MINISTRY OF EDUCATION AND HIGHER EDUCATION

GRADE 12 EXAMS, 2023

CHEMESTRY

2023

P/LAND NATIONAL EXAMINATION BOARD

SomExams

MINISTRY OF EDUCATION AND HIGHER EDUCATION
PUNTLAND NATIONAL EXAMINATIONS BOARD

Name of Student			
Roll Number			
Name of School			
Region:		District:	

FORM FOUR EXAMINATION, 2023
TIME: 2 HOURS AND 10 MINUTES FOR READING

CHEMISTRY

Instructions to candidates

- Answer all the questions
- This paper consists of 10 pages, count it and if any is missing inform your invigilator
- Write your **name and roll number** on the exam paper
- No extra paper is allowed.
- If you make a mistake, **cross out the incorrect** answer and **write your correct answer.**

This exam paper consists of following Parts

Parts	Marks
Part one: Multiple Choice	10 marks
Part two: Structured Questions	90 marks
Total:	**100 Marks**

For the markers only

PARTS	MARKS
Part one:	
Part two	
Total:	

Use this page for rough work. It will NOT be marked.

PART ONE MULTIPLE CHOICE QUESTIONS: (10 MARKS)

1. All **S** orbitals are spherical in nature and can hold up to:
   A. Two electrons
   B. Six electrons
   C. Three electrons
   D. Eight electrons
2. Which group and period is beryllium in the periodic table
   A. Group 1 and period 1
   B. Group 1 and period 2
   C. Group 2 and period 1
   D. Group 2 and period 2
3. The functional group of alkene family is:
   A. Carbon-carbon single bond
   B. Carbon-carbon double bond
   C. Carbon-carbon triple bond
   D. Carboxyl group
4. The molecule 2- methylbuta-2-ol is an example of:
   A. Primary alcohol
   B. Secondary alcohol
   C. Tertiary alcohol
   D. Tertiary halogenoalkanes
5. Which of the following compounds belong to same homologous series?
   A. Ethanol and propane
   B. Ethanol and propanol
   C. Ethyne and ethane
   D. Propyne and ethanol
6. Propyne is an alkyne family, which of the following is the correct molecular formula of propyne.
   A. C_3H_5
   B. C_3H_3
   C. C_3H_4
   D. C_3H_6
7. Which of the following is the most electronegative element in the periodic table:
   A. Fluorine
   B. Chlorine
   C. Hydrogen
   D. Potassium
8. One mole of gas occupies a volume of _____ at room temperature and pressure:
   A. 21 dm^3
   B. 22 dm^3
   C. 23 dm^3
   D. 24 dm^3
9. The relative molecular mass of copper (II) carbonate is:
   A. 123
   B. 124
   C. 142
   D. 114
10. Standard enthalpy change of combustion is the enthalpy change when one mole of an element or compound reacts completely with;
    A. Hydrogen
    B. Carbon
    C. Oxygen
    D. Nitrogen

PART TWO: STRUCTURAL QUESTIONS (90 marks)

Answer all the following questions

QUESTION 1: (23 MARKS) ATOMIC STRUCTURE

1. **Write the electronic configuration of the following elements (spdf).**
   a) Boron _____ (1mark)
   b) lithium _____ (1mark)
   c) Chlorine _____ (1mark)
   d) Argon _____ (1mark)
   e) Calcium _____ (1mark)

2. **Match the terms with their definitions in the table below. (6mark)**

First one is done for you.

No	Term or word	Answer	Letter	Definition
1	Atomic number	G	A	Is a table that displays all the elements with their atomic numbers and mass numbers
2	Electronic configuration		B	The volume of space within which there is a highest probability of finding electrons is called -------
3	Groups		C	Are set of numbers used to describe the position and energy of electrons in an atom.
4	Orbital		D	Describes how the electrons of its atoms are arranged in their shells, subshells and orbitals.
5	Periodic table		E	Are horizontal rows of element in the periodic table
6	Quantum number		F	These are vertical columns of elements found in the periodic table.
7	Periods		G	Is the number of proton in an atom

3. Classify the following elements into (s, p, d, and f block) (6 marks)

Nitrogen	Zinc	Chromium	Beryllium	Aluminum	Hydrogen

a) S block _____

b) p block _____

c) F block _____

d) d block _____

4. a) Explain term second ionization energy. (2marks)

_____

_____

b) Write an equation for second ionization energy of sodium. ΔH = + 4560 $KJmol^{-1}$

(2marks)

_____

c) Write two factors that affect the ionization energy. (2 marks)

_____

_____

QUESTION 2: (12 MARKS) BONDING AND STRUCTURE

1. Sodium sulphate is an ionic compound and has the formula Na_2SO_4.

a) Write the formulae of the two ions in sodium sulphate. (2marks)

_____

b) Calculate the relative formula mass of sodium sulphate

(Relative atomic masses Na = 23, S = 32, O = 16). (2marks)

_____

c) Write the chemical formulae for the following.

i) Calcuim nitrate _____ (1mark)

ii) Magnesium hydroxide _____ (1mark)

iii) Aluminium chloride _____ (1mark)

iv) Zinc oxide _____ (1mark)

2. a) Using dot and cross, draw a diagram of nitrogen molecule. (2marks)

b) How many lone pair does ammonia molecule has? (1mark)

c) Draw the molecular shape of ammonia? (1mark)

QUESTION 3: (14 MARKS) ENERGY IN CHEMISTRY

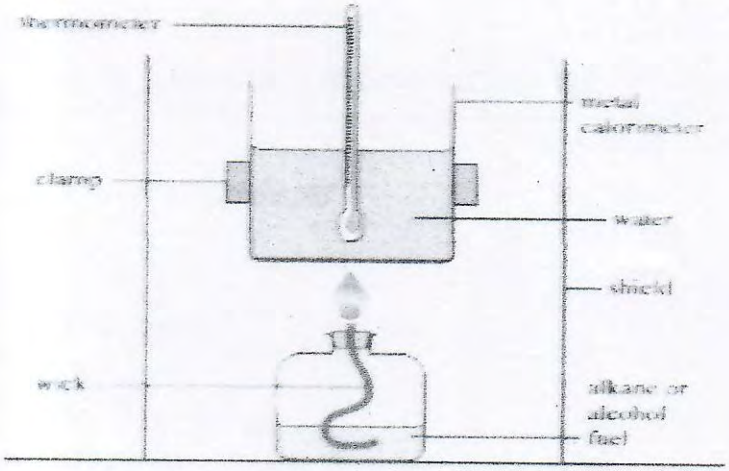
1. Define the following:
   a) Enthalpy (2mark)

   b) Enthalpy change (2mark)

2. When water is converted back to hydrogen and oxygen, heat is absorbed from the surrounding.
   a) Write an equation for the above reaction. (2marks)

b) Draw the energy level diagram for the conversion of water to hydrogen and oxygen. $\Delta H = +282.6$ kj/mol (3marks)

3. The diagram shows how a student set up on experiment to find the energy released when ethanol burnt. (5 marks)



The student burnt 2 gram of ethanol and the water temperature rose by 7 ° C.

Mass of water = 200 g

$\Delta T = 7$ °C

Fuel burnt = 2 grams

Specific heat capacity = 4.2 j/g/c

a) Calculate the energy gained by the water during the experiment. Q= mcΔT?

(2M)

b) Calculate the formula mass of ethanol C_2H_5OH. RAMs (C = 12, H = 1, O= 16)

(1M)

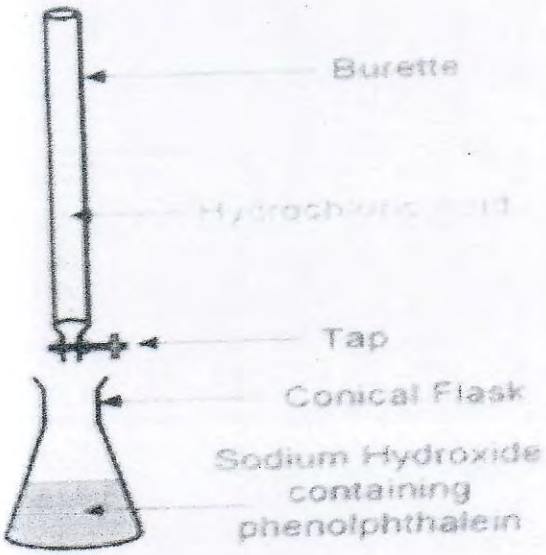
c) Calculate the energy released when one mole of ethanol had been burnt?

(1M)

d) Is the reaction endothermic or exothermic?

(1M)

QUESTION 4: (13MARKS) THE MOLE AND STOICHIOMETRY



1. A 25.00 ml sample of 0.1205M standard hydrochloric acid (HCl) acid solution is titrated with 28.52ml of sodium hydroxide (NaOH) to the end point.

a) Calculate the number of moles of hydrochloric acid? (1mark)

b) Calculate the number of moles of sodium hydroxide by using mole ratio. (2mark)

c) What is the molarity of sodium hydroxide? (1mark)

2. a) Determine the relative molecular mass of calcium carbonate ($CaCO_3$). (1mark)

b) Calculate the mass of 0.015 mole of magnesium (Mg = 24) (1mark)

c) Calculate the concentration in mol/dm^3 of a solution containing $4g/dm^3$ of sodium hydroxide (NaOH). (2Mark)

d) A compound was found to contain 32.4g sodium, 22.6g sulphur and 45g oxygen. Calculate the empirical formula of the compound. (5mark)

QUESTION 5: (15 MARKS) HYDROCARBONS

1. Explain the following:
   a) Concept of organic chemistry (2 marks)

b) Isomerism (2 marks)

c) Addition reaction (2marks)

2. Name the following compounds (3 marks)

a) $CH_3\ CH_2\ CH_2\ CH_2\ CH_3$

b) $CH_2 = CH_2$

c) $CH_3\ CH_2\ \underset{\displaystyle CH_3}{\underset{|}{CH}}\ CH_2\ CH_2\ CH_3$

3. a) Write the general formula of alkanes _____ (1mark)

b) Write the general formula of alkenes _____ (1mark)

d) Draw the displayed formula of ethyne _____ (1mark)

e) Draw molecular formula of Hexane _____ (1mark)

f) Write the reaction between ethene + hydrogen. (2Marks)

QUESTION 6: (13MARKS) FUNCTIONAL GROUPS

1. a) Write the three classes of alcohols (3marks)

_____

_____

_____

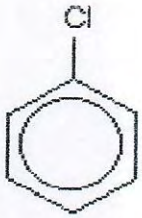
b) Write the general formula of alcohols. _____ (1mark)

2. Name the following compounds:

a) $CH_3CH(OH)CH_3$ _____ (1mark)

b) C_4H_8O _____ (1mark)

c) CH_3COOH _____ (1mark)

d) 

_____ (1mark)

3. Complete the following passage using the words in the box (5 marks)

RCH_2-OH	Carbonyl compounds	Hydrogen gas	Esters	Weak acids

Carboxylic acids are generally _____ with a pH above 4 and below 7.

Carboxylic acids react with electropositive metals to produce _____.

A molecule of alcohol has the structure of _____.

Alcohols are used in manufacturing _____ to give fruit flavouring in sweets.

Aldehydes and ketones are referred as _____

END