EXAMINATIONS COUNCIL OF ESWATINI
Eswatini General Certificate of Secondary Education

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**PHYSICAL SCIENCE** **6888/02**

Paper 2 Structured Questions **October/November 2022**

**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.

A copy of the Periodic Table is printed on page 14.
You may lose marks if you do not show your working or if you do not use the appropriate units.
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 | |
| Total | |

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

**1** Table 1.1 shows some physical properties of metals **A**, **B**, **C** and **D**.

**Table 1.1**

| metal | density / g / cm$^3$ | melting point / °C | hardness | colour of metal salts |
|---|---|---|---|---|
| **A** | 0.89 | 63 | soft | white |
| **B** | 8.96 | 1083 | hard | blue |
| **C** | 1.74 | 670 | hard | white |
| **D** | 0.97 | 98 | soft | white |

**(a) (i)** Identify a Group I metal from Table 1.1 using the letters **A**, **B**, **C** or **D**.

Give a reason for your answer.

metal .....

reason ..... [2]

**(ii)** Identify a transition metal from Table 1.1 using the letters **A**, **B**, **C** or **D**.

Give a reason for your answer.

.....

..... [2]

**(b)** Explain, in terms of metallic bonding, why all the metals in Table 1.1 are good conductors of electricity.

.....

.....

..... [2]

**(c)** Electrical conductivity is a physical property of metals.

State **two** other physical properties of metals **not** shown in Table 1.1.

1.....

2..... [2]

**2** Waves may be classified as transverse or longitudinal.

**(a) (i)** Explain the difference between transverse and longitudinal waves.

.....

.....

..... [2]

**(ii)** State **one** example of a longitudinal wave.

..... [1]

**(b) (i)** A water wave with a frequency of 5 Hz travels at a speed of 15 m/s.

Calculate the wavelength of the water wave.

..... [2]

**(ii)** A light ray enters a beaker of water at an angle of 30° to the normal.

Water has a refractive index of 1.33.

Calculate the angle of refraction for the light ray.

..... [3]

**3** Lungi receives a letter.

She investigates inks from pens belonging to students **L**, **M**, **N** and **Q**.

Fig. 3.1 shows a chromatogram of the inks from the pens of students **L**, **M**, **N** and **Q**.

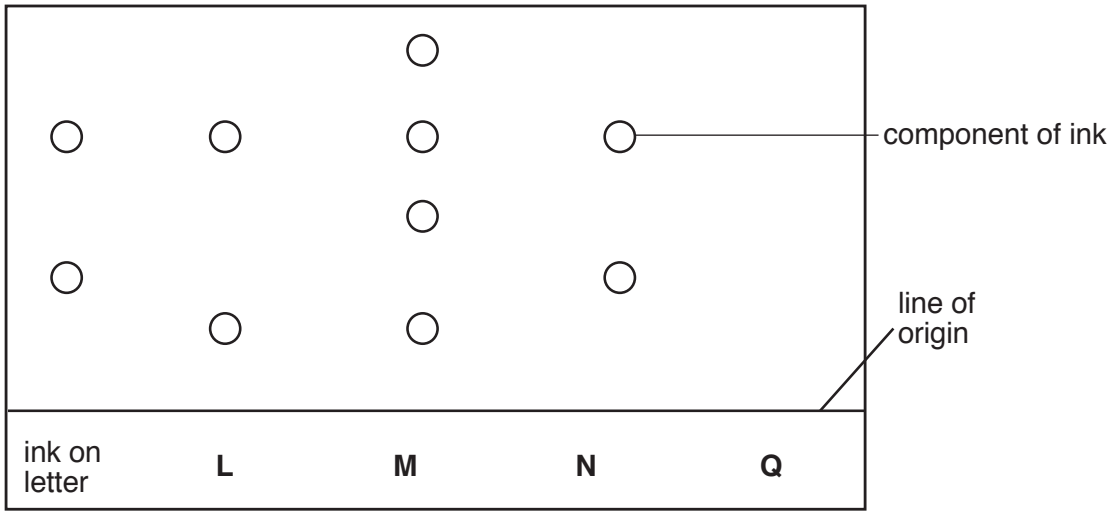



**Fig. 3.1**

**(a)** Suggest a suitable solvent the student uses to obtain the chromatogram.

..... [1]

**(b)** Explain why student **N** is the one that wrote the letter.

.....

..... [1]

**(c)** The ink samples are placed on the line of origin slightly above the solvent line.

Explain why the line of origin is slightly above the solvent line.

.....

.....

..... [2]

**(d)** The components of the ink from student **Q** are invisible in the solvent.

Describe how the components of the ink can be made visible.

.....

.....

..... [2]

**4** Fig. 4.1 shows a simple electromagnet with a plotting compass next to it.

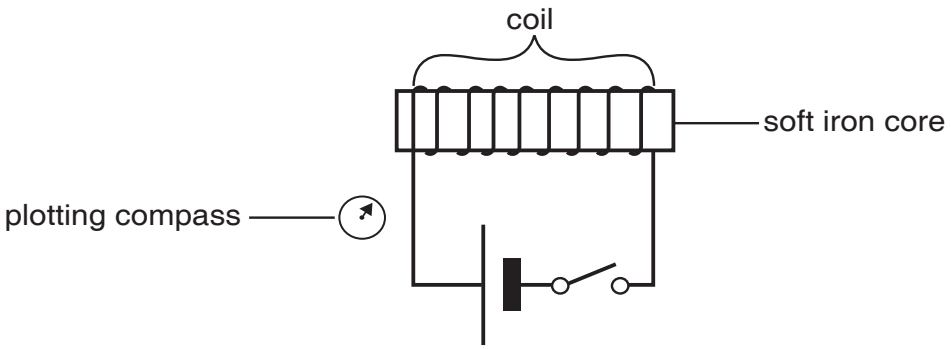



**Fig. 4.1**

**(a)** Name a suitable material for the coil.

..... [1]

**(b)** State **two** ways of increasing the strength of the electromagnet.

1 .....

2 ..... [2]

**(c)** Explain why soft iron is used as a core.

.....

..... [1]

**(d)** When the switch is closed, the needle of the plotting compass deflects.

Explain why the needle deflects.

.....

.....

..... [3]

**(e)** Draw, on Fig. 4.2, the poles of the soft iron core when the switch is closed. [1]

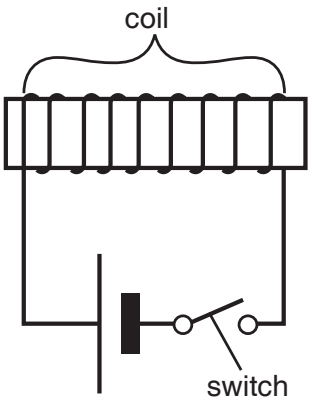


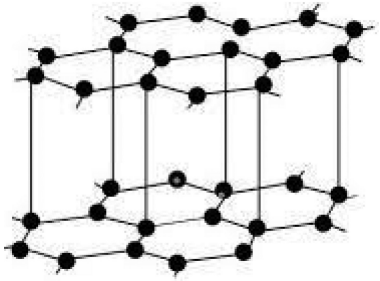

**Fig. 4.2**



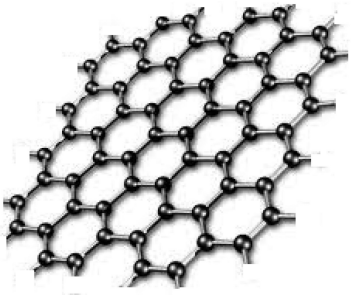


**[Turn over**

**5** Fig. 5.1 shows the structures of two allotropes of carbon, graphite and graphene.



graphite



graphene

**Fig. 5.1**

**(a)** State one;

**(i)** similarity in the structure of graphite and graphene,

.....

..... [1]

**(ii)** difference in the structure of graphite and graphene.

.....

..... [1]

**(b)** State **one** use of graphite and relate it to its property.

use .....

property .....

..... [2]

**6** Radioactive emission occurs randomly over space and time.

**(a)** Describe *radioactive emission*.

.....

..... [2]

**(b)** Alpha and gamma radiation are examples of radioactive emissions.

Describe the behaviour of alpha and gamma radiation in an electric field.

.....

.....

.....

..... [3]

**(c)** Radioisotopes are used to detect leaks from pipes carrying water.

Describe how radioactive isotopes are used to detect leaks from water pipes.

.....

.....

.....

..... [3]

**7** Hydrocarbons are organic compounds.

**(a)** A hydrocarbon is made up of 85.7% carbon and 14.3% hydrogen by mass.

**(i)** Calculate the empirical formula of this hydrocarbon.

..... [3]

**(ii)** The hydrocarbon has a molecular mass of 70.

Determine its molecular formula.

..... [2]

**(b)** An alkane with ten carbon atoms undergoes cracking to form a mixture of gases.

Ethene is one of the gases produced.

The experimental set-up is shown in Fig. 7.1.

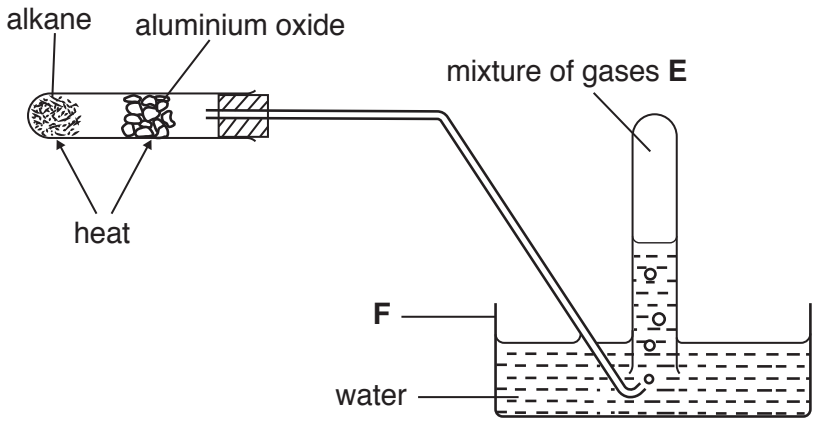



**Fig. 7.1**

**(i)** Name apparatus **F**.

..... [1]

**(ii)** The ethene in **E** decolourises bromine water.

Draw the functional group of hydrocarbons in the same homologous series as ethene.

[1]

**(iii)** Name the other product of the cracking process.

..... [1]

**(c)** Ethene undergoes addition polymerisation to form poly(ethene).

**(i)** Describe addition polymerisation.

.....

.....

..... [2]

**(ii)** Draw the structure of poly(ethene) [1]

**(iii)** Explain why poly(ethene) causes serious pollution problems.

.....

.....

..... [2]

**8** An electric bell has a rating of 240 V, 0.7 A.

**(a)** Calculate;

**(i)** its resistance,

..... Ω [2]

**(ii)** the charge moving in the circuit, if the bell is switched on for 2 minutes.

..... [3]

**(b)** The electric bell is connected with two appliances having resistance of 6 Ω and 3 Ω as shown in Fig. 8.1.

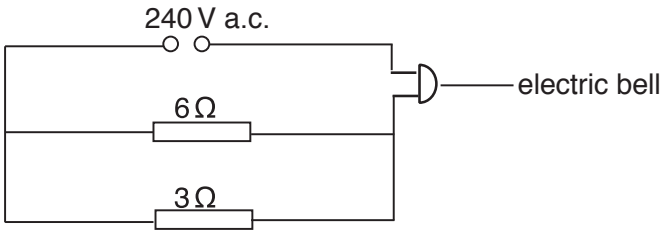



**Fig. 8.1**

**(i)** Calculate the combined resistance of the two appliances.

..... Ω [2]

**(ii)** One of the appliances has a step-down transformer which transforms 240 V to 12 V.

Calculate the number of turns in the secondary coil if the primary coil has 1000 turns.

..... [2]

**9** **(a)** Green copper(II) carbonate undergoes thermal decomposition to form black copper(II) oxide as one of the products.

**(i)** Name the other product of this reaction.

..... [1]

**(ii)** Explain why the thermal decomposition of copper(II) carbonate is a chemical change.

.....

..... [1]

**(b)** Calcium carbonate also undergoes thermal decomposition.

Describe **one** similarity and **one** difference in the thermal decomposition of copper(II) carbonate and calcium carbonate.

similarity.....

.....

difference.....

..... [2]

**(c)** The copper(II) oxide formed can react with hydrochloric acid to form a soluble salt, copper(II) chloride.

Excess copper(II) oxide is used in this reaction.

**(i)** Describe how **pure** crystals of copper(II) chloride can be prepared.

.....

.....

.....

..... [3]

**(ii)** The copper(II) oxide is used as a powder to increase the rate of the reaction.

State **two** other factors that can increase the rate of the reaction.

1 .....

2 ..... [2]

**10** Lunga moves a wire, **GH**, such that it cuts across a magnetic field as shown in Fig. 10.1.

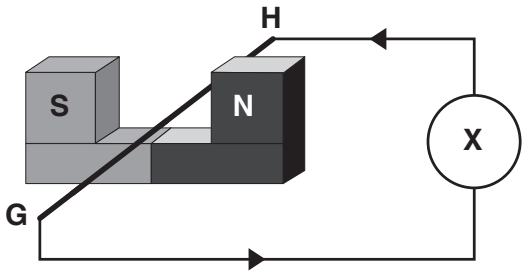



**Fig. 10.1**

The movement of the wire induces an electromotive force (e.m.f) in the wire.

**(a)** State **one** way in which the induced e.m.f can be increased.

.....

..... [1]

**(b)** Name the instrument that Lunga should connect at **X** in Fig. 10.1 to measure the charge generated.

Give a reason for your answer.

name of instrument .....

reason .....

..... [2]

**(c)** Draw, in Fig. 10.2, the magnetic field lines between the poles of the magnet **S** and **N**. [3]

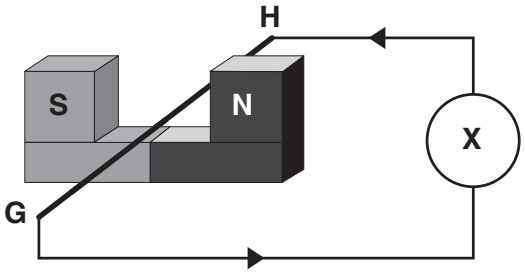



**Fig. 10.2**

**(d)** Fig. 10.3 shows the direction of the induced current in the wire.

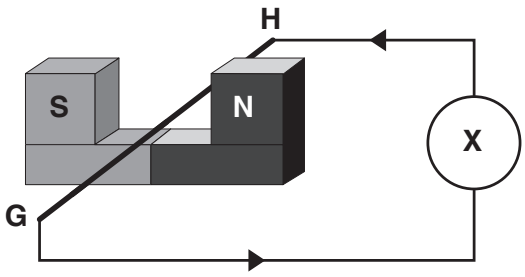



**Fig. 10.3**

Indicate on Fig. 10.3, using an arrow, the direction of movement of the wire **GH** in order for the current to be induced in the direction shown. [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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