



ALEXANDER ROAD HIGH SCHOOL

NOVEMBER 2014

2 HOURS

PHYSICAL SCIENCE – PAPER TWO

KB, CO, IC

TOTAL = 150

GRADE 10

Instructions

- The question paper consists of 9 questions.
 - Answer all the questions.
 - Answer section A on the answer sheet provided.
 - Answer section B on the folio sheets provided.
 - A non-programmable calculator may be used.
 - Number the answers correctly according to the numbering system on the question paper.
 - Start each question on a new page.
 - A data sheet and periodic table will be provided for your use.
 - Round off to two (2) decimal places unless otherwise stated.
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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 answer and make a cross (X) in the block (A – D) next to the question number (1.1 – 1.10) on the attached ANSWER SHEET.

1.1 A certain element has an atomic number Z and a mass number A .

One atom of the element contains:

- A. A neutrons.
- B. A electrons
- C. $(A - Z)$ neutrons
- D. $(A - Z)$ electrons

1.2 Atoms of the isotopes of hydrogen...

- A. have the same mass
- B. have one proton each but different number of electrons
- C. have one proton each but different number of neutrons
- D. have different numbers of protons and neutrons

- 1.3 A particle which has the same electron configuration as an atom of argon is:
- A. Ca^{2+}
 - B. Cl
 - C. Na^+
 - D. K
- 1.4 Which one of the following processes does NOT form part of the water cycle?
- A. Oxidation
 - B. Condensation
 - C. Evaporation
 - D. Precipitation
- 1.5 Which of the following is the correct name for $\text{Cu}(\text{NO}_3)_3$
- A. Copper (I) nitrate
 - B. Copper (II) nitrate
 - C. Copper (III) nitrate
 - D. Copper (IV) nitrate
- 1.6 Which of the following will conduct electricity in the liquid phase but not in the solid phase?
- A. Cl_2
 - B. H_2S
 - C. Zn
 - D. CaBr_2
- 1.7 Cake mix rises in the oven during the baking process because...
- A. sulphuric acid reacts with sodium carbonate to produce CO_2
 - B. sulphuric acid reacts with sodium bicarbonate to produce CO_2
 - C. tartaric acid reacts with a carbonate to produce CO_2
 - D. tartaric acid reacts with a bicarbonate to produce CO_2

1.8 A certain mass of carbon dioxide contains $3,01 \times 10^{24}$ molecules. How many moles of carbon dioxide are present?

- A. 5,5 moles
- B. 4,5 moles
- C. 4,0 moles
- D. 5,0 moles

1.9 0,5 mol of aluminium has reacted completely with excess sulphuric acid. The reaction taking place is represented below:



The number of moles of H_2SO_4 used in this reaction is:

- A. 0,5
- B. 0,75
- C. 1,5
- D. 3,0

1.10 What is the percentage Oxygen present in H_2SO_4 ?

- A. 55,2 %
- B. 65,3%
- C. 60,7%
- D. 57,1%

[10 X 2 = 20]

SECTION B

- Answer all questions on the folio pages provided -
Please leave a line between sub-questions.

QUESTION 2

The elements potassium and chlorine react to form potassium chloride. Potassium chloride is used in medicine, scientific applications and food processing. The element potassium helps to treat or prevent low levels of potassium. A normal level of potassium makes the heart and kidneys work normally.

- 2.1 Write down the:
- 2.1.1 period in which the element, potassium, belongs. (1)
 - 2.1.2 chemical formula for potassium chloride. (1)
- 2.2 Draw and Aufbau diagram for the chlorine atom. (3)
- 2.3 For the potassium atom, write down its...
- 2.3.1 Electron configuration. (2)
 - 2.3.2 Number of protons. (1)
- 2.4 Use Lewis diagrams to represent the formation of potassium chloride. (3)
- 2.5 Name the type of bond formed in the formation of potassium chloride. (1)
- 2.6 Two chlorine atoms can also combine chemically.
- 2.6.1 Name the type of bond that forms when two chlorine atoms combine. (1)
 - 2.6.2 Use a Lewis diagram to represent the chlorine molecule. (2)
- 2.7 Give the chemical name of the following compounds:
- 2.7.1 KNO_3 (2)
 - 2.7.2 BCl_3 (2)
- 2.8 Give the formula for Copper (III) Chloride (2)

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QUESTION 3

The electron configuration of four neutral atoms of elements are given in the table below:

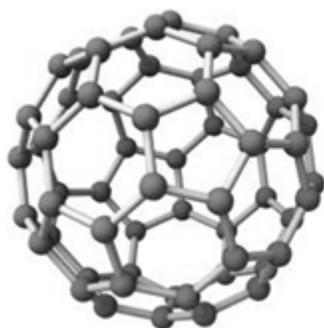
ELEMENT	ELECTRON CONFIGURATION
A	$1s^2 2s^2 2p^6 3s^1$
B	$1s^2 2s^2 2p^6 3s^2$
C	$1s^2 2s^2 2p^6 3s^2 3p^6$
D	$1s^2 2s^2 2p^5$

- 3.1 Which element(s) (A, B, C or D)
- 3.1.1 has/have an atomic number 12? (1)
- 3.1.2 are/is a noble gas(es)? (1)
- 3.1.3 are/is a halogen? (1)
- 3.2 Two of the above elements are metals in their groups in the periodic table.
Write down:
- 3.2.1 The **LETTERS** that represent the metals. (2)
- 3.2.2 Which of these metals burns with a yellow flame? (1)
- 3.3 Write down the formulae of TWO ionic compounds which may be formed by the above elements. (Use the letters A, B, C, D or the actual symbols of the elements) (4)
- 3.4 Two carbon isotopes of carbon are given as C-12 and C-14
- 3.4.1 What are isotopes? (2)
- 3.4.2 Use the notation $\frac{A}{Z}X$ to represent the C-14 isotope. (2)
- 3.4.3 Calculate the relative atomic mass of a sample of carbon if it is made up of 10% carbon-14 and the rest is carbon-12. (3)

[17]

QUESTION 4

Consider the diagrams below depicting buckminsterfullerene (“bucky-balls”) and diamond.

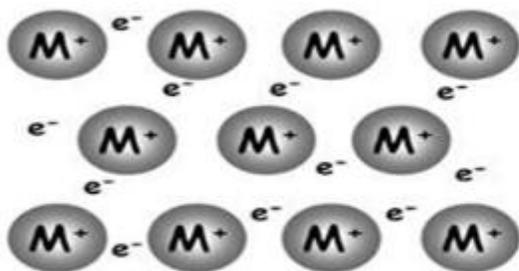


A

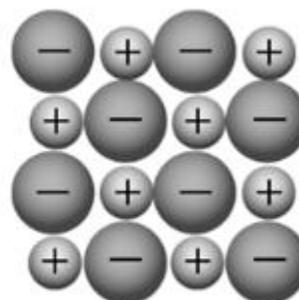


B

- 4.1.1 What type of bond holds the atoms in diamond together? (1)
- 4.1.2 What type of lattice is represented in figure B? (1)
- 4.2 buckminsterfullerene is an Allotrope of diamond.
- 4.2.1 Define the term “Allotrope”. (2)
- 4.2.2 NAME the element that the substance in figure A is composed of. (1)
- 4.2.3 If a number of “bucky-balls” had to arrange themselves into a lattice, what type of lattice would be formed? (1)
- 4.2.4 Which lattice, the one formed by the “bucky-balls” or the diamond, would have the lower melting point? (1)
- 4.2.5 Explain your answer to question 4.2.4. (2)
- 4.3 Figures C and D below represent a metallic and ionic lattice respectively...



C



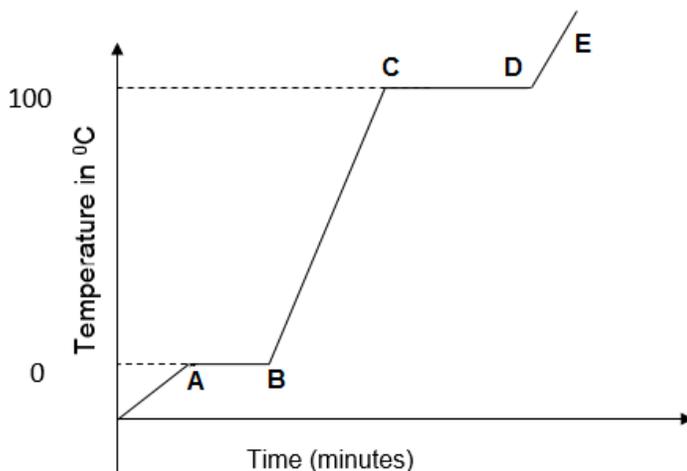
D

- 4.3.1 Which lattice (C or D) would conduct electricity only in solution? (1)
- 4.3.2 Give an explanation for your answer in question 4.3.1. (3)
- 4.3.3 Which lattice (C or D) contains delocalised electrons? (1)

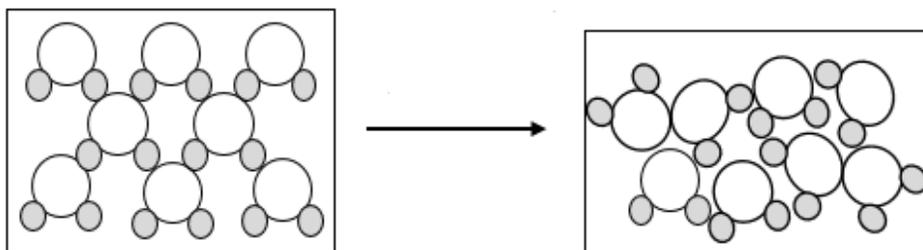
[14]

QUESTION 5

A certain pure substance is heated at atmospheric pressure and its temperature changes as shown in the graph below:



- 5.1 Is this pure substance water? Give a reason for your answer. (2)
- 5.2 What is the phase of the substance at D – E? (1)
- 5.3 Although the substance is heated, the temperature does not rise above the melting point until all the ice is melted. What is this “lost” heat called? (2)
- 5.4 The diagram below depicts the process occurring in one of the regions in the graph above.

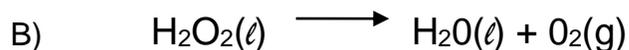


- 5.4.1 What is this process called? (1)
- 5.4.2 Is this a chemical or physical change? (1)
- 5.4.3 Give 2 reasons for you answer in questions 5.4.2. (2)

[9]

QUESTION 6

Two unbalanced chemical equations A and B are given below. One is a word equation and the other a symbol equation as shown:



6.1 What does the (ℓ) represent in equation B above? (1)

6.2 Write down a balanced chemical equation for the word equation A.
(Show the phases of ALL reactants and products) (4)

6.3 Rewrite and balance equation B. (1)

6.4 Name the law you have used to balance the equation in 6.3. (1)

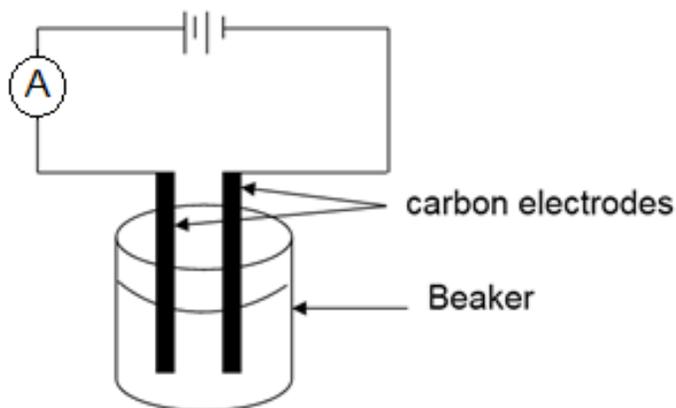
6.5 Use equation B to show that mass is conserved during the reaction. (3)

[10]

QUESTION 7

The apparatus arrangement below is used in a class to investigate the conductivity of solutions and liquids. The electrodes are rinsed between each experiment.

- A. sodium chloride dissolved in water
- B. copper sulphate dissolve in water
- C. sodium hydroxide pellets dissolved in water
- D. sugar dissolved in water.
- E. distilled water



When the beaker is filled with most of the solutions the ammeter registered a reading, but ONE of the solutions did NOT cause a reading on the ammeter.

- 7.1.1 Which solution (A, B, C, D or E) did not cause a reading on the ammeter?
Give a reason for your answer. (3)

The beaker is now filled with 250 ml distilled water and 20 g of sodium hydroxide pellets are dissolved in the water.

- 7.1.2 Write down the formulae of the ions present in this solution. (2)
7.1.3 Calculate the concentration of the sodium hydroxide solution. (5)

Learners are given three bottles A, B and C. It is known that the bottles contain a carbonate, a sulphate and a chloride respectively. The learners pour samples from the bottles into test tubes and perform tests to identify their contents.

They record their findings in the table below:

	A	B	C
	carbonate(aq)	sulphate(aq)	chloride(aq)
Add	HCl(aq)	BaCl ₂ (aq)	AgNO ₃ (aq)
Result	Effervescence/bubble	White solid formed	White solid formed
Positive test	Turn lime water milky	Solid not soluble in HNO ₃	Solid turns purple in sunlight

- 7.2.1 Write down the formula for a carbonate ion. (2)
7.2.2 Give the NAME and FORMULA of the white solid substance in B. (2)
7.2.3 Give the NAME and FORMULA of the white solid substance in C. (2)
7.2.4 Why must the precipitate in B be tested with nitric acid? (2)
7.2.5 Name the type of reaction that takes place in ALL test tubes. (1)

Rewrite/complete/write and balance the following chemical reactions. Also show the phases of all the substances:

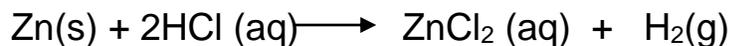


- 7.4 What is the pH scale? (2)

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QUESTION 8

Learners performed an experiment by dropping some zinc metal into dilute hydrochloric acid. The reaction between zinc and hydrochloric acid is represented by the balanced equation below.



During the experiment, zinc reacts with excess dilute hydrochloric acid to produce a zinc chloride solution and hydrogen gas at STP.

8.1.1 What is meant by the term STP? (2)

8.1.2 How many atoms are present in one mole of any substance? (1)

8.1.3 Calculate the mass of Hydrochloric Acid (HCl) which is used when 6.5g of zinc reacts completely with the acid. (6)

8.1.4 Determine the number of atoms present in 6,5g of Zn. (3)

A certain compound contains 30,4 % nitrogen and 69,6 % oxygen by mass.

8.2.1 Calculate the empirical formula of the compound. (4)

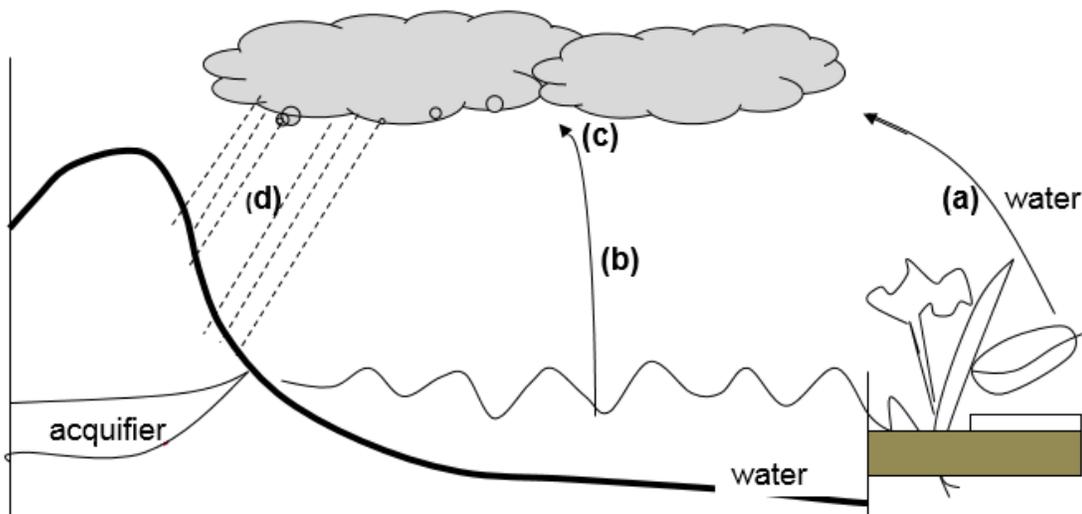
8.2.2 Using your answer in 8.2.1 determine the formula of the compound if the molar mass of the actual compound is $92 \text{ g}\cdot\text{mol}^{-1}$. (2)

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QUESTION 9

The water cycle consists of a set of physical changes that water undergoes as it moves from the hydrosphere to the atmosphere and lithosphere, and back to the hydrosphere.

The diagram below shows how water is constantly recycled on earth.



9.1 Write the name of each process at...

- 9.1.1 (a) (1)
9.1.2 (b) (1)
9.1.3 (c) (1)
9.1.4 (d) (1)

Rain water is not neutral, in fact rain water is slightly acidic (with a pH of around 5,6). This is because as rain falls from the clouds, the rain water reacts with carbon dioxide in the air to form an acid (H_2CO_3).

- 9.2.1 What is the pH of neutral water? (1)
9.2.2 Write the FORMULA for carbon dioxide. (1)
9.2.3 Write a balanced equation for the reaction when the carbon dioxide dissolves in water. (2)

Dams can have both positive and negative effects on people and the environment.

- 9.3.1 Give 3 advantages of building dams. (3)
9.3.2 Give 2 ways in which dams negatively affect the environment. (2)

[13]

TOTAL: 150 MARKS

DATA

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Standard pressure	p^θ	$1,013 \times 10^5 \text{ Pa}$
Molar gas volume at STP	V_o	$22,4 \text{ dm}^3 \cdot \text{mol}^{-1}$
Standard temperature	T^θ	273 K
Avogadro's constant	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$

$$n = \frac{m}{M}$$

$$c = \frac{n}{V}$$

$$n = \frac{V}{V_o}$$

$$\frac{n_a}{n_b} = \frac{c_a V_a}{c_b V_b}$$

$$n = \frac{\text{\# of particles}}{N_A}$$