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 2023**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and candidate name in the spaces provided.
Write in dark blue or black pen.
You may use a 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 the appropriate units.

A copy of the Periodic Table is printed on page 14.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks is 80.

For Examiner's Use	
1	
2	
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12	
Total	

This document consists of **14** printed pages and **2** blank pages.

1 Fig. 1.1 shows the three states of matter with their interconversions.

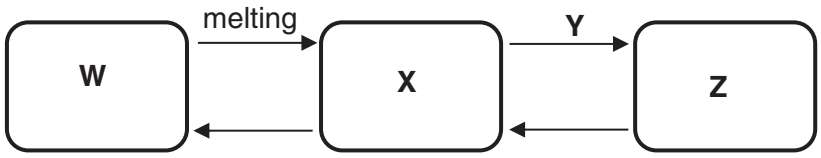

Fig. 1.1

(a) Name

(i) the process **Y** ..... [1]

(ii) the state of matter **Z** ..... [1]

(b) Use the kinetic particle theory to explain the change in arrangement of particles during the melting process.

.....

.....

..... [3]

2 Fig. 2.1 shows a velocity-time graph for a motor-cyclist in the first 100 seconds of his journey.

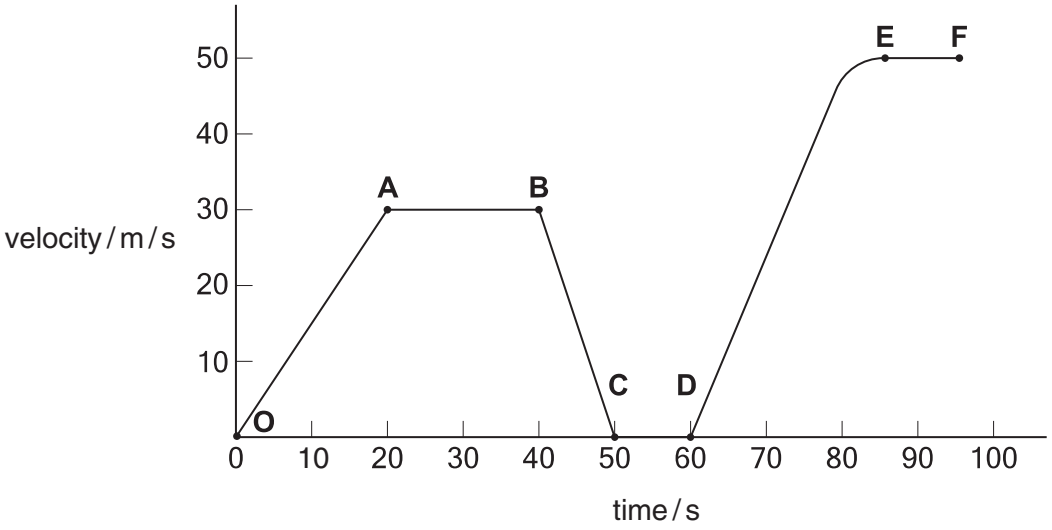

Fig. 2.1

(a) The motor-cyclist is accelerating in region **OA**.

Define *acceleration*.

.....

..... [1]

(b) State the difference in the motion of the motor-cyclist between regions **AB** and **CD**.

.....

..... [1]

(c) Calculate the distance travelled by the motor-cyclist in the first 50 seconds.

distance = ... m [2]

(d) At point **E**, the motor-cyclist reaches terminal velocity.

Explain this statement by making reference to the forces involved.

.....

.....

.....

..... [3]

3 Fig. 3.1 shows the apparatus used to separate a mixture of four alcohols, **G**, **H**, **J** and **K**.

- alcohol **G** has a boiling point of 117 °C
- alcohol **H** has a boiling point of 79 °C
- alcohol **J** has a boiling point of 65 °C
- alcohol **K** has a boiling point of 138 °C

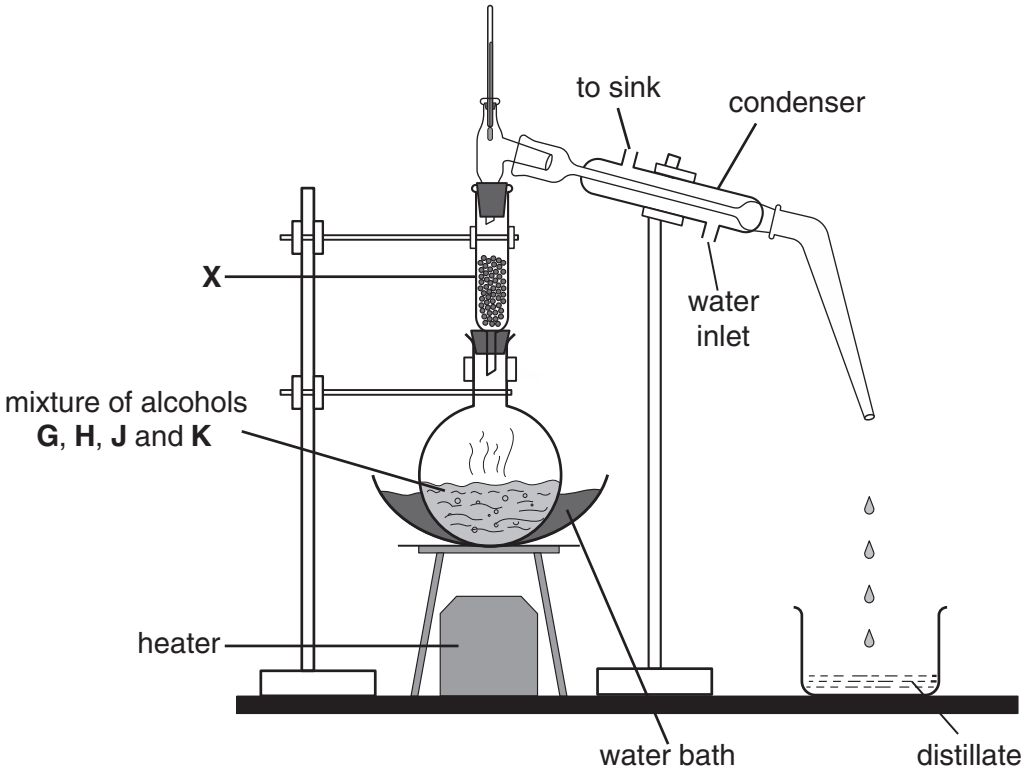

Fig. 3.1

(a) Name the apparatus labelled **X**, in Fig. 3.1.

..... [1]

(b) Explain why alcohol **J** is collected as the first distillate.

..... [1]

(c) Explain why alcohols **G** and **K** will remain in the flask and cannot be separated by this apparatus.

.....

..... [1]

(d) The mixture was heated using a heater instead of a Bunsen burner flame.

Explain why it is not advisable to heat the mixture using a Bunsen burner flame.

.....

..... [1]

4 Sound is a longitudinal wave. Some sounds are audible to the human ear.

(a) State the range of audible frequencies to the human ear.

..... [1]

(b) Explain why sound cannot be transmitted in a vacuum.

.....

.....

..... [2]

(c) Fig. 4.1 shows how echo sounding is used by sailors to estimate the depth of the sea.

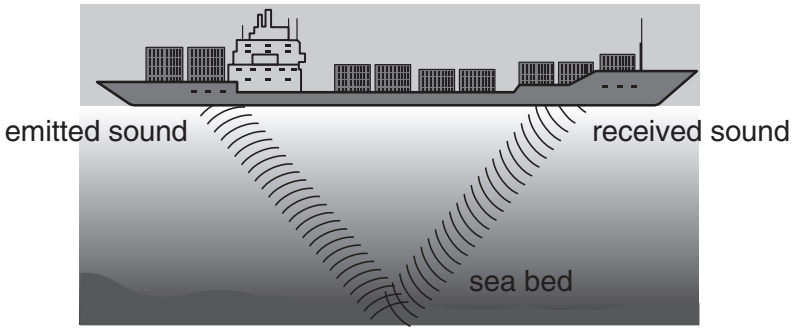

Fig. 4.1

(i) Describe an echo.

..... [1]

(ii) The ship emits sound to the sea bed that is 4 500 m below sea level.

The echo is detected after 6 seconds.

Calculate the estimate of the speed of sound in sea water.

speed ..... m/s [3]

(iii) Electromagnetic waves travel faster than sound.

State **two** other features of electromagnetic waves.

1 .....

2 .....
[2]

5 The following substances are Group VII elements.

fluorine chlorine bromine X astatine

(a) Use the Periodic Table to identify element **X**.

..... [1]

(b) Describe a trend in **one** physical property of the Group VII elements.

.....

..... [1]

(c) Chlorine gas is bubbled through different potassium halides as shown in Table 5.1.

Table 5.1

	potassium fluoride	potassium bromide	potassium astatide
chlorine	no reaction	reaction	reaction
colour change	no colour change	orange	

(i) Complete Table 5.1 by writing the colour change observed when chlorine is bubbled through potassium astatide. [1]

(ii) Explain why there is no reaction when the chlorine is bubbled through potassium fluoride.

.....

..... [1]

(iii) Write a balanced chemical equation for the reaction of chlorine gas, Cl_2, with potassium astatide, KAt, to form potassium chloride and astatine.

..... [2]

6 Fig. 6.1 shows a metal sphere being charged by induction.

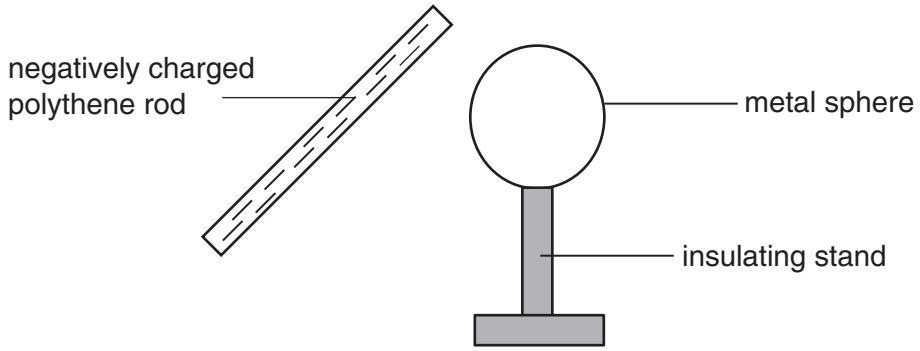

Fig. 6.1

(a) Draw, on Fig. 6.1, the distribution of charge in the metal sphere when the negatively charged polythene rod is brought near it. [2]

(b) Charges are also involved in lightning.

Describe how lightning occurs between a negatively charged cloud and the Earth.

.....

.....

.....

..... [3]

(c) A lightning bolt carries about 1×10^5 C of charge and lasts for about 0.1 second.

Calculate the current produced by the lightning strike.

current = ... [2]

[Turn over

7 Fig. 7.1 shows apparatus for the fractional distillation of liquid air.

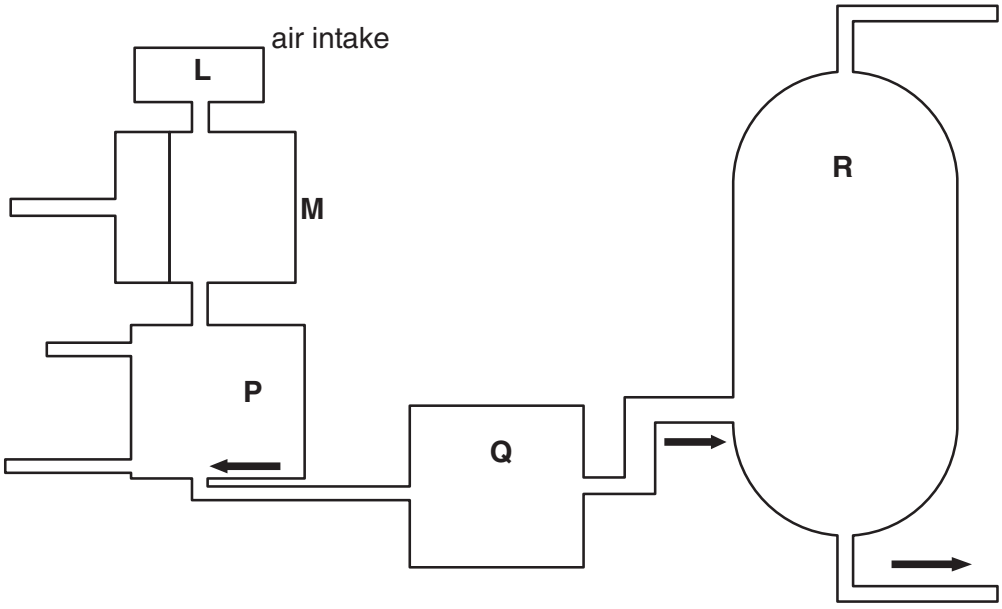

Fig. 7.1

(a) Name the process that removes dust particles from the air in Fig. 7.1.

..... [1]

(b) Carbon dioxide is removed at structure **P**.

Draw the arrangement of particles of the carbon dioxide as it is removed.

[2]

(c) Describe the role of external liquid nitrogen in Fig. 7.1.

Your description should make reference to the structure on which the liquid nitrogen acts.

.....

.....

..... [2]

8 **(a)** Digital systems have replaced analogue systems in electronics.

State the difference between digital and analogue systems.

.....

.....

..... [2]

(b) Digital electronics use electronic switches called logic gates.

Fig. 8.1 shows a logic gate.

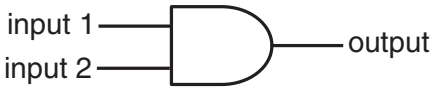

Fig. 8.1

(i) Name the logic gate in Fig. 8.1.

..... [1]

(ii) Table 8.1 is a truth table for the logic gate in Fig. 8.1.

Complete the truth table for the logic gate.

Table 8.1

input 1	input 2	output
0		0
0	1	
	0	0
1	1	

[3]

(c) Fig. 8.2 shows a circuit for an OR gate.

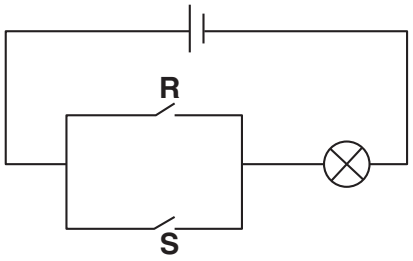

Fig. 8.2

(i) State how you can make the lamp produce light.

.....

..... [1]

(ii) Draw, on Fig. 8.2, a voltmeter to measure the e.m.f. of the cell. [1]

[Turn over

9 Gas **X** has a mass of 0.176 g and occupies a volume of 96 cm^3 at room temperature and pressure (r.t.p).

(a) Calculate the number of moles of gas **X**.

[Use the molar gas volume as 24 dm^3/mol at r.t.p.]

..... moles [2]

(b) Calculate the molar mass of gas **X**.

..... g [2]

(c) Gas **X** is a non-metallic oxide. The oxide has two oxygen atoms.

Name gas **X**.

..... [1]

10 Radioactivity occurs when an unstable nucleus spontaneously emits an alpha particle, beta particle or gamma radiation.

(a) State the nature of beta particles.

..... [1]

(b) An unstable nucleus of radium, $^{226}_{88}Ra$ decays by emitting an alpha particle.

Write a nuclear equation for this decay.

$^{226}_{88}Ra \longrightarrow$ ..... + ...

[3]

(c) Fig. 10.1 shows a decay curve of a radioactive element.

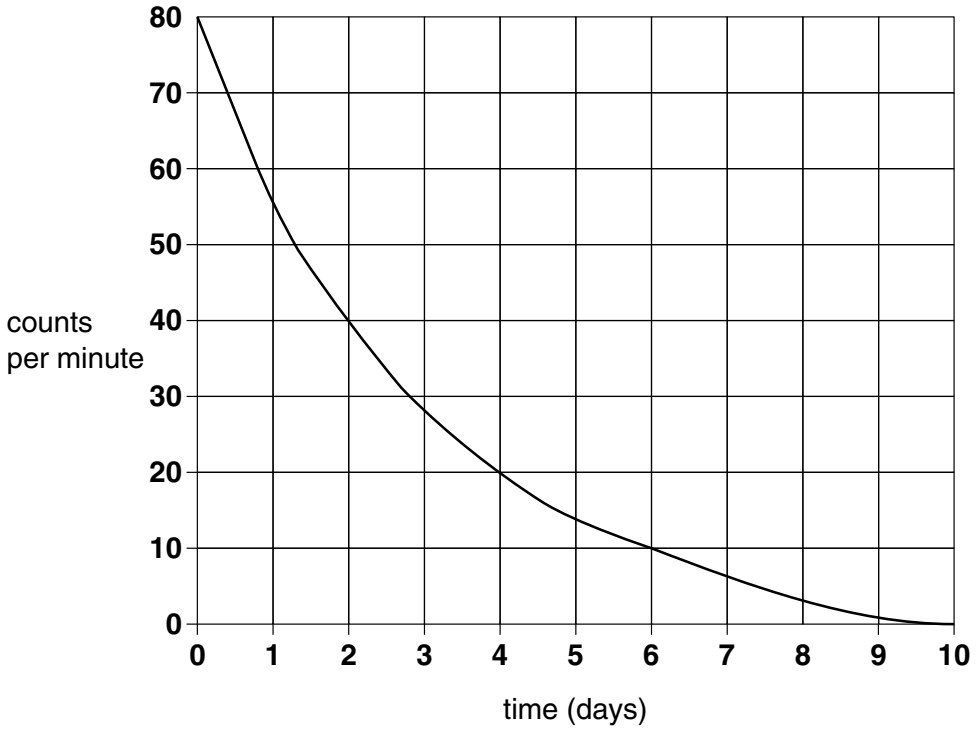

Fig. 10.1

(i) Define *radioactive decay*.

.....

..... [2]

(ii) Use the graph in Fig. 10.1 to determine the half-life of the radioactive element.

..... [2]

[Turn over

11 A photographic film is coated with silver bromide.

The parts on the film exposed to light change from white to grey and then to black.

(a) Silver bromide is made up of ions.

Determine the net oxidation state of silver bromide.

..... [1]

(b) The silver ions are reduced when silver bromide is exposed to light.

The reaction that occurs is:

$2AgBr \longrightarrow 2Ag + Br_2$

Write the equation for the reduction of silver ions.

..... [2]

(c) Reduction also occurs in the Blast furnace.

Describe the reduction of iron(III) oxide by carbon monoxide to form iron.

.....

..... [1]

(d) Silver is recycled since it is a precious metal.

State **one** environmental reason for recycling metals.

.....

..... [1]

12 Ethene is a hydrocarbon that is part of a homologous series.

(a) Describe a homologous series.

.....

..... [2]

(b) Ethene can be obtained from the products of fractional distillation of crude oil.

Outline how ethene can be obtained from paraffin using a suitable catalyst.

.....

.....

.....

..... [3]

(c) Ethene undergoes an addition reaction with steam to form ethanol.

Describe, in general terms, what happens during an addition reaction.

.....

.....

..... [2]

(d) Ethanol undergoes oxidation with potassium dichromate(VI).

Draw the structure of the compound formed when ethanol is oxidised by potassium dichromate(VI).

[2]

(e) Ethanol is a hydrocarbon with many uses.

(i) Ethanol and petrol are both used as fuels.

State **one** advantage of using ethanol as a fuel instead of petrol.

.....

..... [1]

(ii) Explain why ethanol is suitable to use as a hand sanitiser.

.....

..... [1]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II										III	IV	V	VI	VII	0
							1 H Hydrogen 1									4 He Helium 2
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	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 †															

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
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

* 58–71 Lanthanoid series
† 90–103 Actinoid series

Key: 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.).

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