

**EXAMINATIONS COUNCIL OF ESWATINI**

**JC**

**EXAMINATION REPORT**

**FOR**

**SCIENCE (414)**

**YEAR**

**2023**

## General comments

There were **twelve** questions on this paper assessing all the three themes of the syllabus (Physical Properties of matter, chemical Behaviour of substances and Maintenance and Continuity of Life).

These questions were divided into **two** sections:

Section **A** had a total of 60 marks composed structured type of questions assessing mainly knowledge and understanding, handling information and problem solving.

Section **B** carried 20 marks consisting of questions assessing experimental skills and investigations.

About 18600 candidates sat for this examination. All questions on the paper were attempted by a large portion of the entry. However, some questions were left unattempted as seen in the previous years. Poor scientific literacy severely limited the quality of the responses of many candidates. Some candidate' responses showed an excellent usage of scientific language. However, a majority of candidates used of scientific terms inappropriately led to unacceptable responses. It was observed that candidates still have difficulty to construct comprehensive and coherent answers especially when they are asked to describe and explain. Spelling is still a challenge for most candidates.

Most candidates were observed to be lacking basic numeracy, including simple arithmetic which severely handicapped a substantial proportion on the entry. Some candidates lost marks as a result of failure to write formulas in calculations (most of which were given as expressions eg  $F \times d$  instead of  $W = F \times d$ ), units in the final answer and round off the final answer to three significant figures as stated in the syllabus. A few candidates correctly carried out extrapolation on a graph which enabled them to analyse data and draw conclusions with ease.

Questions **1(a), 2(b), 3(a)(i), 5(a), 5(b), 7(a), 11(a)** proved to be easy for most candidates. However, questions **1(c)(ii), 3(b), 3(c)(iii), 6(b), 6(c), 7(b), 7(c), 8(a), 8(c), 9(b), 9(c), 10(c), 11(d), 11(e)** and **12(a)** seemed to be the most challenging questions and greatly affected the overall performance.

## Comments on individual questions

### Section A

#### Question 1

This question was fairly done by most candidates.

- (a) This question was easy for most candidates. Most candidates were able to name the **main** ore of iron. Some candidates gave responses such as magnetite or iron ore which were not awarded the mark.

**Expected response:** haematite;

- (b) This question was challenging to most candidates. Candidates were expected to explain reduction with reference to the given equation. Few candidates correctly explained reduction. A majority of the candidates gave the definition of reduction in terms of oxygen loss without referring to the given examples.

**Expected response:** loss of oxygen from iron (III) oxide; to form iron;

- (c) (i) The question was fair to most candidates. A majority of candidates were able to correctly state the uses of mild steel. Some candidates wrote responses that lacked some descriptive words such as 'making of, manufacture of' which made their responses incomplete. It was common to find responses such as "car bodies, tools, machinery" unqualified.

**Expected response:** manufacture of car bodies;

making of nails / wires / machinery;

- (ii) This question was challenging to most candidates. Candidates were expected to explain why alloys such as mild steel are mixtures. Most candidates' responses were general statements and lacked reference to mild steel. Some candidates gave the definition of an alloy which wasn't required by the question.

**Expected response:** atoms or elements in mild steel are physically combined;

**Question 2**

This question seemed most accessible to most candidates with part **(a)** and **b(iii)** being the easiest.

- (a)** Most candidates were able to identify and name the wave drawn. Some candidates gave an example of the type of the wave instead of **naming the type**. Common wrong responses included sound wave, longitude wave.

**Expected response:** longitudinal wave;

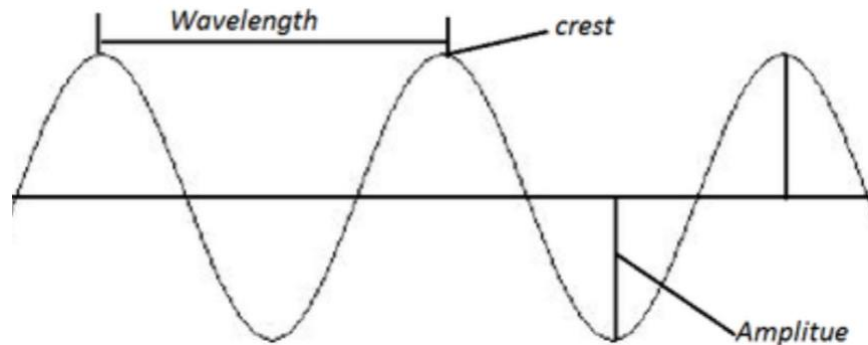
- (b) (i)** This question was challenging to most candidates. Candidates were expected to differentiate between a longitudinal wave as exemplified in Fig. 2.1 and a transverse wave as exemplified in Fig.2.2. Most candidates were unable to state the direction of each wave in relation to the vibration which is the source of the wave.

**Expected response:**

wave in Fig. 2.1	wave in Fig. 2.2
moves in a parallel direction to the vibration or disturbance	moves in a perpendicular direction to the vibration or disturbance
has compressions and rarefactions/decompressions	has crests and troughs

- (ii)** This question was well done by most candidates. Candidates were expected to mark and label the wavelength and amplitude **using a line**. Some candidates lost marks for marking of the wavelength and amplitude using arrows. Some candidates marked the points and left the lines which made resulted to loss of marks.

**Expected response:**



- (iii)** Many candidates understood that frequency. Most candidates gave the expected response to this question. To score all the marks allocated, candidates were expected to give the correct value with the correct units for frequency. Some candidates lost the second mark due to writing incorrect units or leaving an answer without units.

**Expected response:** frequency =  $\frac{\text{number of waves}}{\text{time}} = 3 \div 2 = 1.5$ ;  
waves per second or Hz;

### Question 3

- (a) (i) Whilst most candidates were able to define a cell, a few candidates were uncertain of the definition such that they defined an atom.

**Expected response:** a basic unit of life;

- (ii) Many candidates knew the function of the part labelled **A**, nucleus.

**Expected response:** controls the activities of the cell/ contains genetic material/  
responsible for cell division, growth and manufacture of proteins;

- (b) This proved to be a very demanding question with successful candidates being able recognise that osmosis would cause water to pass through the partially permeable membrane to the soil. Many candidates wrote general statements that could not be awarded marks.

**Expected response:** excess fertilizer increases solute concentration in the soil; causing water to move from the plant into the soil by osmosis; through a selectively permeable membrane;

- (c) (i) Many candidates successfully defined a tissue as a group of similar cells working together to perform a specific function;

- (ii) Many candidates were uncertain of the tissue responsible for conduction of water in a plant. A number of wrong responses were roots and root hairs.

**Expected response:** xylem;

- (iii) Many candidates found this question challenging. Candidates were required to describe the role of water in photosynthesis. Generic answers, such as food or starch, are rarely specific enough to be awarded a mark.

**Expected response:** combines with carbon dioxide;  
to produce glucose;

### Question 4

This question was fairly answered and many candidates scored at least 4 of the marks allocated. This question was fairly answered and many candidates candidates scored at least 4 of the marks allocated.

- (a) (i) This question was well answered. Candidates were able to state one physical property of sodium as a group 1 element.

**Expected response:** soft/ have low melting and boiling point/ have low density;

- (ii) Most candidates were awarded one mark. The question required candidates to state two observations made when sodium reacts with water. Most candidates were able to one observation. Candidates incorrectly gave observations such as a gas is produced, water becomes milk.

**Expected response:** it floats / moves very fast / bubbles formed / smoke / forms a ball;  
fizzy / hissing sound / water turns milky white;

- (iii) Candidates were asked to state and explain an observation made when litmus is put into the resulting solution in (ii). A large number of candidates were able to state the observation but could not explain.

**Expected response:** litmus turns blue;  
an alkaline solution/sodium hydroxide is formed;

- (b) (i) Almost all candidates correctly recalled the property. Candidates were expected to state the property of hydrogen that allows it to be collected using downward displacement of water.

**Expected response:** hydrogen is insoluble in water/ is less dense than water;

- (ii) Most candidates correctly described the test result. Candidates were required to describe how to use the lighted splint. The description was challenging to many candidates and “use a lighted splint” was a frequent wrong response.

**Expected response:** insert a lighted splint into the gas;

burns with a pop sound;

### Question 5

- (a) This question was well answered and candidates correctly named force **B**. Common incorrect responses were friction and contact force.

**Expected response:** gravitational force;

- (b) The vast majority of candidates successfully named the instrument used to measure force **C**. A number of incorrect responses were Newton meter and spring beam balance.

**Expected response:** spring balance / force measurer

- (c) The question proved to be demanding to most candidates. Candidates were required to name the form of energy possessed by the box while on the gardeners head. Most candidates misread the question and as a result they were not specific on the type of potential energy. Some candidates gave vague responses such as energy changes and could not be awarded credit. This highlights the importance of reading the question carefully.

**Expected response:** gravitational potential energy;

- (d) The question was well answered by a vast majority of candidates. Candidates were required to calculate the work done by gravity in pulling the box to the ground. The common errors in the calculations were presenting answers with no formula, substituting into the formula with values not given in the question and incorrect units. Candidates should be encouraged to always write units unless they are already given in the question. Candidates should be aware of acceptable ways of writing units, i.e if the full name of the unit is written, it should start with a lower case except when it is named after a Scientist, and if a symbol is used, it should be written with an upper case letter. For example, ‘j’ as a symbol for joules instead of ‘J’ was not awarded credit.

**Expected response:**  $\text{Workdone} = \text{force} \times \text{distance} / 20\text{N} \times 1.6\text{m};$

32 J;

### Question 6

The question comprised of recall questions only and it proved to be demanding to most candidates.

- (a) Many candidates could correctly identify the cell as a white blood cell. Candidates had to identify a given blood cell and state its function in the body. A common incorrect response was red blood cell.

**Expected response:** name of cell – white blood cell / phagocyte;

function – engulfs and kill / digests / ingests disease causing microorganisms;

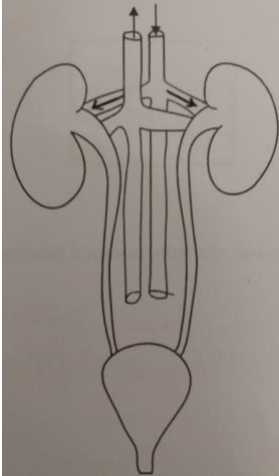
- (b) The question was fairly answered by many candidates. Candidates were expected to describe functions of plasma in the human body. Some candidates had difficulty in expressing their ideas clearly. Common incorrect functions were to provide heat to the body and removes wastes out of the body.

**Expected response:** distributes heat around the body;

transports dissolved nutrients/ waste substances/hormones/antibodies round the body;

- (c) (i) A large number of candidates found this question challenging. Most candidates did not realise that this question was asking them to draw an arrow showing the direction of flow of blood in the renal artery. Many candidates drew an arrow pointing at the renal artery. Some candidates drew arrows to show the flow of blood through the whole urinary system and were not awarded credit.

**Expected response:**



- (ii) The question required candidates to differentiate between the composition of blood in the renal artery and in the renal vein. A most common incorrect response was blood in the renal artery is oxygenated and in the renal vein, blood is deoxygenated (no comparison in terms of amount of oxygen). Some candidates lost marks when stating that in the renal vein, blood has no urea / oxygen / nutrients.

**Expected response:**

	<b>renal artery</b>	<b>renal vein</b>
difference 1	• more oxygen	less oxygen;
difference 2	• less carbon dioxide	lore carbon dioxide;
difference 3	• more urea	less urea;
difference 4	• more water	less water;
difference 5	• more nutrients / named nutrient eg glucose	less nutrients / named nutrient;

**Question 7**

- (a) A large number of candidates correctly identified process **F** as evaporation.
- (b) The question required candidates to explain why substances in the solid state have a definite shape. A vast majority of candidates explained in terms of the arrangement of particles in a solid e.g. particles are close together with no spaces between them. This is a true statement but did not answer the question and no mark was credited. Some stronger responses referred to the strength of forces of attraction between the particles and the effect on the movement of the particles.

**Expected response:** particles held together by strong forces of attraction:

causing them to vibrate in their fixed positions;

- (c) Many candidates were aware that particles of a substance are of the same size and shape, and the arrangement of particles in a liquid was challenging to most candidates. A large majority of candidates drew particles showing a regular pattern or particles not touching at all with relatively large spaces between them and were not awarded credit. Another common error was the drawing of particles that are either larger or smaller compared to the set size on the diagram making the substance to look like a mixture.

**Expected response:** particles of the same size and shape (to the particle already drawn); most of them touching but some having small spaces between + irregular pattern;



- (d) Many candidates were able to score at least the first mark on speed. A majority could not describe the change in forces of attraction when melting occurs. A very common response was “forces of attraction are lost” and this is scientifically incorrect. The forces of attraction exist in the liquid state but a bit weaker compared to solids.

**Expected response:** speed increases;  
forces of attraction are weakened;

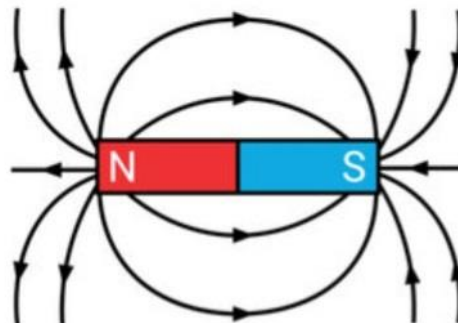
### Question 8

- (a) Most candidates successfully stated **one** other property of the bar magnet shown in the figure. A common correct response was ‘magnets attract materials made of iron.’ A common incorrect response was ‘magnets attract metals’.

**Expected response:** magnet attract materials made of iron, steel, cobalt or nickel; each pole of a magnet attracts an unlike pole of another magnet/ repels a like pole of another magnet; when a magnet is freely suspended, it rests in the North South direction; magnetic force is stronger at the poles;

- (b) There was some uncertainty on drawing of magnetic field . Most common errors were drawing of magnetic field lines using dotted or broken lines, touching field lines due to drawing too many lines, drawing the pattern made by iron fillings when sprinkled around the magnet.

**Expected response:** solid lines drawn from one pole to another above and below the magnet + not touching; arrows drawn on field lines showing the correct direction (from North to South);



- (c) Candidates were expected to state an observation made when a hammered magnet is brought close to an iron bar. The question was well answered and candidates clearly understood demagnetisation.

**Expected response:** observation – no attraction;  
explanation – magnet demagnetised/ loses magnetism;

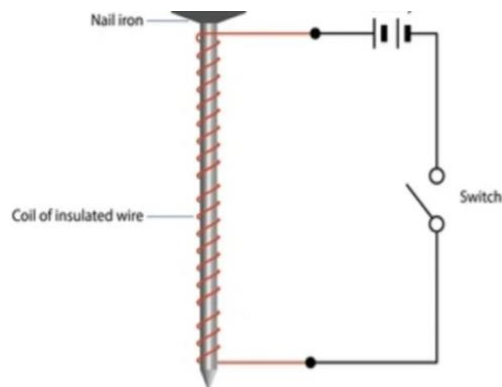
- (d) This question was well answered. Candidates were required to draw a labelled diagram of an electromagnet having two cells, an insulated copper wire, and an iron nail. Some candidates were able to draw the components correctly and arranging them correctly was challenging.

**Expected response:** correct connection of the components + labelled;

iron nail shown on the diagram;

at least 3 or more turns of the coil around the iron nail;

correct symbol showing two cells;



### Question 9

This question was challenging to a large number of candidates. Only a few were able to score 3 of the 5 marks.

- (a) Candidates were expected to name the stimulus that causes the student to spit out a consumed substance. A few candidates were able to recall stimuli detected by the tongue as chemicals. A common incorrect response was 'acids'. Some candidates gave vague responses e.g you should not eat in the laboratory and were not awarded the mark.

**Expected response:** chemicals;

- (b) This question was challenging to most candidates and a few candidates were certain of the role of the tongue as a sense organ.

**Expected response:** the tongue has receptor cells; that convert the stimuli/chemicals; to nerve impulses;

- (c) The question proved challenging. There was a great deal of uncertainty about possible reasons why the student wouldn't want to go to class. Candidates would benefit from a greater understanding of voluntary action. Common incorrect responses were: the student did not like the next lesson / student's tongue is burnt / sound of the bell wasn't loud enough etc.

**Expected response:** student makes a conscious decision/ action taken involving the brain

**Section B**

**Question 10**

The question was well answered by a majority of candidates.

**(a)** This question was well answered, and most candidates were able to correctly state the colour of calcium carbonate as white

**(b) (i)** This question was well answered, and most candidates correctly stated the observations made when calcium carbonate granules are reacted with dilute hydrochloric acid. Many candidates gave the correct answer.

**Expected response:** bubbles;  
fizzy sound;  
effervescence;; (earns both marks)

**(ii)** This question was well answered and most candidates were able to describe how they would use the universal indicator paper to determine the acidity of the hydrochloric acid.

**Expected response:** dip universal indicator paper into the acid;  
it turns red;

**(c)** Most candidates clearly understood about ways of increasing the rate of a chemical reaction.

**Expected response:** decrease particle size/increase surface area;  
by using powdered calcium carbonate;  
OR  
increase temperature;  
by heating the acid;  
OR  
increase concentration;  
by adding more acid solute/adding more concentrated acid;

**Question 11**

The question was well answered, and common errors were writing of incorrect units, answers not to three significant figures and incorrect formula for calculations.

- (a) A vast majority of candidates correctly identified and named the stopwatch. Some candidates referred to it as a speed watch.
- (b) Candidates were expected to determine time taken by an athlete to run a 200m race. This was well answered by most candidates and a minority either did not write units or write the correct units.

**Expected response:** 24 – 12.5;

11.5 s;

- (c) This question proved to be challenging. A few candidates successfully calculated the athlete's speed using the time from (b) above and the distance given. Most candidates did not round off the answer to three significant figures and were not credited the mark. Candidates should be made aware that answers are to be given to three significant figures as stated in the syllabus. Common responses were 17.3 and 17.39 m/s.

**Expected response:**  $\text{Speed} = \frac{\text{distance}}{\text{time}} = \frac{200 \text{ m}}{11.5 \text{ s}} ;$   
 $= 17.4 \text{ m/s}$

- (d) This question was well answered and candidates were expected to differentiate between speed and velocity.

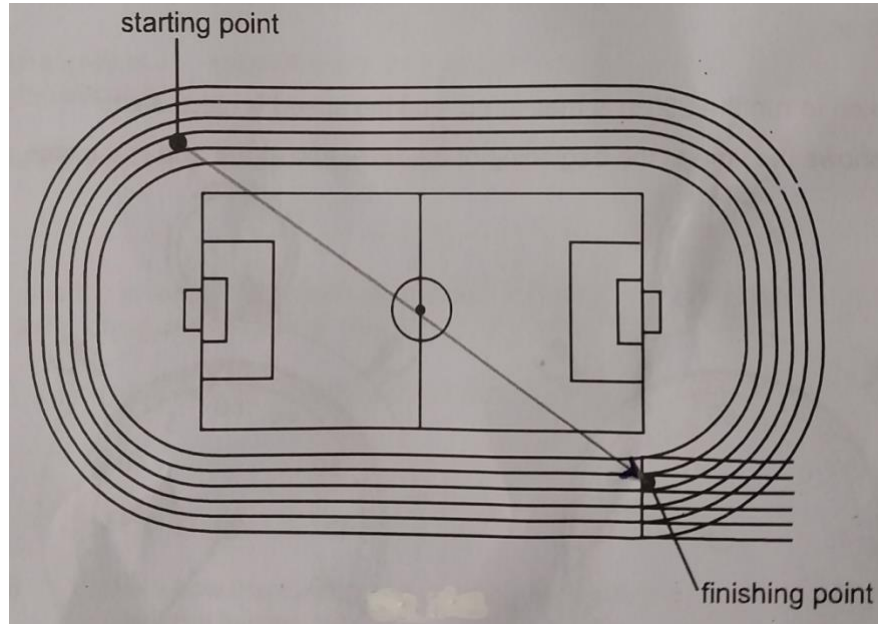
**Expected response:**

<b>speed</b>	<b>velocity</b>
scalar quantity	vector quantity;
has magnitude only	had magnitude and direction;
calculated as distance ÷ time	calculated as displacement ÷ time;
distance covered per unit time	distance covered per unit time in a specified direction;

- (e)

- (f) The question was challenging to many candidates. Candidates were expected to draw an arrow line showing the direction in which the athlete's displacement is measured. There was some uncertainty about to draw the arrow line and as such most candidates drew arrows following the track the athlete ran.

**Expected response:** an arrow line from the starting point, passing across the sports field and ending at the finishing point.



### Question 12

This question proved to be demanding to most candidates. A majority of candidates could not use the given graphs to answer the questions.

- (a) Candidates were asked to use the graph to find the breathing rate of student **H** at 5 minutes. This proved to be challenging to most candidates. Common errors were candidates not show their working (extrapolation on the graph) and writing incorrect units yet units were given in the question.

**Expected response:** evidence of drawn line at five minutes to take the reading;  
26.4 breaths/minute;

- (b) A vast number of candidates were able to describe the relationship between exercise and the rate of breathing.

**Expected response:** breathing rate increases with exercise;

- (c) Candidates were asked to calculate the difference in breathing rate for the two students at 3 minutes. This question was well answered.

**Expected response:** breathing rate of student **G** – breathing rate of student **H** (at 3 minutes);

- (d) Candidates were asked to state an observation made when student **G** breathes into a test tube with lime water. Most candidates were able to state the correct colour change observed due to the presence of carbon dioxide in exhaled air

**Expected response:** lime water turns milky;  
exhaled air contains carbon dioxide;