

**EXAMINATIONS COUNCIL OF
ESWATINI**

JC

SCIENCE

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JC SCIENCE

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. In addition, candidates are expected to be able to display science process skills such as carrying out investigations correctly, interpret and evaluate experimental observations and data. The paper was 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 19500 candidates sat for the examination. This year's cohort seemed to have performed better than year 2021 cohort. Several candidates obtained more than half of the overall marks on offer and more marks above 10. Even so, many candidates continue to leave some questions unanswered making it difficult to know if time for the paper was inadequate or the questions seemed difficult for them to respond correctly to.

Examiners noted with concern that the correct use of grammar in expressing and presenting scientific concepts still remained a challenge to most candidates especially in descriptive questions. Some seemed to be unable to use the scientific terminology to explain or describe scientific concepts. For example, in **Question 6(b)(i)**, most candidates used their general knowledge to try to justify why alcohol is classified as a drug. Similarly, in **Question 1(c)**, students used their general knowledge. Inappropriate use of grammar had a negative impact to responses given eventually changing the scientific understanding of the concept for example, in **Question 2(b)(ii)**, most candidates stated that the light rays scattered.

It was also noted that some students still wrote incomplete formulas in calculations i.e. wrote the expressions only and /or incorrect units. Spelling was another challenge which made some lose marks, for example in **Question 2(a)(i)** where they wrote reflaction, refraction instead of refraction.

Questions 3 (c), 3 (d), Question 4 (a), 4 (c) (i), 4 (c) (ii), 5 (a) (i), 5 (b) (ii), 9 (a), 9(c), 9 (d), 10 (a) (i), 10 (a) (ii) and 10 (a) (iii) seemed to be easy. On the contrary, **Questions 1(c), 4 (b), 5 a (ii) and 8 (c)** were the most challenging.

Comments on Specific Questions

Section A

Question 1

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

- (a) Candidates were asked to draw the arrangement of particles in solid iodine. Most candidates displayed understanding of the concept that particles should be of equal size and should be touching in a solid leaving no spaces. Even though the concept has been tested many times, some candidates still drew particles that were of different sizes. This resulted in a loss of marks.

Expected diagram: particles should be of the same size and shape
all touching (no spaces between) in at least two rows

- (b) This question was fairly done, most candidates were able to explain sublimation and what happens when particles of iodine take in heat energy (in terms of the kinetic particle theory). There were only a few candidates failed to explain in terms of the kinetic particle theory.

Expected response: solid iodine changes to a gas
iodine particles gain kinetic energy/move faster and further apart
forces of attraction become weakened

- (c) This question was challenging to most candidates. Candidates could not explain why sand does not sublime with iodine on heating. It was a great concern that some candidates are still challenged with writing comparative statements. Common incorrect responses included 'sand has a high melting point' without comparing it to iodine or using a comparative term 'higher'. Some candidates used their general knowledge to attempt the question and they too lost marks.

Expected response: sand has a higher melting point/sand has stronger forces of attraction

- (d) Candidates were expected to state the group and period of the Periodic Table in which silicon is found. A majority got this one correct, while a few gave the nucleon number and proton number written next to silicon as the period and group number.

Expected response: group 4
period 3

Question 2

This question was fairly done as well, most candidates were able to obtain more than half of the allocated marks.

- (a) (i) Candidates were required to name the process that occurs when a light rays passes from water to air. It was noted that candidates could not differentiate between reflection and refraction. Marks were lost due to wrong spelling such as reflaction or refreccion which made it difficult to determine if the candidate knew the correct response or not.

Expected response: refraction

- (ii) This question was challenging. Most candidates who attempted this question failed to explain how light bends when passing from a more dense medium to a less dense medium. The common wrong response was that air is always above water.

Expected response: light bends away from the normal

light travels faster in air than in water/air is less optically dense than water

- (iii) Quite a number of candidates got the 1 mark allocated. A few candidates confused this concept with angles in mathematics, responses such as acute, obtuse were common.

Expected response: angle of incidence

- (b) (i) The question required candidates to draw a beam of light after it passes through a convex lens. Most candidates got all the marks allocated in this question. Those that missed some marks failed to put arrows on the rays indicating the direction of the ray and a few were showing the convergence either above or below the principal axis. Such drawings were not awarded marks.

Expected response: rays (solid line with an arrow) converge

pass through the black dot that was placed in line with the principal axis

- (ii) Most candidates were able to state the effect of a concave lens on a parallel beam of light. A few gave responses such as “causes light to bend” which is an effect of both convex and concave lenses. This response lacked the explanation on how the bending is. Candidates also lost marks when giving responses like “scattered”.

Expected response: light rays diverge or spread out

- (iii) In this question, candidates were required to state one use of a convex lens in our daily life. This one was most accessible to a majority. Some candidates missed marks by stating that it is used for looking instead of stating that it is found in the human eye, while some were failing to name the kind of eyeglasses with convex lenses.

Expected response: human eye

microscope

camera

binoculars

telescope

magnifying lens

Question 3

This question was fairly done. A majority of candidates were able to score at least 4 or 5 of the marks offered.

- (a) Candidates were expected to state the characteristic of living things shown by the plant. Even though it was most accessible to a majority, some candidates lost the 1 mark allocated when giving growth as a characteristic yes it was written on the stem of the question.

Expected response: sensitivity/ irritability/respond to stimulus

- (b) This question required candidates to explain why a plant kept in a dark box grows towards a hole on the side. Most candidates were able to give the first marking point which was “to get light”. They missed the second point which was to state the use of the light in the process of photosynthesis. Marks were not awarded when the response given was “to manufacture food”. Candidates should be encouraged to use scientific terms used in the syllabus

Expected response: grows towards light/to get or trap light

needed for the process of photosynthesis

- (c) Candidates performed this one well, even though some missed that the question required them to give characteristics shown on Fig. 3.1 not just general characteristics for dicotyledons. Responses such as tap roots, have two cotyledons were not awarded marks because those were not shown in the given Figure 3.1.

Expected response: broad leaves
lateral veins

- (d) Candidates were required to label any part of the cell given on Fig. 3.2 that is not found in a red blood cell. Most gave correct responses. Marks were forfeited when candidates used arrows when labelling. Candidates should be encouraged to adhere to the instruction that states that labelling should be done using a label line.

Expected response: correctly labelled cell wall/ chloroplast/ vacuole/nucleus

Question 4

This question was challenging, and most candidates lost marks in part (a), (b) and (d).

- (a) Most candidates were not able to state the physical properties of magnesium as a metal. Some were mistaking the name magnesium for magnet such that they gave responses such as “it can attract metallic objects’. Such responses were not awarded marks. Others lost marks when giving properties such as “high density” which is not true for magnesium.

Expected response: malleable
Sonorous
Lustrous/shiny
Ductile
Conducts heat
Conducts electricity
High melting and boiling point
(any one of these)

- (b) The question was challenging to most candidates. Candidates were required to describe two observations when magnesium ribbon burns in air. Only a few candidates gave correct responses to this question. Candidates were giving general observations of combustion reactions, yet they were required to be specific to magnesium.

Expected response: white bright flame
white ash

- (c) (i) Most candidates were able to state why the burning of magnesium is exothermic. Only a few candidates missed marks in this question.

Expected response: releases heat energy to the surroundings

- (ii) This question was well attempted by most candidates. Candidates gave expected properties of a chemical change.

Expected response: formation of a new substance
generally irreversible
heat energy released

- (d) Candidates were required to name the component of air that is involved in combustion/burning. Most candidates missed marks here either by writing air as one of the reactants in the equation or by adding another product besides magnesium oxide.

Expected response: magnesium + oxygen → magnesium oxide

Question 5

Performance was low in this question, most candidates could hardly get half of the marks allocated.

- (a) (i) The question required candidates to calculate the moment of force exerted by the small boy, given the force and the distance at which the force is exerted. Most candidates were able to calculate correctly using the correct formula. Those that missed marks were dividing the two quantities instead of multiplying. Candidates should also be encouraged to write the correct formula in full.

Expected response: Moment = Force x distance
 = 20N 0.75m
 = 15 Nm

- (ii) This was one of the most challenging questions to a majority of candidates. They could not explain why it becomes difficult to close the door when the force is applied at the pivot in relation to the turning effect produced. Most stated that it is because the man is pushing at the pivot and this was mentioned in the question.

Expected response: perpendicular distance from the pivot is shorter
 so less turning effect of the force

- (b) (i) A majority of candidates were able to label on the wheelbarrow where force is applied when it is used.

Expected response: label line along any point on the handles

- (ii) This question was well answered. Candidates were able to define a lever correctly. **Expected response:** any type of a simple machine or a rigid bar that rotates about a fixed point called the pivot when force is applied on it

Question 6

The question assessed candidates' knowledge and understanding of coordination and response. Many candidates could not obtain at least half of the marks on offer.

- (a) Candidates referred to the tongue as a tasting organ instead of a sense organ. This response was not awarded marks.

Expected response: sense
 receptor
 stimulus
 sensory

- (b) (i) Candidates were expected to at least give the definition of a drug as a way of justifying why alcohol is classified as drug or give the specific effect of alcohol in the body. Some candidates lost marks because they used general knowledge, for example, it causes people to be drunk.

Expected response: externally administered
 affects/modifies chemical reactions in the body

- (ii) Candidates were required to describe two effects of cannabis on the body. Quite a number of candidates were able to give effects. Some were not credited for not specifying the type of cancer caused by cannabis.

Expected response: infertility
 lung cancer
 depression
 bipolar mania
 insanity

increased heart rate

Question 7

This question was fairly done with a majority of candidates scoring about 4 out of 6 marks.

- (a) Candidates were able identify the missing condition in test tube 1 that did not allow rusting to occur but could not explain how using boiled water helps in rust prevention.

Expected response: water is boiled to remove dissolved air/oxygen
oil prevents entry of oxygen/excludes air

- (b) Candidates were expected to explain why galvanizing is considered a better method of rust prevention. The use of comparative language seemed to be a challenge, candidates failed to state differences correctly. Most candidates described one of the two methods and such responses were awarded only 1 mark. For such questions candidates should be encouraged to use comparative language.

Expected response: oiling only prevents rusting when the object is completely covered while galvanizing prevents rusting even if the object is not completely covered (offers sacrificial protection)

The zinc used in galvanizing is not removed easily while oil can be easily removed

- (c) (i) Many candidates were able to recall the element that is added to iron to form mild steel.

Expected response: carbon.

- (ii) Most candidates were able to recall uses of stainless steel.

Expected response: making surgical instruments
making cutlery
making cooking pots
manufacture of chemical plants

Question 8

Most candidates got challenged in part (b) and (c), making the overall performance to be low.

- (a) Candidates were expected to calculate the amount of work done by a man lifting a box with a force of 50N for 2m above the floor. This question was accessible to most candidates.

Expected response: work done = force x distance
= 20N x 2m
= 100 J

- (b) Candidates lost marks in this question by failing to recall the type of potential energy in the energy conversions taking place.

Expected response: chemical potential → kinetic → gravitational potential

- (c) This question was challenging. Most candidates could not state applications and consequences of thermal expansion in solids. Some lost marks by directing their responses to liquids and gases yet question was with respect to solids.

Expected response: bridge building/ road construction/ construction of railway lines/thermostats/ overhanging power cables
Cracking of walls/floors/breaking of glass when put in hot water/bending of railway lines

Question 9

The question assessed candidates' knowledge and understanding of reproduction in humans. It was well attempted, and most candidates scored more than 3 out of 6.

(a) Candidates were expected to study Fig. 9.1 and then use simple recall to name the part labelled **C**. Most candidates identified the part correctly. The most common errors included candidates writing wrong spelling, naming the part as a sperm tube and all resulted to loss of marks.

Expected response: sperm duct

(b) Candidates could not explain well the function of sperm in reproduction. Most were repeating the information written in the stem of the question, that is, 'it helps to form an offspring' and this was not awarded any mark.

Expected response: fuses with the ovum
to form a zygote

(c) The question required candidates to state how a condom prevents pregnancy. Candidates attempted this one very well.

Expected response: collecting the semen/prevents sperm from entering the cervix.

(d) (i) The question was a fair question to most candidates. Many candidates were able to recall symptoms of gonorrhoea. Candidates who gave signs of gonorrhoea were not awarded marks because the question was asking for symptoms. Candidates seemed to lack of mastery of the difference between signs and symptoms.

Expected response: pain when urinating/abdominal pains

(ii) This question required candidates to state how gonorrhoea is treated. Some candidates were able to give the expected response but a majority could not recall it.

Expected response: using antibiotics/penicillin

Section B

The question intended to assess candidates in experimental skills and investigations. The question required candidates to be familiar with laboratory equipment and procedures, as well as, application of science process skills such as analyzing and interpreting data. It was noted with concern that a majority of the candidates performed below average in this section.

When considering factors that could have made the performance to be low in this section, it was envisaged that the time available for teaching and learning was a bit short which could have impacted negatively on candidates' preparedness both psychologically and emotionally. Teachers focused more on covering the theoretical aspects of the syllabus at the expense of practical work in the process leaving the manipulative and investigative skills unattended.

Question 10

(a) This question was testing candidates' understanding of reactions of metals with acids as well as order of reactivity of metals.

- (i) Candidates were required to analyse data given in a table and explain why no bubbles were produced when metal **F** was put in dilute acid. A few candidates lost marks by stating that **F** is less reactive/ does not react because there are no bubbles at all.

Expected response: **F** is unreactive

- (ii) Candidates were expected to use information in Table 10.1 and deduce the order of reactivity of the metals **E** to **F**. They were also required to the metals starting with the most reactive and ending with the least reactive. This seemed easy for most candidates. However, some lost marks by writing names of the metals and not in the correct order.

Expected response: most reactive **H**
E
G
 least reactive **F**

- (iii) Candidates were expected to describe a test for hydrogen gas. Most candidates seemed to be competent with the concept making the overall performance to be high.

Expected response: test: insert a lighted splint into hydrogen gas
 result: burns with a pop sound

- (iv) This question was challenging to several candidates. A majority gave could not describe well how the speed of the reaction could be increased. Candidates who gave the response "add more acid or increase the metal" missed marks.

Expected response: using powdered **E**/ decrease size of particle (increase surface area for **E**)
 increase temperature of the acid
 increase the concentration of the acid

(b) Candidates were expected to apply their knowledge and understanding of a series circuit.

- (i) Candidates were required to state the value of the current flowing in the circuit through the bulb with $2\ \Omega$ in Fig. 10.1. Some candidates calculated the resistance and got 2 A which was wrong. The fact that current flowing in a series circuit is the same at every point should be emphasised.

Expected response: 1A

- (ii) Most candidates failed to score marks in this question which required them to describe the function of a fuse. Most used responses such as protecting the appliance which did not explain how it does that.

Expected response: breaks the circuit to prevent excess current flow/if there is excess current

- (iii) This question was challenging to most candidates. They failed to use the given quantities to calculate power. Those who did the correct calculation could not state the correct units. As a result, the question was poorly done.

Expected response: power = voltage \times current
 = 2V \times 1A
 = 2 Watts

- (iv) This was also well attempted. Candidates were able to state and explain how brightness is affected by increase in number of cells.

Expected response: brightness increases
 due to an increase in current flowing through the bulbs/ voltage

- (c) This question was assessing candidates' understanding of plant nutrition.

- (i) Candidates were asked to describe how destarching a plant is carried out. Those who were able to state that it has to be kept in the dark lost a mark for not stating the duration.

Expected response: keep the plant in the dark for at least 24hrs

- (ii) Candidates were expected to describe how chlorophyll is removed from a leaf. Most candidates did not understand the purpose of the soda lime in the set up such that they referred to it as the one that removes chlorophyll. Another part they missed was in explaining how ethanol is heated when removing the chlorophyll.

Expected response: put the leaf in a test tube with ethanol
 heat using a hot water bath

- (iii) Most candidates to correctly name the required reagent when testing a leaf for starch.

Expected response: iodine solution.

- (iv) This question required candidates to explain the difference in results when testing a leaf for starch from a plant that had all the conditions necessary for photosynthesis. They had to differentiate between a leaf from plant **K** and that from **L**. It was also noted that candidates use of comparative language was poor.

Expected response: a leaf from **K** would turn brown while a leaf from **L** would turn blue black.
 plant **K** had no CO₂/no starch/could not photosynthesize while plant **L**
 had starch/ photosynthesized