



**ALEXANDER ROAD HIGH SCHOOL**

June 2022

**PHYSICAL SCIENCES JUNE PAPER 2**

1,5 HOURS

CO

**GRADE 10**

TOTAL = 75

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Instructions:

- The question paper consists of 6 questions.
  - Answer all the questions.
  - Answer section A on the answer sheet provided AND section B on folio sheets.
  - A non-programmable calculator may be used.
  - Number the answers correctly according to the numbering system.
  - Round off to at least two (2) decimal places where necessary.
  - A periodic table has been provided on the back of the answer sheet.
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**SECTION A**

*(answer on the answer sheet)*

**QUESTION 1:**

Four possible options are provided as answers to the following questions. Each question has only one correct answer. Choose the correct answer and write the letter (A – D) next to the relevant question number (1.1 – 1.4) on the answer sheet.

- 1.1 Which one of the following is a mixture?
- A. Air
  - B. A diamond
  - C. Distilled water
  - D. Sodium chloride
- 1.2 The type of bond between a metal and a non-metal atom when there is a large difference between electronegativities (more than 2):
- A. covalent
  - B. ionic
  - C. metallic
  - D. dative covalent

- 1.3 When an atom X of an element in Group 2 reacts to become  $X^{2+}$ , the...
- mass number of X increases.
  - atomic number of X decreases.
  - number of occupied energy levels decreases.
  - charge of the nucleus increases.
- 1.4 The number of neutrons in an atom of  ${}_{11}\text{Na}^{23}$  is ...
- 1
  - 11
  - 12
  - 23

**TOTAL SECTION A = [8]**

**SECTION B** (answer on folio paper)

**QUESTION 2:**

- 2.1 What is the difference between a mixture and a compound? (2)
- 2.2 Choose an item from COLUMN B that best matches a description/item in COLUMN A.

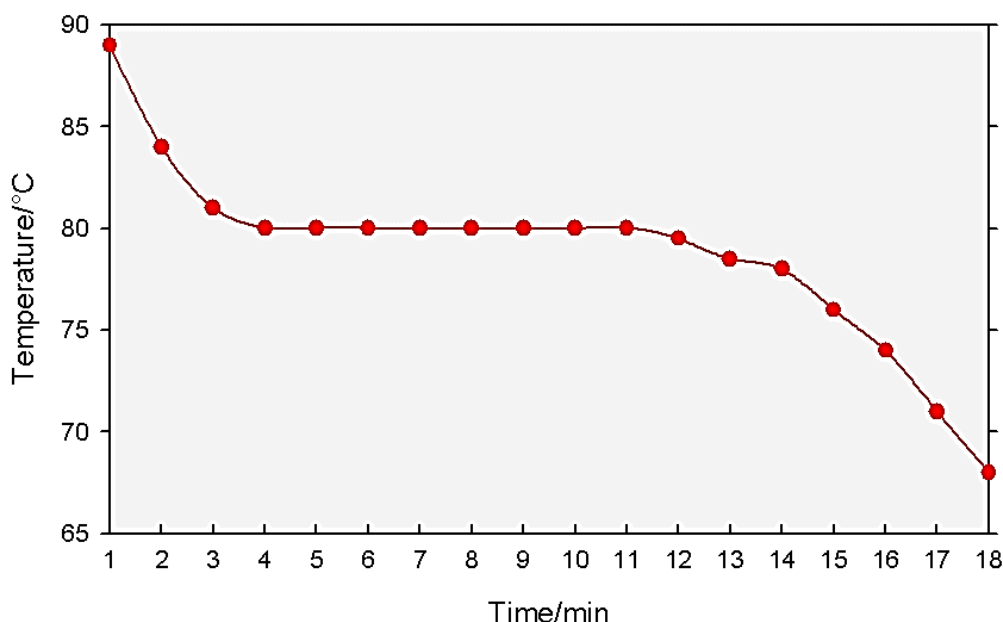
**Write only the letter** (A-G) next to the question number (2.2.1 – 2.2.6).

<b>COLUMN A</b>	<b>COLUMN B</b>
2.2.1 Magnetic substance	<b>A</b> molecule
2.2.2 Chocolate	<b>B</b> compound
2.2.3 Good conductor of electricity	<b>C</b> nichrome
2.2.4 Increasing conductivity with increasing temperature.	<b>D</b> copper
2.2.5 Copper sulphate crystals	<b>E</b> cobalt
2.2.6 A non-metal element	<b>F</b> silicon
	<b>G</b> sodium chloride
	<b>H</b> mixture
	<b>I</b> sodium
	<b>J</b> sulphur

(6)  
[8]

### QUESTION 3:

A part of the **cooling curve** of stearic acid is obtained after temperature changes were recorded over a period of 18 minutes. It is further given that the boiling point of this acid is  $361^{\circ}\text{C}$  and the melting point is  $79^{\circ}\text{C}$ .



Answer the questions below with reference to the graph.

- 3.1 Write an investigative question for this investigation. (2)
- 3.2 What is the dependant variable in this investigation? (1)
- 3.3 What phase change does the acid undergo between 5 and 10 minutes? (1)
- 3.4 Although the acid is being cooled between 5 and 10 minutes, the temperature does not change. Explain in terms of the kinetic molecular theory why the temperature remains the same. (2)
- 3.5 The particles experience a decrease in temperature at 15 minutes. How does this change influence the movement of the particles? Fully explain. (2)
- 3.6 What is the temperature of the acid after 18 minutes? (1)
- 3.7 What is the phase of the acid when this investigation is completed? (1)

**[10]**

#### QUESTION 4:

- 4.1 The discovery of the atom followed a timeline with many contributors. Who was responsible for the following contributions?
- 4.1.1 The atom is a solid ball that forms the basic 'building block' of matter. (1)
- 4.1.2 The nucleus is the small positive part of the atom and the electrons are contributing to the volume of the atom. (1)
- 4.2 Calcium has 20 protons.  
Give the electron configuration (in sp notation) for the calcium ion. (2)
- 4.3.1 Define *isotopes*. (2)
- 4.3.2 Silicon is an element that exists in three main isotopes:  
 $\text{Si}_{28} - 92,2297 \%$   
 $\text{Si}_{29} - 4,6832 \%$   
 $\text{Si}_{30} - 3,0872 \%$   
Calculate the relative atomic mass of this silicon sample. (2)
- 4.3.3 Draw the Aufbau diagram for silicon. (2)

**[10]**

#### QUESTION 5:

- 5.1 Give the names of the element(s) on the periodic table which match the following descriptions:
- 5.1.1 In the 3<sup>rd</sup> period with a similar valence shell electron configuration to oxygen. (1)
- 5.1.2 It has the highest ionization energy in the 3<sup>rd</sup> period. (1)
- 5.1.3 The ionic form has a charge of 3+ and it is in the 2<sup>nd</sup> period. (1)
- 5.1.4 A metal ion **and** a non-metal ion with the same electron configuration as neon. (2)
- 5.1.5 The sp-notation of the element is:  $[\text{Ne}] 3s^2 3p^1$  (1)

5.2 Study the table of first and second ionisation energies and answer the questions that follow.

	FIRST IONISATION ENERGY (kJ.mol <sup>-1</sup> )	SECOND IONISATION ENERGY (kJ.mol <sup>-1</sup> )
Li	520	7 297
Be	899	1 757
B	801	2 427
C	1 086	2 352
N	1 402	2 854
O	1 214	3 391
F	1 681	3 381
Ne	2 080	3 964

5.2.1 Define the term *ionisation energy*. (2)

5.2.2 Use the information in the table to explain why:

5.2.2(a) metals form cations easily. (2)

5.2.2(b) Neon is chemically unreactive. (2)

5.2.3 Explain why the second ionisation energy of lithium is higher than its first ionisation energy. (2)

[14]

### **QUESTION 6:**

6.1 Define *covalent bonding*. (2)

6.2 Use Lewis diagrams to represent the molecules of:

6.2.1 Nitrogen (2)

6.2.2 HOCl (2)

6.2.3 PH<sub>3</sub> (2)

6.3.1 Is the bond in hydrogen chloride POLAR or NON-POLAR? (1)

6.3.2 Explain your answer in 6.3.1, also show the Couper diagram of the molecule and the partial charges on each atom. (3)

6.4.1 Define *metallic bonding*. (2)

6.4.2 Explain why metallic bonding is fundamentally responsible for electrical conductivity. (2)

6.5 Show the formation of potassium fluoride by using Lewis structures. (3)

- 6.6 Write the chemical formulas for the following compounds:
- 6.6.1 Sodium sulphate (1)
- 6.6.2 Ammonium carbonate (1)
- 6.6.3 Nitrogen dioxide (1)
- 6.7 Explain, by referring to electronegativities, why potassium chloride forms an ionic bond. (2)
- 6.8 Salts are not molecules. What is the arrangement of ions called? (1)

[25]

**TOTAL SECTION B = [65]**