EXAMINATIONS COUNCIL OF ESWATINI
Eswatini General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

PHYSICAL SCIENCE **6888/02**

Paper 2 Structured Questions **October/November 2024**

1 hour 15 minutes

Candidates answer on the Question Paper.

No additional materials are required.

READ THESE INSTRUCTIONS FIRST

Write your name, centre number and candidate number in spaces provided.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Do **not** use staples, paper clips, highlighters, glue or correction fluid.
Do **not** write on the barcode.

Answer **all** questions.

You may use an electronic calculator.
You may lose marks if you do not show your working or if you do not use appropriate units.

A copy of the Periodic Table is printed on page 16.

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

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

This document consists of **15** printed pages and **1** blank page.

1 The following elements are in the same period of the Periodic Table.

Na	Mg	A*l*	Si	P	S	C*l*	Ar

Identify an element from the list that:

(a) is ductile ..... [1]

(b) is in the same group as calcium ..... [1]

(c) is unreactive ..... [1]

(d) reacts with water to form an alkali ..... [1]

(e) displaces iodine from potassium iodide ..... [1]

(f) is in the same group as the element that forms the allotropes, graphite and graphene

..... [1]

2 Fig. 2.1 shows an instrument that a mechanic uses to measure the diameter of a spherical ball bearing.

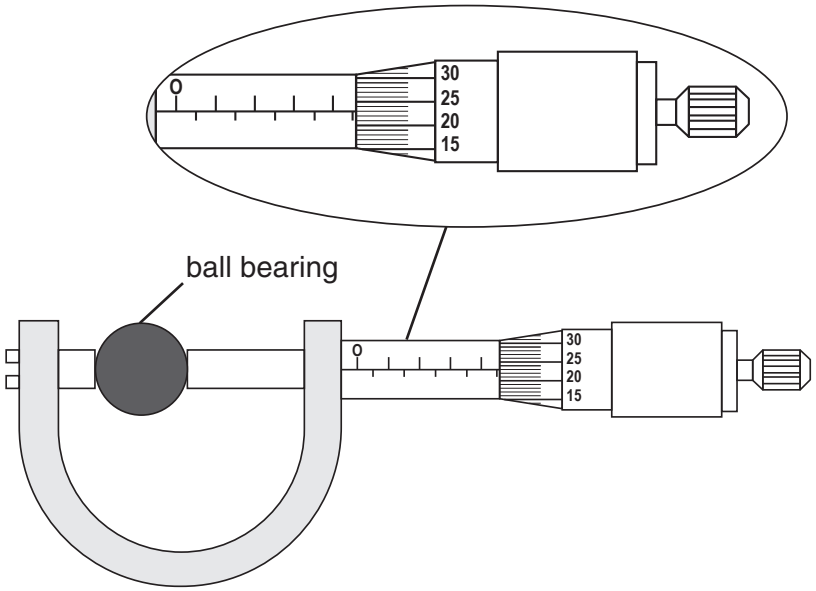

Fig. 2.1

(a) Name the instrument shown in Fig. 2.1.

..... [1]

(b) Determine the diameter of the ball bearing in Fig. 2.1. Show your working.

[Write your answer in centimetres, cm.]

..... cm [3]

(c) The volume of a sphere is given as:

$$V = \frac{4}{3}\pi r^3$$

Calculate the volume of the ball bearing. Give your answer to 3 significant figures.

..... cm^3 [3]

3 **(a)** Iodine-126 and iodine-129 are naturally occurring atoms of iodine.

(i) State the name given to two or more atoms of the same element that have the same proton number, but different nucleon numbers.

..... [1]

(ii) Complete Table 3.1 to show the numbers of subatomic particles in an atom and ion of iodine.

Table 3.1

subatomic particle	^{126}I	$^{129}I^-$
protons		
neutrons		
electrons		

[3]

(b) Iodine reacts with barium to form barium iodide, BaI_2.

Draw a dot and cross diagram for barium iodide, BaI_2.

[Show outer shell electrons only.]

[2]

4 A minibus carrying passengers travels from bus stop **A** to bus stop **B**.

The three stages of the journey from **A** to **B** are:

1. Uniform acceleration from rest for 6 seconds.
2. Uniform speed for 10 seconds.
3. Non-uniform deceleration for 5 seconds.

Fig. 4.1 shows an incomplete speed-time graph for the journey of the minibus.

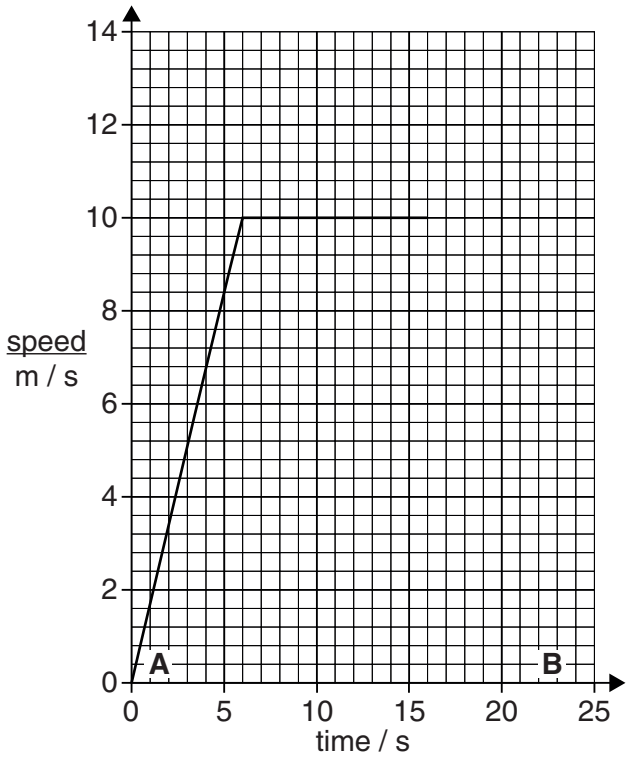

Fig. 4.1

(a) Define the term *acceleration*.

..... [1]

(b) (i) Complete the graph in Fig. 4.1 to show stage 3 of the journey. [1]

(ii) Calculate the acceleration of the minibus during the first 6 seconds of the journey.

..... m/s^2 [2]

(iii) Using the graph in Fig. 4.1, calculate the distance the minibus travels in the first 6 seconds.

..... m [2]

(c) The mass of the minibus and passengers is 2800 kg.

Calculate the net force needed to produce the acceleration obtained in **(b)(ii)**.

State the unit.

..... [3]

5 Lead and tin are two transition elements that can be mixed to form an alloy known as solder.

(a) State what is meant by the term *element*.

.....

..... [1]

(b) Explain why solder conducts electricity.

.....

..... [1]

(c) Suggest **one** harmful effect on human health of using solder.

.....

..... [1]

(d) Bronze is another alloy made up of 70% copper and 30% tin.

Draw the arrangement of particles in bronze in the box.

Use: ○ for a copper particle, and

⊗ for a tin particle.

[2]

6 **(a)** Most electronic devices convert data as digital signals.

Explain what is meant by a digital signal.

.....

..... [1]

(b) Computers and other electronic gadgets use logic gates.

Fig. 6.1 shows a combination of logic gates for a car door-light system.

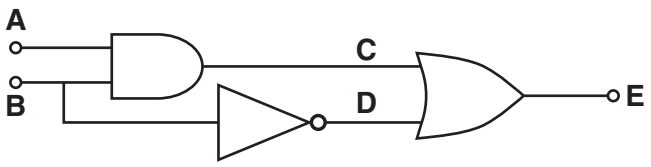

Fig. 6.1

Table 6.1 shows the truth table for the car door light system.

Table 6.1

Inputs to AND gate		Inputs to OR gate		Output **E**
A	**B**	**C**	**D**	
0	0		1	1
0	1	0		0
1	0	0	1	
1	1	1		1

Complete Table 6.1 by filling the empty boxes. [2]

(c) In Fig. 6.2, draw the symbols of a NAND gate and a NOR gate.

NAND gate NOR gate

Fig. 6.2

[2]

(d) State how the output of an AND gate differs from that of a NAND gate.

.....

..... [1]

(e) Fig. 6.3 shows a symbol for an electronic component.

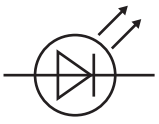

Fig. 6.3

Name the component represented by the symbol in Fig. 6.3.

..... [1]

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[Question 7 begins on page 9]

7 Fig. 7.1 shows a flow diagram for the reactions of calcium carbonate and the common names of the calcium compounds.

One of the common names of calcium carbonate is limestone.

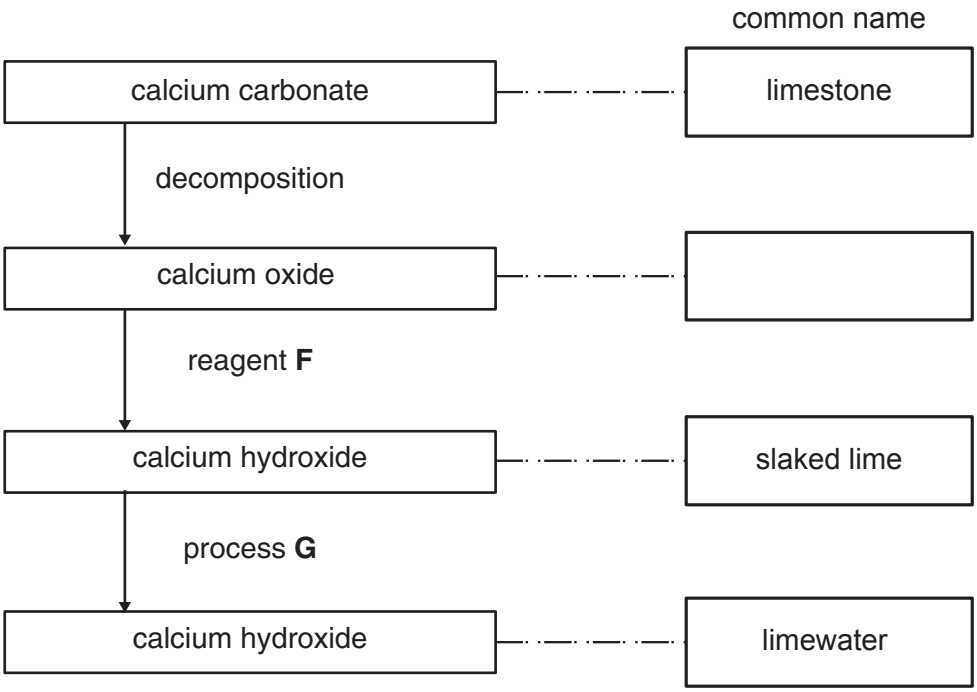


Fig. 7.1

(a) (i) Complete the empty box in Fig 7.1 by filling in the common name of calcium oxide. [1]

(ii) State the name of reagent **F**.

..... [1]

(b) Explain why process **G** is a physical change.

.....

..... [1]

[Turn over

(c) A student reacts excess calcium carbonate, $CaCO_3$, with hydrochloric acid, HCl, to produce carbon dioxide gas, CO_2.

$$CaCO_3 + 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$

(i) The student:

- collects carbon dioxide gas produced in a plastic bottle
- half-fills the bottle with distilled water, closes it, and shakes it.

After shaking for about two minutes, the bottle collapses.

Explain the observation.

.....

.....

.....

..... [2]

(ii) The calcium chloride, $CaCl_2$, formed is a soluble salt.

Describe how pure calcium chloride crystals can be obtained from the solution.

.....

.....

.....

.....

..... [3]

(iii) Calculate the volume of carbon dioxide gas produced when excess calcium carbonate is added to 100 cm^3 of 0.4 mol / dm^3 of hydrochloric acid, HC*l*, at room temperature and pressure.

[Use the molar gas volume as 24 dm^3.]

Follow these steps:

Step 1
Calculate the number of moles in 100 cm^3 of 0.4 mol / dm^3 HC*l*.

..... mol [2]

Step 2
Calculate the number of moles of carbon dioxide gas produced.

..... mol [1]

Step 3
Calculate the volume of carbon dioxide gas produced.

..... dm^3 [2]

8 **(a)** A spring is an elastic object.

Define elasticity of an object.

.....

..... [1]

(b) Table 8.1 shows the length of a spring when different masses are suspended on it.

Table 8.1

mass / g	length of spring / cm	extension / cm
0	10	0
50	14	
100	18	
150		12
200		16

Complete Table 8.1 by filling in the empty boxes. [2]

(c) Fig. 8.1 shows an extension-load graph for another spring.

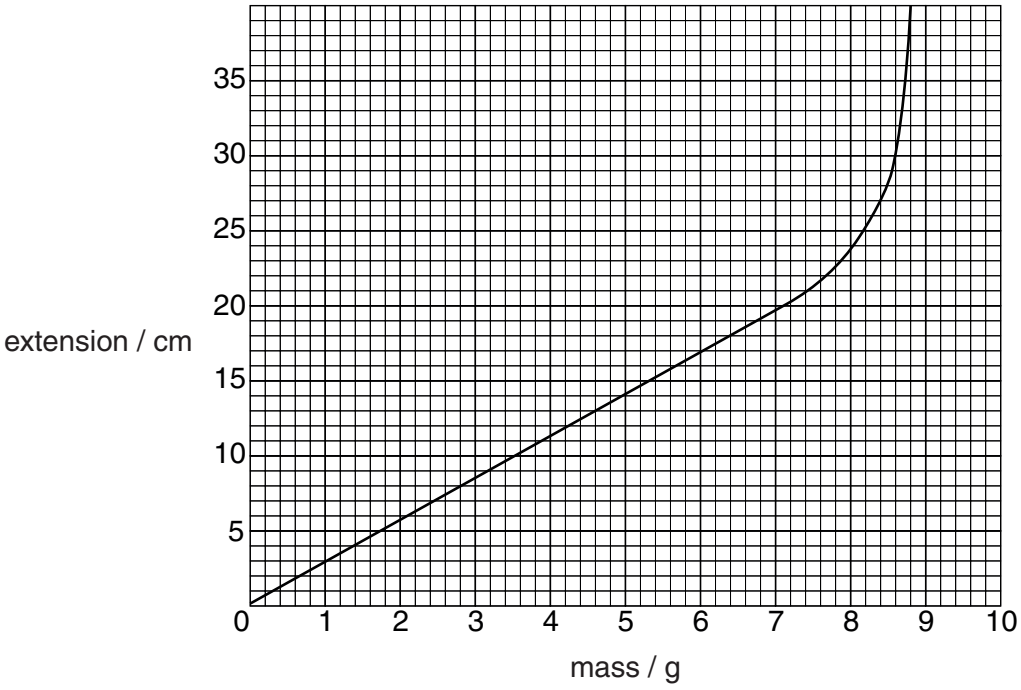


Fig. 8.1

(i) On Fig. 8.1, mark the 'limit of proportionality' with a cross (×). [1]

(ii) A load of 9 g is suspended on the spring and then removed.

Explain what happens to the spring when the load is removed.

.....

.....

..... [2]

9 Energy is needed to do work.

(a) Describe what is meant by 1 J of work.

.....

.....

..... [2]

(b) State the main energy changes that take place in a power station that uses nuclear fission to release energy.

.....

..... [2]

(c) Explain why the energy changes in a car engine are not 100% efficient.

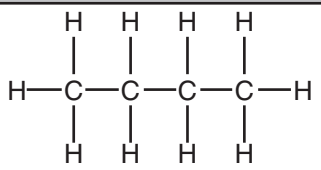
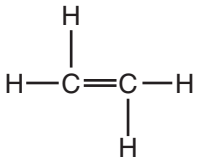
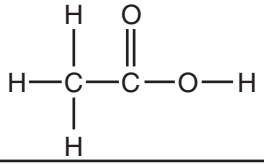
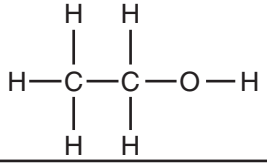
.....

.....

..... [2]

10 Table 10.1 shows some structures of organic compounds.

Table 10.1

H	**J**
	
K	**L**
	

(a) State the homologous series to which compound **H** belongs.

..... [1]

(b) **(i)** Identify which structure in Table 10.1 is an unsaturated organic compound.

..... [1]

(ii) Describe the test for an unsaturated organic compound.

test .....

result .....

.....

[2]

(c) State the conditions needed to convert **L** into **J**.

.....

.....

..... [2]

(d) Draw the structure formed when **K** reacts with **L**.

[2]

(e) Starch is a natural polymer formed by combining many glucose molecules.

Draw the part-structure of starch.

Use this model to represent a glucose molecule: H—O—□—O—H

[2]

11 Fig. 11.1 shows a set-up of transformers used in high voltage transmission of electricity.

[Assume the transformers are 100% efficient.]

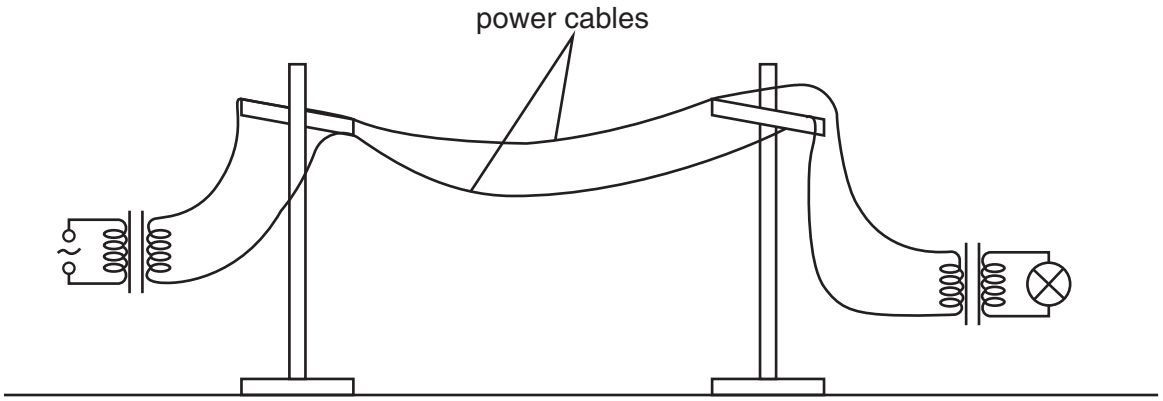


Fig. 11.1

(a) Describe the difference between a step-down transformer and step-up transformer.

.....

.....

..... [2]

(b) Explain why high voltage is used in the transmission of electricity.

.....

..... [2]

(c) Explain why the power cables are slack between the poles, as shown in Fig. 11.1.

.....

..... [1]

DATA SHEET
The Periodic Table of the Elements

	Group																	
	I	II									III	IV	V	VI	VII	0
																4 He Helium 2
						1 H Hydrogen 1										
	7 Li Lithium 3	9 Be Beryllium 4									11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
	23 Na Sodium 11	24 Mg Magnesium 12									27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57 *	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	209 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

* 58–71 Lanthanoid series	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	163 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
† 90–103 Actinoid series	232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	244 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	247 Bk Berkelium 97	251 Cf Californium 98	252 Es Einsteinium 99	257 Fm Fermium 100	258 Md Mendelevium 101	259 No Nobelium 102	260 Lr Lawrencium 103

Key

b	a
	X

a = relative atomic mass
X = atomic symbol
b = atomic (proton) number

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).