EXAMINATIONS COUNCIL OF ESWATINI
Junior Certificate Examination

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

SCIENCE   **414/02**

Paper 2   **October/November 2023**

1 hour 45 Minutes

Additional Materials required: Electronic calculator.

READ THESE INSTRUCTIONS FIRST

Write your name, centre number, candidate number and name in the spaces provided.

Write in dark blue or black ink pen in the spaces provided on the Question Paper.

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Do **not** use staples, paper clips, highlighters or correction fluid.

This paper consists of two sections (Section **A** and **B**).

Answer **all** questions in both sections **A** and **B**.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this paper is 80.

Question	Examiner's use
Section A	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Section B	
10	
11	
12	
Total	

This document consists of **16** printed pages.

[Turn over

SECTION A

Answer **all** questions

1 Iron can be extracted from its main ore by reduction using carbon.

(a) Name the main ore of iron.

…………………………………………………………………………………………….. [1]

(b) The word equation for the reduction of iron(III) oxide is

Iron(III) oxide + Carbon monoxide → Iron + Carbon dioxide.

Define *reduction* using this equation.

………………………………………………………………………………………..

……………………………………………….………………………………………… [2]

(c) Mild steel is an alloy of iron.

(i) State **one** use of mild steel.

……...……………………………………………………………………………….... [1]

(ii) Explain why alloys such as mild steel are mixtures.

…………………………………………………………………………….......... [1]

[Total: 5]

2 Fig. 2.1 shows waves produced in a loudspeaker.
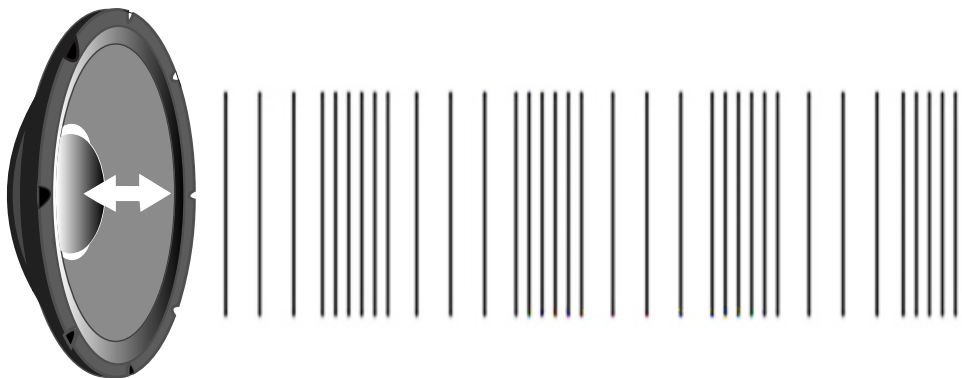
Fig. 2.1

(a) Name the type of wave shown in Fig. 2.1.

……………………………………………………………………………………..… [1]

(b) Fig. 2.2 shows another wave produced in a rope.
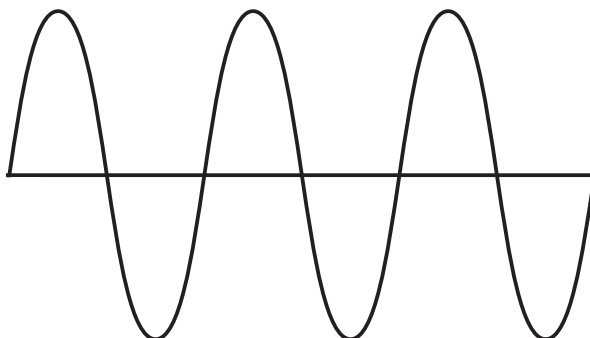
Fig. 2.2

(i) Describe **one** difference between the wave in Fig. 2.1 and the wave in Fig. 2.2.

…………………………………………………………………………………………

………………………………………………………………………………… [1]

(ii) On Fig. 2.2, use a line to mark and label the wavelength and amplitude. [2]

(iii) Fig. 2.2 shows three complete waves, all produced in two seconds.

Calculate the frequency of the waves in Fig. 2.2.

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………………………………………………………… [2]

[Total: 6]

3 **(a)** Fig. 3.1 shows a root hair cell.
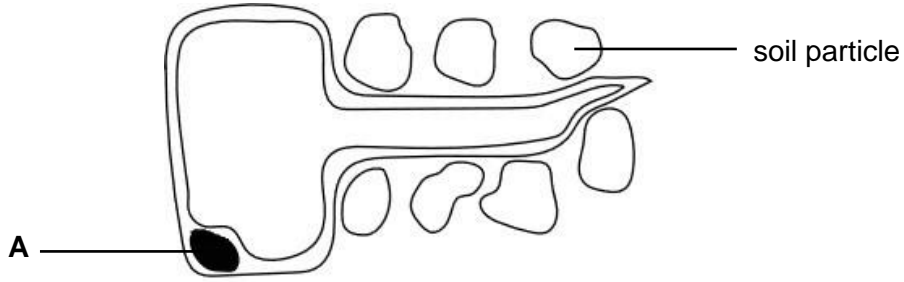
Fig. 3.1

(i) Define a *cell*.

……………………………………………………………………………………….... [1]

(ii) State the function of the part labelled **A** in Fig. 3.1.

………………………………………………………………………………...........

……………………………………………………………………………............. [1]

(b) A farmer accidentally adds too much fertiliser on plants. The farmer waters the plants regularly.

After some time, the plants started wilting.

Explain why the plants are wilting.

………………………………………………………………………………………..

………………………………………………………………………………………..

…………………………………………………………………………….................

……………………………………………………………………………........ [3]

(c) In a plant, water is conducted from the roots to the leaves by a tissue.

(i) Define the term *tissue*.

………………………………………………………………………….................

…………………………………………………………………………………. [1]

(ii) Name the tissue that conducts water from the roots to the leaves.

..…………………………………………………………………………………. [1]

(iii) Describe the role of water in photosynthesis.

…………………………………………………………………………………………

…………………………………………………………………………............... [2]

[Total: 9]

4   A teacher reacts sodium metal with water.

The teacher cuts a small piece of the sodium using a knife and drops it into the water.

(a)   **(i)**   State **one** physical property of sodium that identifies it as a Group I element.

…..…………………………………………………………………………………[1]

(ii)   State **two** observations made by the teacher when sodium reacts with water.

1.……………………………………………………………………………………

2.…………………………………………………………………………………..[2]

(iii)   The teacher dips litmus paper into the water after the reaction.

State and explain what the teacher observes.

observation…………………………………………………..…………………….

explanation………………………………………………..…………………… [2]

(b)   Calcium metal reacts with water to form calcium hydroxide and hydrogen gas.

Hydrogen gas can be collected using the method of downward displacement of water.

(i)   State one property of hydrogen gas that makes it possible for it to be collected using the downward displacement of water.

……………………………………………………………………………….... [1]

(ii)   Describe a test for hydrogen gas.

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

……………………………………………………………………………........... [2]

[Total:8]

5 Fig. 5.1 shows a gardener with a height of 1.6 m lifting an empty box from the ground. The gardener places it on the head, then starts moving towards the garage.
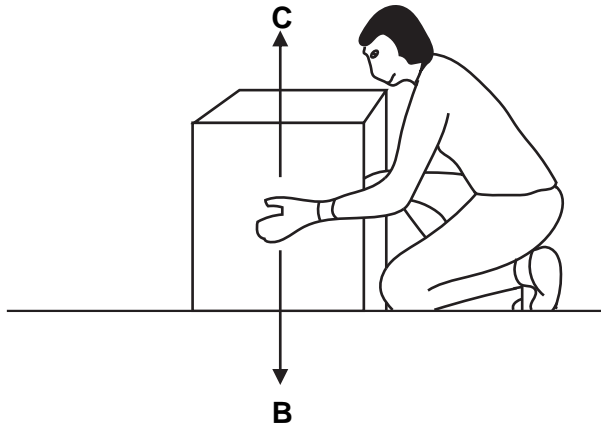

Fig. 5.1

(a) Name the force **B** in Fig. 5.1.

.... [1]

(b) Name the instrument that can be used to measure force **C** in Fig. 5.1.

.... [1]

(c) Name the form of energy possessed by the box while on the gardener's head.

.... [1]

(d) The box accidentally falls from the gardener's head to the ground.
If force **B** is 20 N, calculate the work done by gravity in pulling the box to the ground.
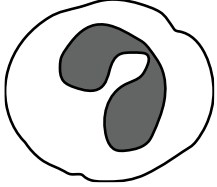
work done = …………………[2]

[Total: 5]

6 **(a)** Table 6.1 shows a blood cell.

Complete Table 6.1, by naming the blood cell and stating its function.

Table 6.1

blood cell	name of blood cell	Function of blood cell

[2]

(b) Describe **two** roles of plasma in a human body.

1……………………………………………………………………………….......

…………………………………………………………………………………..

2……………………………………………………………………………………

……………………………………………………………………………………. [2]
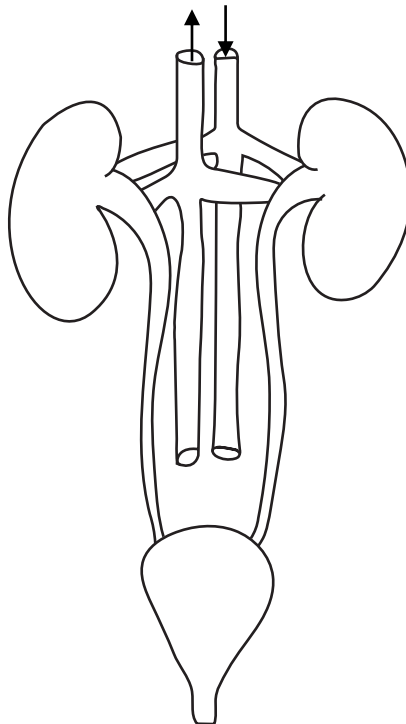
(c) Fig. 6.1 shows the urinary system.

Fig. 6.1

(i) Draw an arrow line in Fig. 6.1 to show the direction of flow of blood in the renal artery. [1]

(ii) Complete Table 6.1 by describing **one** difference between the composition of blood in the renal artery and the renal vein.

Table 6.1

	renal artery	renal vein
difference		

[1]

[Total: 6]

7 Fig. 7.1 shows the inter-conversions of the three states of matter.

```
  ┌──────────┐          ┌──────────┐
  │  solid   │  ←────   │ state E  │
  │          │   ────→  │          │
  └──────────┘          └──────────┘
        ↖ melting        process F ↗
           ↘              ↙
         ┌──────────┐
         │ state D  │
         └──────────┘
```
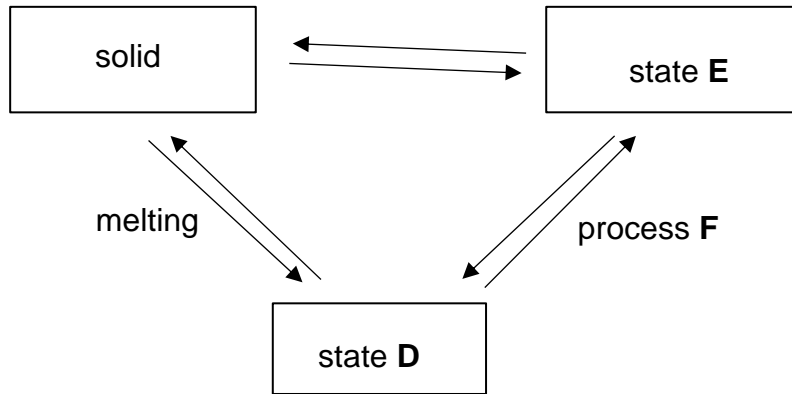
Fig. 7.1

(a) Identify process **F** in Fig. 7.1.

……………………………………………………………………………………………….. [1]

(b) Explain why substances in the solid state have a definite shape.

....

………………………………………………………………………………………………

……………………………………………………………………………………………….. [2]

(c) Draw the arrangement of particles in state **D** in the box below.

```
┌─────────────────┐
│                 │
│                 │
│  ◯              │
└─────────────────┘
```
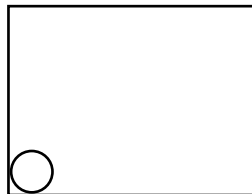
[2]

(d) Describe how the speed and forces of attraction between particles change when melting occurs.

………………………………………………………………………………………………..

………………………………………………………………………………………………

………………………………………………………………………………………………

……………………………………………………………………………………………… [2]

[Total: 7]

8 Fig. 8.1 shows a bar magnet that a student uses in the laboratory.
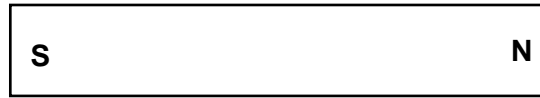
S	N

Fig. 8.1

(a) One of the properties of a magnet is that it has a N-pole and S-pole as shown in Fig. 8.1.

State **one** other property of the bar magnet

……………………………………………………………………………………….. [1]

(b) Draw magnetic field lines around the bar magnet in Fig. 8.1. [2]

(c) The magnet in Fig. 8.1 is hammered continuously for 3 minutes.

The student then places the North pole of the bar magnet next to an iron bar as shown in Fig. 8.2.
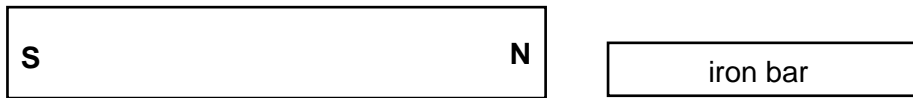
S	N		iron bar

Fig. 8.2

State and explain the observation that the student makes in Figure 8.2.

Observation

………………………………………………………………………………………

Explanation

………………………………………………………………………………………..

……………………………………………………………………………………… [2]

(d) A teacher constructs an electromagnet in the laboratory using an insulated copper wire, two cells, and an iron nail.

Draw, in the space below, a labelled diagram of the electromagnet.

[4]

[Total: 9]

9 During a science lesson in the laboratory, a student puts a substance in the mouth and quickly spits it out.

(a) Name the stimulus that causes the student to spit out the substance.

.... [1]

(b) Describe the role of the tongue in causing the student to spit out the substance.

....

....

....

....

....

.... [3]

(c) The bell rings at the end of the science lesson.

The same student hears the bell but voluntarily delays getting to the next lesson and goes to drink water.

Explain why this action is voluntary.

....

....[1]

[Total:5]

SECTION B

Answer **all** questions.

10 A student carries out an experiment to investigate the reaction of calcium carbonate with dilute hydrochloric acid.

(a) State the colour of calcium carbonate.

………………………………………………………………………………………………… [1]

(b) During the investigation, the student adds 5 g of calcium carbonate granules (marble chips) into 20 cm^3 of dilute hydrochloric acid in a beaker.

(i) Describe two observations the student makes.

1………………………………………………………………………………………....

2………………………………………………………………………………………[2]

(ii) Describe how the student uses a universal indicator paper to test for the acidity of the hydrochloric acid solution.

……………………………………………………………………………………….

………………………………………………………………………………… [2]

(c) Describe **one** change to the procedure that the student can make in order to increase the speed of the reaction of the calcium carbonate with the dilute hydrochloric acid.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………….......[2]

[Total: 7]

11 In an experiment for measuring speed of an athlete, an athlete runs a distance of 200 m in a sports field.

The time taken to run the 200 m is measured, and the speed is calculated.
Fig. 11.1 shows the time at the beginning of the race, and at the end of the race.
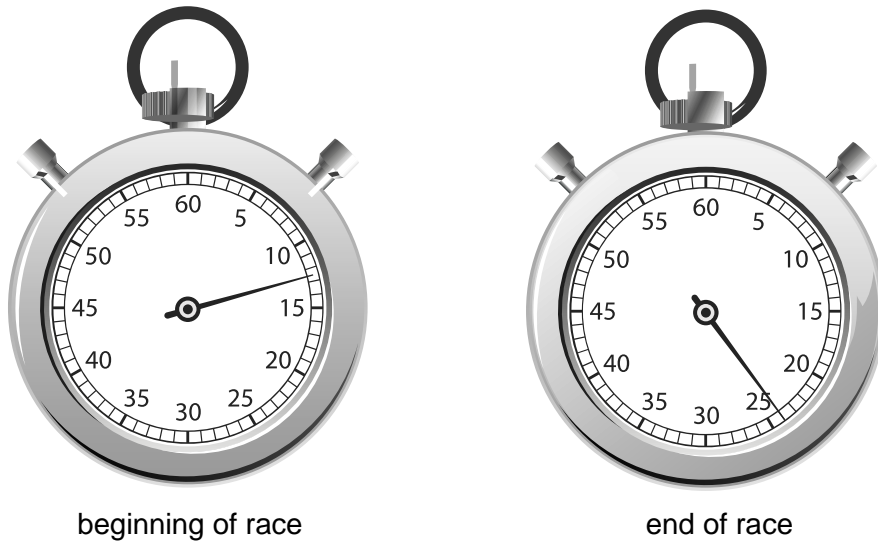
beginning of race   end of race

Fig. 11.1

(a) Name the instrument, in Fig. 11.1.

…………………………………………………………………………………………….. [1]

(b) Calculate the time taken by the athlete to run the 200 m distance.

…………………………………… [2]

(c) Calculate the speed of the athlete in the race.

.……………………………….m/s [2]

(d) State **one** difference between the athlete's speed and velocity.

……………………………………………………………………………………………

.………………………………………………………………………………............ [1]

(e) Fig.11.2 shows the sports field in which the boy is running.
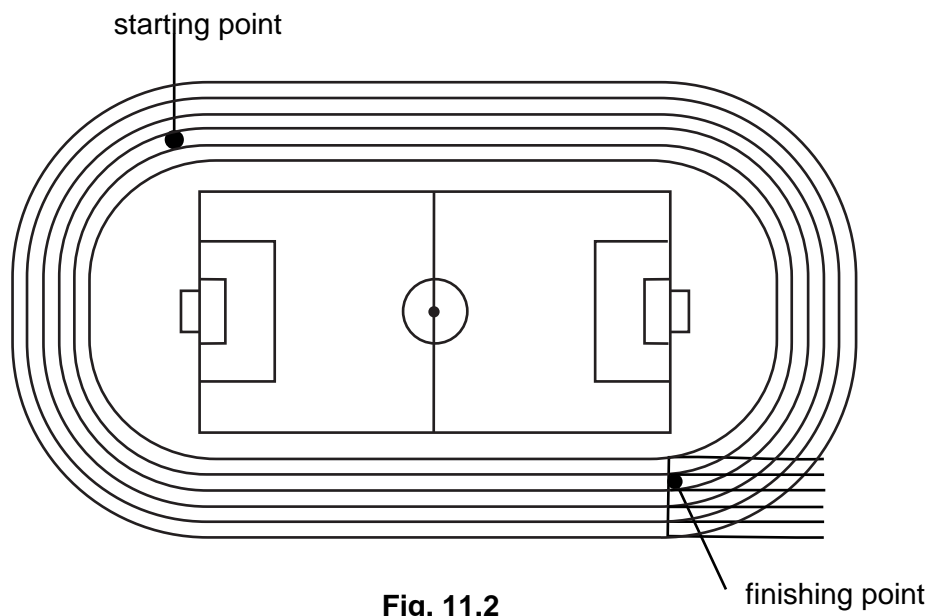
starting point

Fig. 11.2

finishing point

Draw on Fig. 11.2, an arrow line showing the direction in which the athlete's displacement is measured. [1]

[Total: 7]

12 A group of Form 2 students carry out an investigation to see the effect of exercise on the breathing rate of students **G** and **H**.

The breathing rate of the students **G** and **H** before exercise was measured and recorded in Table 12.1.

The two students then exercise for 2 minutes and stop.

The number of breaths per minute for the two students, is recorded in Table 12.1 during and immediately after the exercise at 2 minutes intervals.

Table 12.1

Time/minutes	0	2	4	6
Breathing rate of student **G**	15	50	35	25
Breathing rate of student **H**	14	45	33	22

The results were plotted in Fig. 12.1
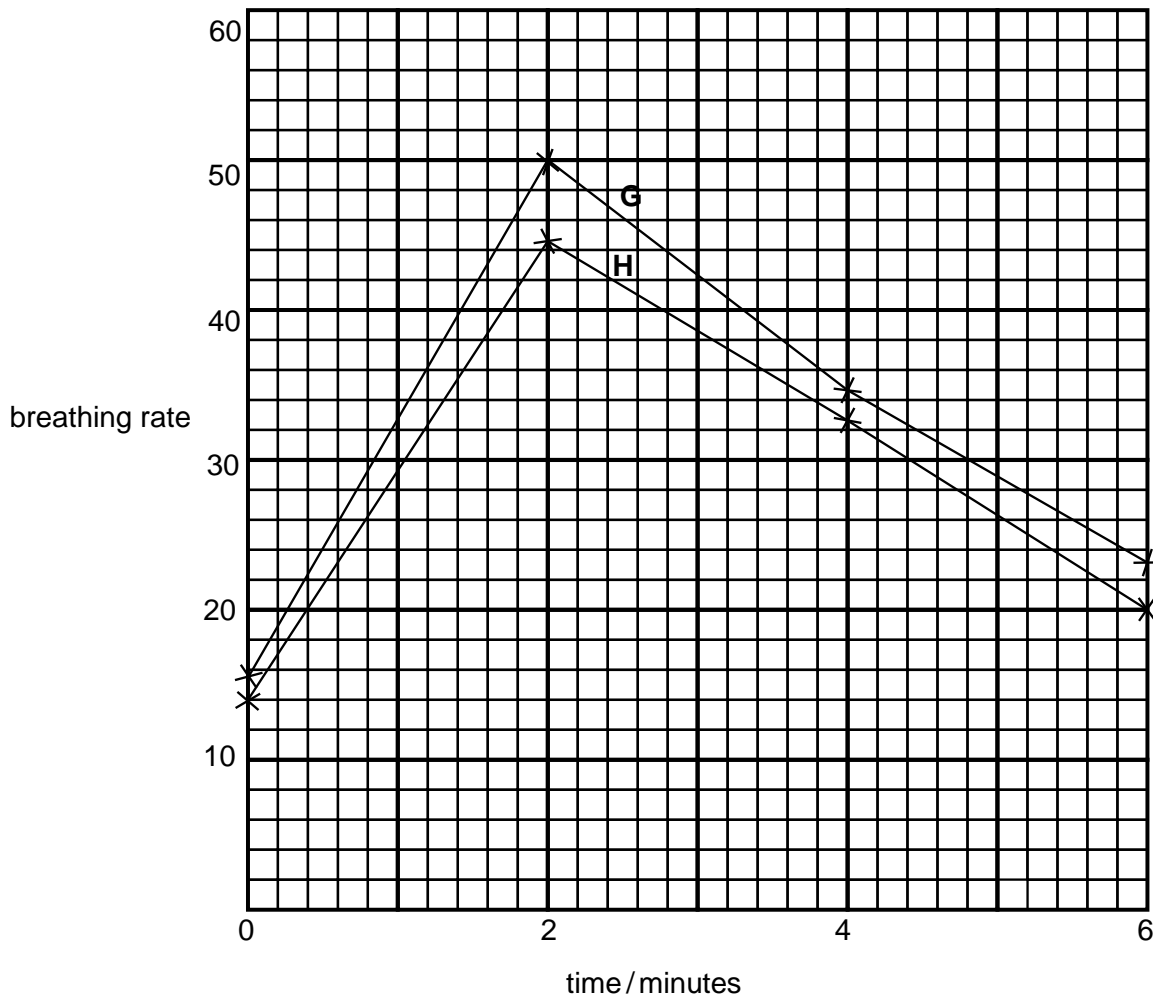
Fig.12.1

(a) Use Fig. 12.1 to find the breathing rate of student **H** at 5 minutes.

…………………………………………………………………………………….. [2]

(b) Describe, using Fig.12.1, the relationship between the rate of breathing and exercise.

…………………………………………………………………………………………

…………………………………………………………………………….......... [1]

(c) Calculate the difference in the breathing rate for the two students at 3 minutes.

difference in breathing rate = ……….………….… [1]

(d) After the exercise, student **G** breathes into a test tube with lime water.

State and explain the observation made by student **G**.

Observation

…………………………………………………………………………………………

Explanation

……………………………………………………………………………….............

……………………………………………………………………………………[2]

[Total: 6]