

JUNE 2018



TIME: 2h

EXAMINER: Mr McEwan

PHYSICAL SCIENCE PAPER 2

TOTAL = 100

GRADE 10

Instructions

- The question paper consists of 5 questions.
- Answer all the questions.
- Answer section A on the answer sheet provided AND section B on folio sheets.
- Rule off after each question in Section B.
- A non-programmable calculator may be used.
- Number the answers correctly according to the numbering system.
- Round off to two (2) decimal places where necessary.
- Formulas have been included at the end of the question paper and a periodic table on the reverse side of the answer sheet.

QUESTION 1: Multiple Choice: write down the letter corresponding to the best answer on the A5 answer sheet provided.

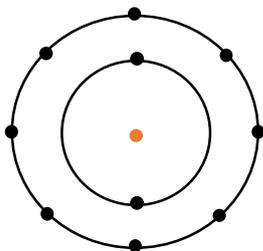
1.1 James Chadwick is remembered for discovering:

- A electrons.
- B protons.
- C neutrons.
- D photons.

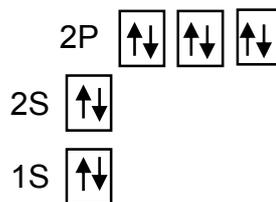
1.2 O^{2-} , F^{-} , Ne and Mg^{2+} all:

- A have the same number of protons.
- B have the same number of electrons.
- C are in the same period on the periodic table.
- D are non-metals.

1.3



This diagram shows the Bohr model of a particular element. The black dots represent electrons in the energy levels. This could be the electron configuration of:



- A the element represented by the Aufbau diagram
- B Na^+
- C Ne
- D All of the above, i.e. A, B & C.

1.4 Which of the following statements is the definition of **ionization Energy** of an element:

- A The amount of energy released per mole when its atoms each gain an electron.
- B A measure of how strongly its atoms attract bonded electrons to themselves.
- C The minimum amount of energy required to remove an electron from the ground state of an atom in the gas phase.
- D None of the above.

1.5 The order of increasing first ionization energy of the following elements: Li, Na, K, Rb is:

- A Li, Na, K, Rb.
- B Rb, K, Na, Li.
- C K, Na, Li, Rb.
- D insufficient information.

1.6 When an element X in Group II ionizes to become X^{2+} , the ...

- A mass number decreases
- B atomic number decreases
- C Charge of the nucleus increases
- D The number of occupied energy levels decreases

1.7 ***When molecules react they first have to break apart.***

Given that idea, choose which of the following molecules (whose Couper notations are shown) is the most reactive?

- A F-F
- B O=O
- C N≡N
- D insufficient information.

1.8 During an experiment, a group of learners observe ice melting in a beaker. Which ONE of the following best explains the learners' observation?

- A The ice is releasing heat energy.
- B The ice is undergoing a physical change.
- C The ice is undergoing a chemical change.
- D The ice is decomposing into the elements hydrogen and oxygen.

1.9 Which ONE of the following is a mixture?

- A Air
- B A diamond
- C Distilled water
- D Sodium chloride

1.10 In which ONE of the following compounds do BOTH ions have the same electron configuration as argon?

- A Calcium sulphide
- B Magnesium oxide
- C Sodium sulphide
- D Calcium bromide

[10X2=20]

QUESTION 2

Subatomic Particles, Formulae, Names and Chemical Equations.

2.1 The following symbols ${}_{17}^{35}\text{Cl}$ and ${}_{17}^{37}\text{Cl}$ represent two “versions” of chlorine atoms that occur in nature.

2.1.1 What do we call these “versions” of chlorine? (1)

2.1.2 If their relative percentage occurrence of ${}_{17}^{35}\text{Cl} : {}_{17}^{37}\text{Cl} = 70:30$, calculate what the relative mass number would be on the periodic table. (3)

2.1.3 Name and give the number of the sub-atomic particles in each of these versions, i.e. number of protons, electrons & neutrons in each. (4)

2.2 Consider the compound NaOH.

2.2.1 What is its chemical name? (1)

2.2.2 Calculate the formula mass of NaOH. (2)

2.3 Write formulae for the following compounds:

2.3.1 Ammonium carbonate.

2.3.2 Potassium sulphate.

2.3.3 Hydrogen sulphide.

2.3.4 Magnesium nitrate.

2.3.5 Iron (III) sulphate. (10)

2.4 Which of the substances in 2.3 above is NOT a salt but made of molecules. (1)

2.5 Convert the following word equation into symbols **and** balance it:

Sodium metal plus oxygen reacts to form sodium oxide (4)

[26]

QUESTION 3 Bonding

3.1 Consider the electron configuration of Sulphur. Give:

3.1.1 the Aufbau diagram for sulphur. (2)

3.1.2 the sp-notation for sulphur. (1)

3.1.3 the Lewis structure for sulphur. (1)

3.2 Contrast the type of bonding and crystal structure of the following two solids. Include a labelled 2D diagram of each showing at least nine particles in the solid structure and name the type of bonding.

3.2.1 $\text{Mg}_{(s)}$. (4)

3.2.2 $\text{NaCl}_{(s)}$. (4)

3.2.3 Use the above bonding models to explain the difference in properties of $\text{Mg}_{(s)}$ and $\text{NaCl}_{(s)}$ regarding conductivity AND malleability. (4)

3.3 Explain the bonding between the atoms in a water particle. Your answer should include the:

3.3.1 Type of bonding, (1)

3.3.2 Couper notation and (1)

3.3.2 Lewis notations of:

a) the elements and (2)

b) the compound. (2)

3.4 The element Carbon has the ability to bond in more than one way. These are called the **allotropes** of Carbon. Charcoal or coal is one form of carbon.

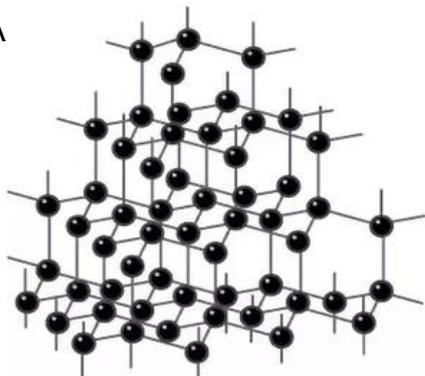
3.4.1 Name two other **allotropes** of Carbon and give a property of EACH that is different from charcoal. (4)

3.4.2 The diagrams A & B below are common representations of these other two allotropes.

Which is which? Identify each allotrope.

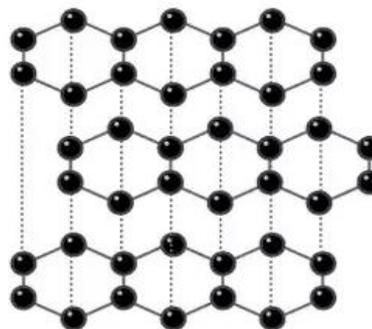
(2)

A



Each carbon bonded tetrahedrally to 4 others in a giant molecule

B



Layers of carbon atoms each bonded to 3 others. Layers weakly held together by delocalized electrons.

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QUESTION 4 Physical Change

4.1 Define the following terms:

4.1.1 Temperature.

(2)

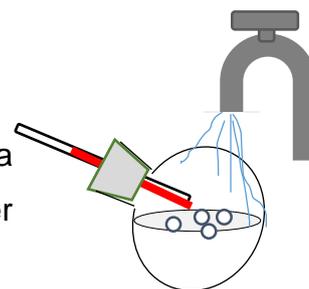
4.1.2 Boiling.

(2)

4.1.3 Boiling Point.

(1)

4.2 In a practical demonstration it was demonstrated that water in a round bottomed flask could be made to boil at a temperature lower than 100°C .



4.2.1 What needed to be done before the round bottom flask was stoppered with the thermometer?

(2)

4.2.2 In some classes it boiled at as low as 50°C . Explain why the water boils again when it is placed under the cold tap.

(2)

4.3. Consider boiling a pot of rice in water on a stove. The temperature does not rise above 100°C whilst the water is boiling.

4.3.1 Where is the heat going if it's not raising the temperature? (2)

4.3.2 What is this so called "lost heat" called? (1)

4.3.3 Why does the rice burn quickly after the water has all boiled off? (1)

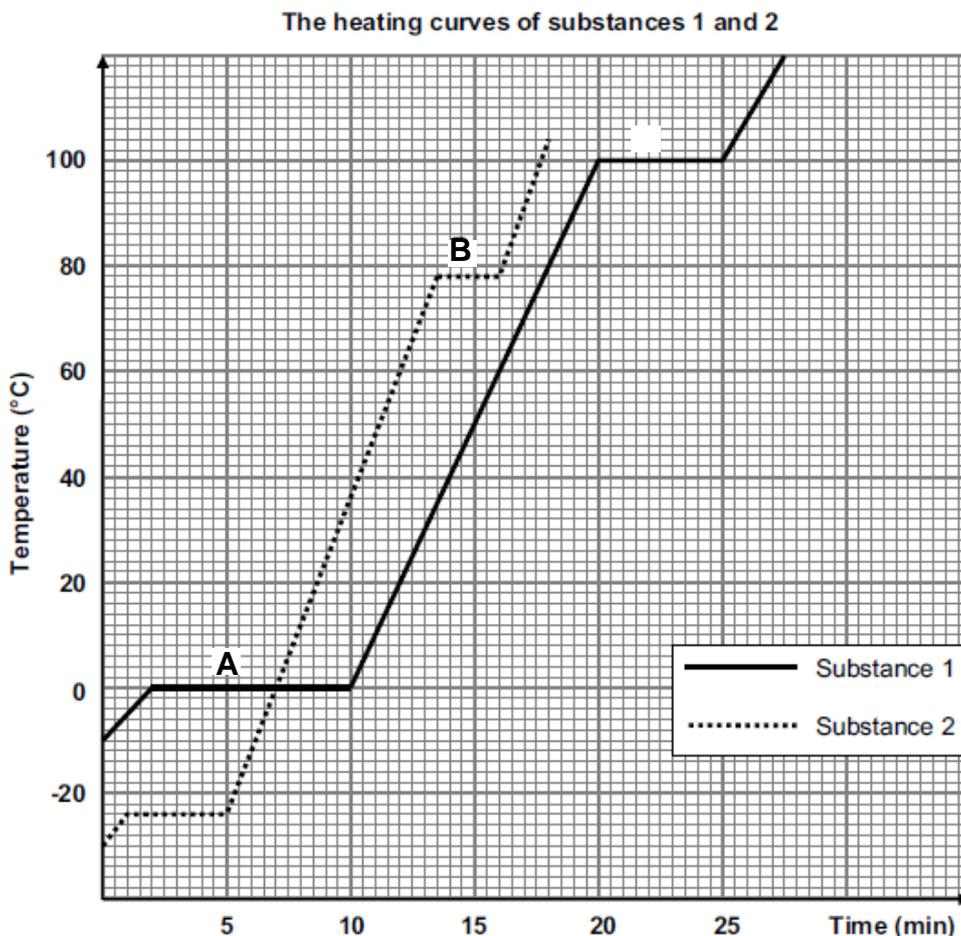
4.4 Explain why evaporation causes cooling. (2)

[15]

QUESTION 5: Practical Investigation

Learners are investigating the effect of increasing temperature on two different substances (1 and 2) over a period of time.

Study the temperature versus time graphs below and answer the questions that follow.



5.1 Write down the:

5.1.1 Dependent variable (1)

5.1.2 Independent variable (1)

- 5.2 In which phase is substance **1** at $-10\text{ }^{\circ}\text{C}$? (1)
- 5.3 At what temperature does substance **2** melt? (1)
- 5.4 State the phase change that takes place at **B**. (1)
- 5.5 Which substance on the graph has the weakest forces between its molecules (i.e. intermolecular forces) in the liquid phase? Give a reason for the answer. (2)
- 5.6 How does the average kinetic energy of substance 1 compare to the average kinetic energy of substance 2 at $90\text{ }^{\circ}\text{C}$?
Write down LESS THAN, EQUAL TO or GREATER THAN and give a reason for the answer. (2)
- 5.7 Why is it necessary to stir the container very well during phase change **A**? (1)
- 5.8 What is substance **1** most likely to be? (1)

[11]