station in Fig. 5.1 as a hydroelectric power station. Some would say hydro power station. Those who named it as an electricity power station were not awarded marks because that was seen as a repetition of information given in the question.

(ii) This was also fairly done even though some candidates failed to show the proper conversion of energy in the power station. Most were able to score the first mark by stating the energy possessed by the water in the dam as gravitational potential energy.

Some candidates lost marks due to listing other conversions which do not result in the generation of electricity e.g. potential energy \longrightarrow kinetic energy \longrightarrow sound energy \longrightarrow electrical energy. Such an arrangement was found to be scientifically incorrect.

Expected response: (gravitational) potential \longrightarrow kinetic energy \longrightarrow electrical energy

(iii) This part was well done. Candidates were able to recall the law of conservation of energy. Only a few candidates missed the concept and stated ways of conserving electrical energy e.g. switch off unused appliances, use energy saving bulbs etc.

Expected response: energy is neither created nor destroyed.

Question 6

Question was fairly done. Common mistakes noted were failure by candidates to the term compound with reference to NaCl and not being able to state observations which indicate that candidates might not have been exposed to practical activities.

(a) (i) Candidates were giving a general definition of a compound yet they were required to define with reference to sodium chloride, NaCl. In such a case candidate scored only half of the marks allocated.

Expected response; NaCl is a substance made up of two elements/ two different atoms that are chemically combined /bonded

- (ii) Candidates were required to describe how NaCl differs from a mixture. Some candidates missed marks by describing how a mixture is without describing NaCl while some went to the extent of describing the difference between a physical change and a chemical change.

Expected response:

- NaCl has elements chemically combined while a mixture is physically combined
- elements in NaCl can be separated using chemical means while in a mixture, substances are separated using physical means
- in NaCl elements are combined in a fixed ratio while in a mixture there is no fixed ratio

- (b) Candidates were able to state the charge of a proton as positive but had a challenge with stating the position of a neutron in an atom. Most candidates were giving names of parts of a cell e.g. cytoplasm.

Expected response: nucleus.

- (c) (i) Failure to give distinguishing physical properties of group one metals may have attributed to candidates not performing well in this question. Candidates were mostly giving general properties of all metals, yet the question required that they single out those that are specific to alkali metals (Group 1). The most common one that candidates mentioned was their **softness** that enables them to be cut with a knife. Other correct physical properties were low melting and boiling points.
- (ii) This question was challenging. The main challenge was understanding the term observation. For instance, some candidates mentioned that hydrogen gas was produced yet it is the bubbles that are observed. Lack of practical activity might have been the reason why candidates did not do well in this question.

Expected responses: - bubbles

- decrease in the size of sodium
- water becomes milky white
- fizzy/hissing sound

Question 7

This question was fairly done with a majority of candidates scoring about 4 out of 7 marks.

- (a) Candidates were able to name the part labelled L as the trachea. Only a few named it as a windpipe and this was not awarded any marks.

- (b) (i)** This question was well done. Most candidates were able to identify gas **M** as carbon dioxide
- (ii)** This question proved difficult for most candidates. A majority of candidates could not name the process by which gaseous exchange takes place. Some wrote respiration while others wrote gaseous exchange as their responses.

Expected response: diffusion

- (iii)** This question was the accessible to most candidates. They were able to identify a red blood cell in the given diagram (disc shaped cells moving inside the capillary). Only a few labelled the cells of the epithelial lining of the capillary or the internal lining of the alveolus.
- The most common mistake noted here was labelling using arrows instead of a label line. This is highly discouraged when labelling diagrams because an arrow is used to show direction in science. Such candidates lost marks in this question.
- (iv)** Performance was also good in this question. Candidates were able to show a comparison in oxygen content between inhaled air and exhaled air. Those who lost marks were only identifying gas **N** as inhaled air and **P** as exhaled air with no comparison in terms of the amount of oxygen in each.

Expected response: **N** contains more (21%) oxygen while **P** contains less (16%)

- (c)** This question was well done. Quite a number of candidates were able to score all 2 marks allocated. Those who missed marks were saying the rib cage contracts yet it's the muscles that contracts causing the rib cage to move up.

Expected response: rib cage moves up and outwards/ raised
diaphragm is lowered/flattens/ moves down

Question 8

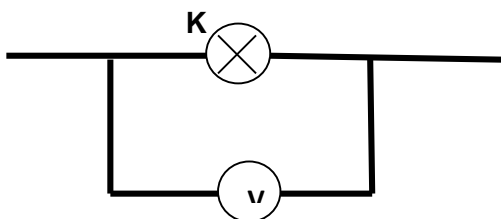
The performance was considered satisfactory in this question. Candidates displayed good understanding of concepts learnt in the topic examined.

- (a)** Quite a number of candidates were able to name component **B** as a switch even though the spelling was wrong in some cases. A few candidates named the component as "on and off" which was not permissible. Such responses were not awarded marks. For component **J**, candidates were able to name it correctly as a "cell". A common incorrect response given was batteries.

(b) Candidates did not show clear understanding of the concept on current flow in a series connection. Some candidates gave the correct response when asked to predict the reading in Ammeter A_1 as 0.5A. Other candidates were dividing the current in Ammeter A_2 by 2 to get 0.25A as the reading in A_1 . In a series circuit, the current that flows through each of the components is the same. Therefore, the correct response was 0.5A in Ammeter A_1 .

(c) This question was fairly done. Most candidates were able to draw the correct symbol of a voltmeter but could not connect it correctly in the circuit. Some were connecting it in series. Those who remembered to connect it in parallel were doing so any point of the circuit even though it was specified that it should be across bulb **K**.

Correct connection:



Question 9

The performance was not good in this question. This might have been due to **Question by (b) (iii)** which was fairly discriminating among the candidates.

(a) (i) Only a few candidates were able to define reduction in terms of oxygen loss. A majority was giving the general English meaning of reduction for example reduction being defined as the loss of something or something getting smaller. Such responses were not awarded marks because they did not carry the scientific meaning of the term.

Expected response: reduction is the loss of oxygen.

(ii) This was one of the most accessible questions in the paper. A majority of candidates were able to give the correct name of the main ore of iron as Haematite or Magnetite. Some candidates named the main ore as "iron ore". Such a response was not awarded any marks because the syllabus clearly specifies the names of main ores.

(b) (i) This question proved difficult for most candidates. Some candidates were just giving names of metallic elements they remembered even though they are not used in making of stainless steel while others left it unanswered. A few were able to give names of the elements used.

Expected response: nickel/chromium/carbon

chromium

carbon

- (ii) This part was well done. Candidates were able to describe how alloying helps to improve properties of pure metals.

Expected response: improves strength/ makes metal stronger/ makes the metal resistant to corrosion/prevents rusting

- (iii) This question was not well answered by a majority of candidates. Most failed to explain why aluminium cannot be extracted using reduction just like iron. They could not explain the difference in reactivity in reference to carbon. Most were comparing the reactivity of aluminium to that of iron instead of comparing the two with carbon used in the reduction process.

Expected response: aluminium is more reactive than carbon/ above carbon in the reactivity

series

therefore, cannot be displaced by carbon

Section B

This section assesses candidates in experimental skills and investigations. The questions require familiarity with laboratory equipment and procedures.

Question 10

This question was testing understanding on the formation of an image by a plane mirror as well as reflection of light.

(a) Candidates were required to list any two properties of an image formed by a plane mirror. Quite a number of candidates were able to score full marks in this part question. A few candidates lost marks by being general for example “image looks the same as the object” without being specific. Others were failing to state the point on distance between the mirror and the object being equal to that between the mirror and the image.

Expected responses:

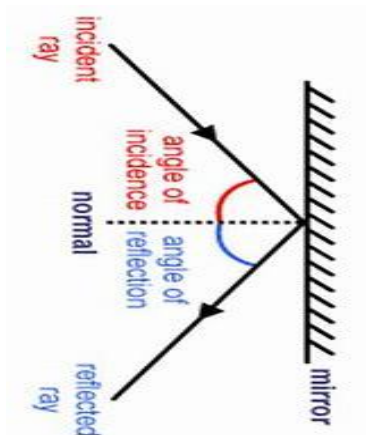
- upright
- Same size as the object
- laterally inverted
- virtual
- distance from the mirror to the image is equal to that from the mirror to the object

(b) This question required the candidates to draw a diagram showing the reflection of light by a plane mirror. Performance was not good. It is important that drawings should be done using a set of mathematical instruments. A large number of candidates missed marks due to the following mistakes;

- failing to draw an incident ray with the proper arrow to show direction.
- the normal drawn in a slanting position from the mirror instead of being perpendicular to the mirror at the point of incidence.
- angles i and r being unequal
- incorrect labelling of the incident ray, normal and reflected ray.

Some candidates changed the given reflected ray and used it as an incident ray.

Correct drawing



Question 11

This question was testing understanding of the concept of osmosis. Candidates were given results of an experiment on osmosis and were required to apply their knowledge in interpreting and explaining the results given.

- (a) (i)** Candidates were expected to state and explain the results obtained when an uncooked potato strip was left in distilled water for 4 hours. Most candidates were able to state that there was increase in length/ size of the potato strip. Only a few responded by stating that there was change from 5cm to 7cm without describing that as an increase. Such responses were not awarded marks because the length was given in the table.

The main challenge was on the part where candidates were supposed to explain the increase. This then affected the overall performance in the question. A majority was giving the general definition of osmosis yet they were expected to apply that knowledge in explaining the change.

Expected response: water particles moved from the distilled water outside into the potato cells.

- (ii)** The first part of the question was easy for candidates. However, the second part of the question where candidates were expected to explain was challenging.

Expected response: length remains the same
 cell membrane is dead
 therefore, water does not move into cells

(b) Candidates were asked to describe factors to keep constant when investigating osmosis. This question was well done, a majority of candidates gave correct responses.

Expected response: amount of distilled water
 temperature of the water
 age and type of potato
 same size of potato strips
 time in distilled water

Question 12

This question was fairly done. A large number of candidates were scoring more than half of the marks allocated. The question was testing understanding of reactions of acids with metals, the properties and test for gases.

(a) This question was well answered. Candidates were able to name the dilute acid that produces chlorides as hydrochloric acid. The most common mistake was writing incorrect spelling of the acid e.g. hydrochloride or chloride acid.

Expected response: hydrochloric acid.

(b) (i) Candidates were expected to recall and apply their understanding on properties of hydrogen gas to explain why it is collected using an inverted test tube. Some were repeating the statement in the question by stating that so that the gas can be collected.

Expected response: to prevent the gas from escaping
 because it is less dense than air

(ii) Candidates were supposed to describe the test for hydrogen gas and state the result. Some candidates lost marks due to failure to describe how the lighted splint is used, some were referring to the splint used as a burning splint. These responses were not awarded marks.

Expected response: insert/ put a lighted splint into a test tube with the gas
 a pop sound is produced

- (iii) Candidates were asked to name an indicator that could be used to test and prove that the product of the reaction of zinc with dilute hydrochloric acid has pH 7.

This question was difficult for most candidates especially the part where they were supposed to describe how the indicator is used. Some lost marks by naming indicators that are not able to indicate pH value such as litmus.

Expected response: Universal indicator

paper is dipped into solution/ drops of indicator are put into the solution,
matched with pH chart, green colour observed.