

MINISTRY OF EDUCATION AND HIGHER EDUCATION

FORM FOUR EXAMS, 2013

# CHEMISTRY



P/LAND NATIONAL EXAMINATION BOARD



**SECTION ONE: MULTIPLE CHOICE QUESTION (10 MARKS)**

**INSTRUCTIONS FOR THIS SECTION:**

For each question in this section, **circle** the most correct answer.

- 1- Which of the following metals is the most reactive?  
A) Potassium      B) Iron      C) Calcium      D) Aluminum
- 2- Soda water is made by dissolving carbon dioxide in water. Which of the following correctly describes the substances?

	<b>Carbon dioxide</b>	<b>Water</b>	<b>Soda water</b>
A	Solvent	Solute	Solution
B	Solute	Solvent	Solution
C	Solvent	Solution	Solute
D	Solute	Solution	Solvent

- 3- What would be the concentration, if 0.25 moles of sodium hydroxide was dissolved in 250cm<sup>3</sup> of distilled water?  
A) 2.5 mol/dm<sup>3</sup>      C) 1 mol/dm<sup>3</sup>  
B) 0.1 mol/dm<sup>3</sup>      D) 5.2 mol/dm<sup>3</sup>
- 4- The only products of the complete combustion of a fuel were shown to be carbon dioxide and water. The fuel therefore contained :  
A) Carbon, hydrogen and oxygen.  
B) Hydrogen because carbon and oxygen are present in the air.  
C) Carbon because hydrogen and oxygen are present in the air.  
D) Carbon and hydrogen because oxygen is in the air.

- 5- In the electrolysis of molten lead bromide, using carbon electrodes, the products formed are:
- A) Hydrogen gas and oxygen gas
  - B) Lead atoms and oxygen gas
  - C) Lead atoms and bromine vapor
  - D) Oxygen gas and bromine vapor
- 6- The molecular formula of 2-chloro-3-methyl pentane is:
- A)  $C_6H_{13}Cl$
  - B)  $C_6H_{15}Cl$
  - C)  $C_6H_{12}Cl$
  - D)  $C_5H_{12}Cl$
- 7- Which of the following correctly describes the particles which carry a current of electricity through copper and copper (II) sulphate solution?

	<b>Copper</b>	<b>Copper (II) sulphate solution</b>
A	Ions	Electrons
B	Electrons	Ions
C	Ions	Ions
D	Electrons	Electrons

- 8- The two types of bonds found in ammonium ion are:
- A) Covalent bond and ionic bond
  - B) Metallic bond and ionic bond
  - C) Covalent bond and dative bond
  - D) ionic bond and dative bond
- 9- A hydrocarbon with the molecular formula  $C_5H_{10}$  decolorizes bromine water rapidly, using this information, the hydrocarbon is likely to be:
- A) A cyclo-alkane
  - B) An alkene
  - C) An alkane
  - D) A saturated hydrocarbon

10-A standard enthalpy change of a reaction takes place under standard conditions.

In which of the following pairs is the conditions of standard enthalpy change of reaction.

- A) Pressure of 100kpa and temperature of 200K.
- B) Pressure of 120kpa and temperature of 298K
- C) Pressure of 110kpa and temperature of 300k
- D) Pressure of 100kpa and temperature of 298K.

**SECTION TWO: STRUCTURED QUESTIONS (90 MARKS)**

**ANSWER THE ENTIRE QUESTION IN THE SPACE PROVIDED**

**QUESTION ONE: (10 MARKS)**

1- a) Some of the elements in the periodic table with their symbols, atomic numbers and mass numbers are given in the table below. Write them in a short hand form.

**Example:** Na, atomic number 11, mass number 23. Short hand form =  ${}_{11}^{23}\text{Na}$

Symbol	Atomic number	Mass number	Short hand form
i) Al	13	27	
ii) Ca	20	40	
iii) Fe	26	56	
iv) Si	14	28	
v) Cu	29	64	

b) Indicate whether the following substances are **elements, compounds or mixtures**.

i) Salt solution \_\_\_\_\_ 1mark



ii) iron sulphide \_\_\_\_\_ 1 mark

iii) Sodium \_\_\_\_\_ 1mark

iv) Crude oil \_\_\_\_\_ 1 mark

v) Water \_\_\_\_\_ 1 mark

**QUESTION TWO: (11 MARKS)**

2- a) The element Carbon has two allotropes which are diamond and graphite, they have different physical properties.

i) What does the word allotropes mean? 1 Mark

---

---

ii) Which allotrope conducts electricity? Explain your answer. 2 Marks

---

---

---

iii) Which allotrope is very hard? 1 mark

---

iv) Which one is used for jewellery? 1 Mark

---

b) Look at each description below. Say whether it fits **Oxygen, sulphur or chlorine** .

i) Solid at room temperature. \_\_\_\_\_ 1 mark

ii) Reacts with metals to form oxides. \_\_\_\_\_ 1 mark



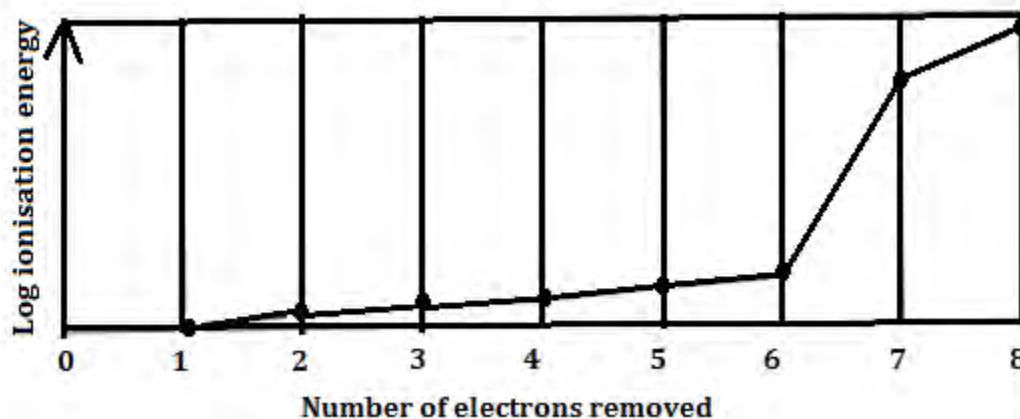
- iii) Poisonous gas \_\_\_\_\_ 1 mark
- iv) Added to rubber to make it tough and strong. \_\_\_\_\_ 1 mark
- v) Relights a glowing splint. \_\_\_\_\_ 1 mark
- vi) Burns to form an oxide which causes acid rain. \_\_\_\_\_ 1 mark

**QUESTION THREE: (10 MARKS)**

1. A) Write the box form electronic configuration of the following elements:

- i) Fluorine = 9 electrons \_\_\_\_\_ 1 Mark
- ii) Neon = 10 electrons \_\_\_\_\_ 1 Mark
- iii) Magnesium = 12 electrons \_\_\_\_\_ 1 Mark
- iv) Argon = 18 electrons \_\_\_\_\_ 1 Mark

b) Successive ionization energy provides evidence for the arrangement of electrons in an atom. The graph below shows the eight successive ionization energy of oxygen. Study it and answer the questions that follow.



i) Explain the term ionization energy? 1 Mark

---

---

ii) Write the equation, including state symbols to represent the second ionization energy of oxygen. ( $\Delta H_{i2} = 3390 \text{ kJmol}$ ) 2 Marks

---

---

iii) Between which two ionization energies is there a large difference in ionization energy? 1 Mark

---

---

C- An element has the following electronic configuration:  $1s^2 2s^2 2p^6 3s^2$

i) Which block of the periodic table does it belong? 1 Mark

---

---

ii) Name that element. 1 Mark

---

---



**QUESTION FOUR: (10MARKS)**

(a) In experiment soap solution is added to 50 cm<sup>3</sup> samples of water until a lather is formed. The experiment was repeated using new samples of water. The water is boiled before the soap solution is added. The results are shown in the table.

Water sample	Volume of soap solution required before boiling (cm <sup>3</sup> )	Volume of soap solution required after boiling (cm <sup>3</sup> )
A	0.5	0.5
P	3.0	3.0
Q	5.0	4.0
R	4.0	0.5

i) Name a piece of apparatus suitable for measuring out the water samples.

1 Mark

ii) Which water sample could be distilled?

1 Mark

iii) Which water sample contains only temporary hardness?

1 Mark

iv) Which water sample contains only permanent hardness? Explain your choice.

2 Mark



- v) Which water sample contains both temporary hardness and permanent hardness? Explain your choice. 2 Marks

---

---

---

---

- b) Finish the sentences below by choosing the best word from this. 3 marks

**Bubbles    detergent    magnesium    scum    soap    sodium**

Water containing dissolved calcium and .....compounds

is said to be hard water. Hard water does not lather well with.....

but forms .....



**QUESTION FIVE: (10 MARKS)**

A. Titration is used to determine the unknown concentration of a solution using known concentration of another solution.  $0.2 \text{ mol/dm}^3$  of  $50 \text{ cm}^3$  of sodium hydroxide (NaOH) was titrated against  $20 \text{ cm}^3$  of sulphuric acid ( $\text{H}_2\text{SO}_4$ )

i) Write a balanced chemical equation for the reaction between the acid and the base above. 1 Mark

ii) Calculate the number of moles of sodium hydroxide used? 1Mark

iii) What mole of the acid reacted with base using mole ratio? 1 Mark

iv) Determine the concentration of Sulphuric acid?

1 Mark

B. If a metal oxide dissolves in water, what can be said about the PH of the solution produced? 1 mark



c) If a non metal oxide dissolves in water, what can be said about the PH of the solution produced? 1 Mark

---

---

d) Give the formulae of the negative ions present in aqueous solutions of the following:

i) Nitric acid 2 Marks

---

---

ii) Sulphuric acid 2 Marks

---

---

**QUESTION SIX: (10 MARKS)**

A) Using the bond enthalpy given below to answer the question that follows.

Bond	Bond energy in KJ/mol
H – H	+ 436
Cl – Cl	+ 242
H – Cl	+ 431

i) Define the term bond enthalpy? 1 mark

---

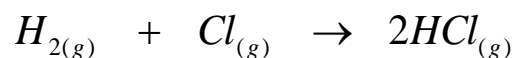
---

- ii) Give a reason why the bond enthalpy is positive? 1 Mark

---

---

B) The reaction between Hydrogen gas and chlorine is shown below.



- i) Calculate the energy needed to break all the bonds in the reactants? 1 Mark

---

---

---

---

- ii) Calculate the energy given out during bond forming? 1 Mark

---

---

---

- iii) Calculate the overall enthalpy change of the reaction? 1 Mark

---

---

---

iv) Is the reaction exothermic or endothermic? Explain your choice. 2 Marks

---

---

---

C) Define the following terms :

i) Standard enthalpy change of combustion. 1 Marks

---

---

---

ii) Standard enthalpy change of reaction. 1 Marks

---

---

---

iii) Standard enthalpy change of formation. 1Mark

---

---

---

**Question SEVEN: (10 Marks)**

- a) The table below gives some of the properties of elements in group (II) of the periodic table.

Element	Symbol	Reaction with water	Formula of chloride
Beryllium	Be		BeCl <sub>2</sub>
<b>Magnesium</b>	Mg	Reacts slowly with cold water	MgCl <sub>2</sub>
<b>Calcium</b>	Ca	Reacts steadily with cold water	CaCl <sub>2</sub>
<b>Strontium</b>	Sr	Reacts vigorously with cold water	SrCl <sub>2</sub>
<b>Barium</b>	Ba	Reacts very vigorously with cold water	BaCl <sub>2</sub>

- i) Arrange the four metals in bold italics (*Mg, Ca, Sr, Ba*) in order of reactivity, putting the most reactive first. 1 mark

Most reactive \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Least reactive \_\_\_\_\_

- ii) Suggest what would happen when beryllium is added to cold water? 1 Mark

\_\_\_\_\_

\_\_\_\_\_

- b) When barium is heated in chlorine gas they react to form a solid?

- i) Give the name and formula of the solid.

Name \_\_\_\_\_ 1 Mark

Formula \_\_\_\_\_ 1 Mark



- ii) What type of bonding is formed between barium and chlorine? 1 Mark

---

- c) The diagram below shows a simple representation of the particles of gas.



- i) Describe the movement of the particles in a gas. 1 mark

---

---

- ii) Why does increasing the temperature of the gas increase the pressure of the gas? 2 Marks

---

---

---

- iii) Explain why the boiling point of chlorine is greater than that of fluorine? 2 marks

---

---

---



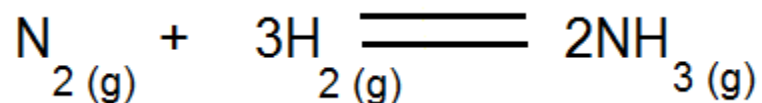


iii) Write the general formula of alkanes?

1 Mark

**QUESTION NINE: (10 MARKS)**

a) Ammonia is made in industry from its elements by the Haber process.



i) Name the raw materials that are used for making ammonia.

2 Marks

ii) State three conditions that are used in the Haber process.

3 Marks

iii) Which catalyst is used in the Haber process?

1 mark

b) Explain how the following affects the yield (product) of ammonia.

i) Increase in the temperature.

1 mark



---

iv) Increase in the pressure.

1 Mark

---

c) i) Ammonia solution is a weak alkali, explain why?

1 Mark

---

d) What would be the PH of the solution?

1 Marks

END



