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 2021**

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 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 **16** printed pages.

1 Table 1.1 shows the composition of particles **A**, **B**, **C** and **D**.

Table 1.1

particle	number of protons	number of neutrons	number of electrons
A	7	8	7
B	11	12	10
C	10	12	10
D	7	7	10

(a) Explain why particles **A** and **C** are atoms.

.....

..... [1]

(b) Explain why particles **B** and **D** are oppositely charged ions.

.....

.....

..... [2]

(c) Explain why particles **A** and **D** are isotopes.

.....

.....

..... [2]

(d) Draw the electronic configuration of ion **B**.

[2]

2 A cube of side 10.31 mm is totally submerged in a measuring cylinder.

The water in the measuring cylinder rises up to 33 cm^3.

(a) (i) State the name of an instrument which could be used to measure the length of the side of the cube accurately.

..... [1]

(ii) Calculate the volume of the cube.

..... cm^3 [2]

(iii) Calculate the initial volume of water in the measuring cylinder.

..... cm^3 [2]

(b) The density of the cube is 1.2 g/cm^3.

Calculate the mass of the cube.

..... g [2]

3 Fig. 3.1 shows a flow diagram for the preparation of fertiliser **F**.

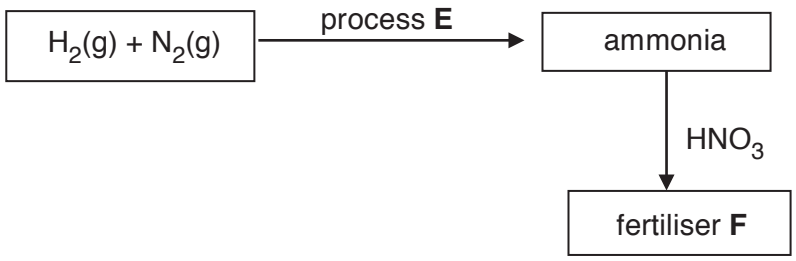


Fig. 3.1

(a) Identify

(i) process **E**,

..... [1]

(ii) fertiliser **F**.

..... [1]

(b) Describe fractional distillation of liquid air to obtain the nitrogen used in process **E**.

.....

.....

.....

.....

..... [3]

(c) Write a balanced chemical equation for the formation of ammonia in Fig. 3.1.

..... [2]

(d) Fertilisers provide plants with the necessary nutrients to grow well.

Name **one** use of nitrogen in plant life.

..... [1]

4 Fig. 4.1 shows two skydivers falling towards the ground from a height of 1500 m.

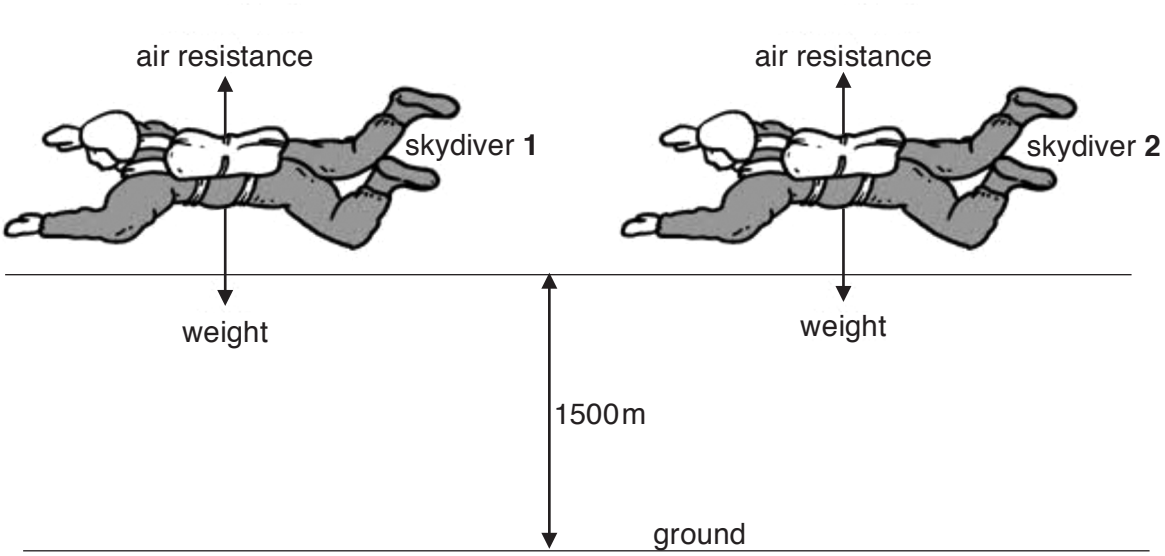


Fig. 4.1

Skydiver **1** opens the parachute before he reaches terminal velocity while skydiver **2** opens the parachute upon reaching terminal velocity.

(a) Explain why the air resistance is eventually greater in skydiver **2**.

.....

.....

.....

..... [2]

(b) State the function of the upwards resultant force when the parachute is opened.

.....

..... [1]

(c) Describe how skydiver **2** reaches terminal velocity.

.....

.....

.....

..... [2]

[Turn over

(d) Describe the motion of the skydivers if there is no air resistance.

.....

.....

..... [2]

5 Fig. 5.1 shows an incomplete set-up used in the laboratory to decompose water by electrolysis.

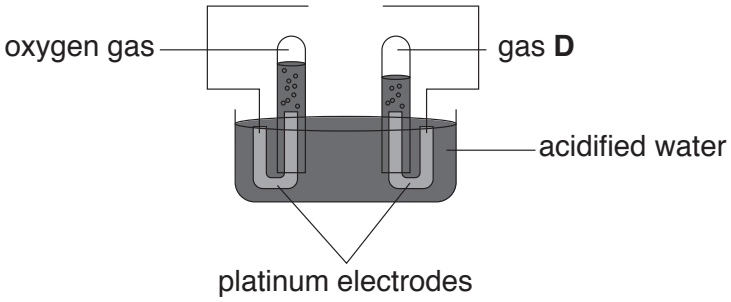


Fig. 5.1

(a) Complete Fig. 5.1, by drawing in the cell symbol. [1]

(b) Explain why the water is acidified during electrolysis.

..... [1]

(c) Describe the reaction that occurs at the cathode.

.....

.....

..... [2]

(d) State the importance of using platinum electrodes in Fig. 5.1.

.....

..... [1]

[Turn over

6 Fig. 6.1 shows a simple crane with a 5000 kg load suspended on it.

The horizontal beam of the crane has a mass of 1000 kg.

The crane is pivoted at **A** and is balanced by mass **F**.

The centre of mass of the crane is at point **C**.

[g = 10 N/kg]

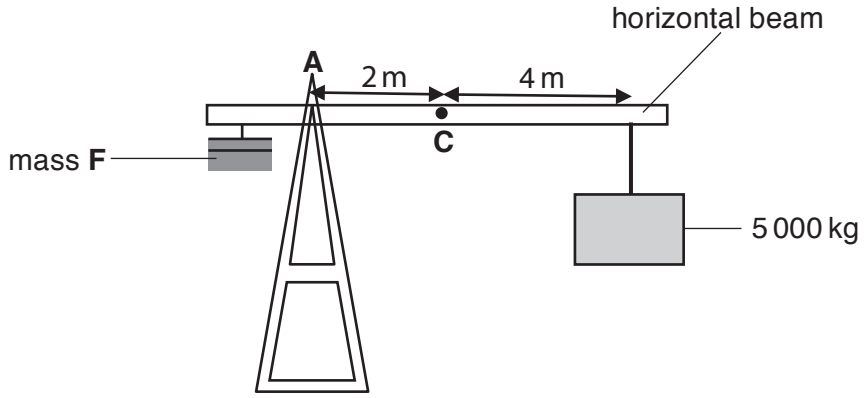


Fig. 6.1

(a) State the meaning of centre of mass.

.....

..... [1]

(b) Calculate the weight of the horizontal beam.

..... N [2]

(c) Calculate the total clockwise turning effect about pivot **A**.

..... [3]

(d) Explain why mass **F** is larger than the combined mass of the beam and the 5000 kg load.

.....

.....

..... [2]

7 Some metals such as magnesium react with salt solutions to form other salts.

(a) Describe **one** characteristic of magnesium that shows it is a metal.

.....

..... [1]

(b) Table 7.1 shows the results of adding some metals to salt solutions.

Table 7.1

	salt solutions		
metal	magnesium sulfate	iron(II) sulfate	copper(II) sulfate
magnesium		$MgSO_4$	$MgSO_4$
iron	no reaction		
copper		no reaction	

(i) Complete Table 7.1 by writing the missing information. [2]

(ii) Name the type of reaction that takes place when the metals in Table 7.1 react.

..... [1]

(c) The chemical equation for the reaction of magnesium metal with aqueous copper(II) sulfate is:

$$Mg(s) + CuSO_4(aq) \longrightarrow MgSO_4(aq) + Cu(s)$$

(i) Explain reduction, in terms of electron transfer, using the above equation.

.....

.....

..... [2]

[Turn over

(ii) 16 g of copper(II) sulfate is reacted with magnesium.

Calculate the number of moles in 16 g of copper(II) sulfate.

[A_r Cu = 64; A_r S = 32; A_r O = 16]

..... [3]

(iii) Use the equation in **(c)(i)** to show that copper(II) sulfate is the limiting reagent when 16 g of copper(II) sulfate is reacted with 0.2 moles of magnesium.

.....

.....

.....

..... [2]

(d) Calculate the percentage composition of copper in copper(II) sulfate, $CuSO_4$.

[A_r Cu = 64; A_r S = 32; A_r O = 16]

..... [2]

8 Fig. 8.1 shows a very small animal, **A**, represented by a dot in an aquarium (a transparent tank of water).

A student looks at the small animal through a lens.

F is the focal point of the lens.

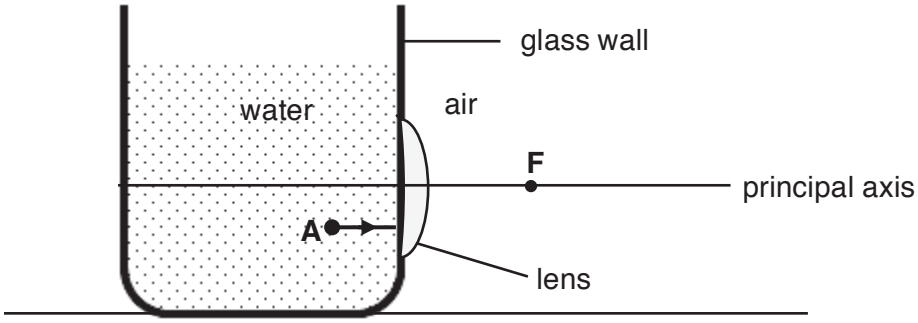


Fig. 8.1

(a) Complete, on Fig. 8.1, the path of the ray, from the animal **A**, passing through the lens into air. [3]

(b) Draw another ray, on Fig. 8.1, to determine the position of the image of the small animal, **A**.

Label the image **I**. [2]

(c) Draw, on Fig. 8.1, an eye in a position which enables the student to see the image in **(b)**. [2]

9 Polymers are formed from monomers by the process of polymerisation.

Fig. 9.1 shows the structure of a polymer formed by addition polymerisation.

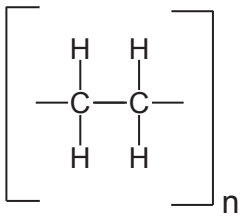


Fig. 9.1

(a) Draw the structural formula of the monomer from which the polymer in Fig. 9.1 is formed.

[2]

(b) Fig. 9.2 shows two monomers that undergo condensation polymerisation to form a polyester known as terylene.

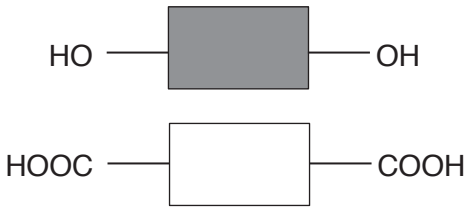


Fig. 9.2

(i) Draw the part-structure of a terylene molecule.

[2]

(ii) Explain why this is a condensation polymerisation.

..... [1]

(iii) Name a natural polymer that has the same ester linkage as terylene.

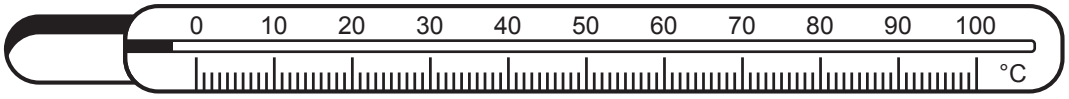
..... [1]

(c) Some synthetic polymers are non-biodegradable.

State the effect of these polymers on the environment.

..... [1]

10 Fig. 10.1 and Fig.10.2 show two liquid-in-glass thermometers, drawn not to scale.



NOT TO SCALE

Fig. 10.1

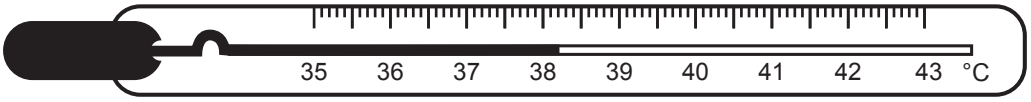


Fig. 10.2

(a) (i) Describe, using Fig. 10.2, the range of a thermometer.

.....

.....

..... [2]

(ii) Explain why the thermometer in Fig. 10.2 is more sensitive than the one in Fig. 10.1.

.....

.....

..... [2]

(b) In industries, a thermocouple is used rather than a liquid-in-glass thermometer.

(i) State the physical property that varies with temperature, which a thermocouple uses.

..... [1]

(ii) Explain **one** advantage of a thermocouple over a liquid-in-glass thermometer.

.....

.....

..... [2]

11 Fig. 11.1 shows a simplified electrical circuit inside a hairdryer.

The circuit consists of a fuse, motor and a heater.

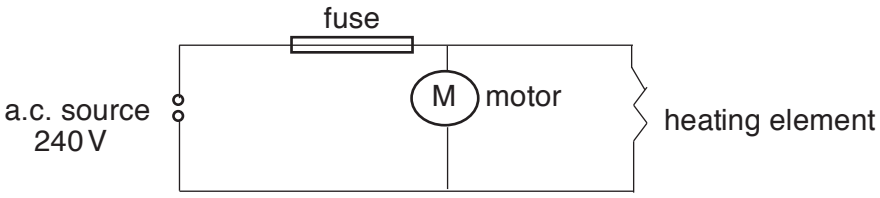


Fig. 11.1

(a) State the type of circuit connection shown in Fig. 11.1.

..... [1]

(b) Indicate, on Fig. 11.1, the live wire. [1]

(c) The heater is rated 1000 W.

Calculate the current through the heating element.

..... **A** [2]

[Turn over

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 **A*l*** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **C*l*** 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 **T*l*** 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 **X** b	
	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.).