

MINISTRY OF EDUCATION AND HIGHER EDUCATION

FORM FOUR EXAMS, 2022

CHEMISTRY



P/LAND NATIONAL EXAMINATION BOARD



MINISTRY OF EDUCATION AND HIGHER EDUCATION
PUNTLAND NATIONAL EXAMINATIONS BOARD

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| Roll Number | | | |
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FORM FOUR EXAMINATION, 2022
TIME: 2 HOURS AND 10 MINUTES FOR READING

CHEMISTRY

Instructions to candidates

- Answer all the questions
- This paper consists of 11 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 | 30 marks |
| Part two: Structured Questions | 70 marks |
| Total: | 100 Marks |

For the markers only

| PARTS | MARKS |
|-----------|-------|
| Part one: | |
| Part two | |
| Total: | |



Part one: Multiple Choice Questions: (30 marks)

Instructions for this section: **Circle** the correct answer from A, B, C, D.

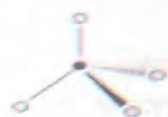
For each question there is **only one** correct answer.

- The neutral atoms of all the isotopes of the same element have
 - Different numbers of protons.
 - Equal numbers of neutrons.
 - The same number of electrons.
 - The same mass numbers.
- Which of the following materials can be used to make electrical wires?

| | |
|----------------|-------------------|
| A- Copper wire | C- Wood |
| B- Plastic | D- foam insulator |
- Sulphuric acid acts as a dehydrating agent. That means,
 - It removes oxygen from a substance
 - It removes water from a substance
 - It removes carbon dioxide from a substance
 - It removes hydrogen from a substance
- Which of the following electron configurations is correct for calcium?

| | |
|----------------------------|----------------------------|
| A- $[\text{Ar}] 4s^1 3d^8$ | C- $[\text{Kr}] 4s^1 3d^8$ |
| B- $[\text{Kr}] 4s^1 4d^8$ | D- $[\text{Kr}] 4s^2$ |

- 5- The shapes of some molecules are shown below. Tetrahedral, bent, linear, pyramidal.



tetrahedral



pyramidal



bent



linear

The shape of a molecule of water is likely to be:

- | | | | |
|----------------|---------|--------------|-----------|
| A- Tetrahedral | B- Bent | C- Pyramidal | D- Linear |
|----------------|---------|--------------|-----------|
- The enthalpy changes in when one mole of a compound is formed under standard conditions is called

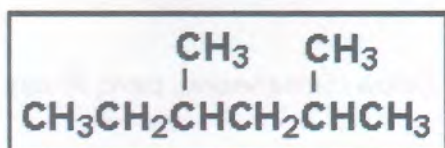
| | |
|-------------------|---------------|
| A- Reaction | C- Combustion |
| B- Neutralization | D- Formation |
 - Energy is measured, in which of the following units?

| | | | |
|-----------|-----------|-----------|---------|
| A- Joules | B- Kelvin | C- Pascal | D- Mole |
|-----------|-----------|-----------|---------|

- 8- Which of the following can be drawn into wires?
 A- Copper B- Nitrogen D- Oxygen C- Sodium
- 9- What is the chemical formula of copper II sulphate?
 A- CuO B) CuCO₃ C- CuSO₄ D- CuCl₂
- 10- Which non-metal catches fire if it exposed to air?
 A- Phosphorus B- Hydrogen C- Carbon D- Bromine
- 11- Which row of the table shows the heat energy changes that occur when bond are broken and bonds are formed?

| | Bonds broken | Bonds formed |
|---|-------------------------|-------------------------|
| A | Heat energy is released | heat energy is released |
| B | Heat energy is required | heat energy is required |
| C | Heat energy is released | heat energy is required |
| D | Heat energy is required | heat energy is released |

- 12- Select the correct name of this molecule



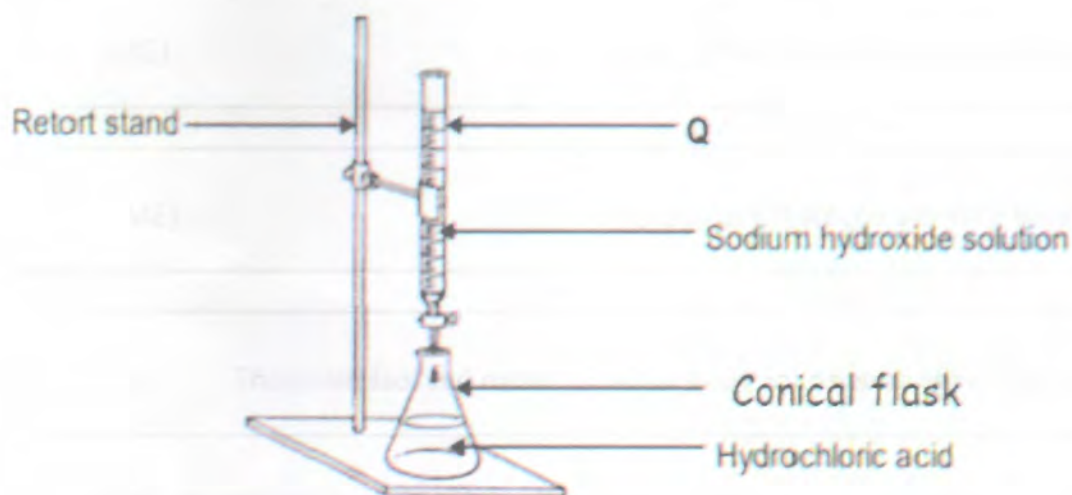
- A- 1,1,3-trimethylpentane C- 3,5-dimethylhexane
 B- 2,4-dimethylhexane D- 3,5,5-trimethylpentane
- 13- Which of the following formulas represents an alkene?
 A- CH₃CH₂CH₃ C- CH₃CH₂CH = CH₂
 B- CH₃CH₃ D- CH₃CH₂Cl
- 14- The material which is to electroplated
 A- Is connected to the terminal anode
 B- Can be connected to either cathode or anode
 C- Is freely kept in the electrolytic cell
 D- Is connected to the terminal cathode

Question 2: (15 marks)

1- Hydrochloric acid (HCL (aq)) is a strong acid, and important used in laboratory.

a) Give a reason why hydrochloric acid is classifies as strong acid? (2M)

b) A student uses the apparatus below to titrate hydrochloric acid against a sodium hydroxide solution.



i) Write down the name of apparatus Q in the above diagram. (1M)

2- During a titration, 25 cm³ of the excess sodium hydroxide solution NaOH (aq) is titrated with 50 cm³ of 0.10 mol·dm⁻³ hydrochloric acid solution, HCl(aq).

Steps

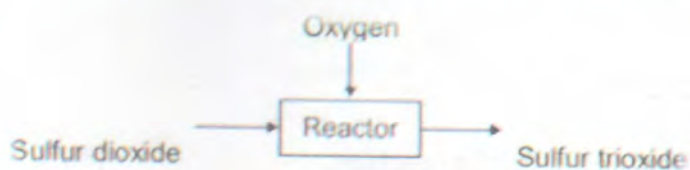
a) Calculate the number of moles of sodium hydroxide? (1M)

b) Write balanced equation for the reaction between hydrochloric acid and sodium hydroxide with state symbols. (2M)

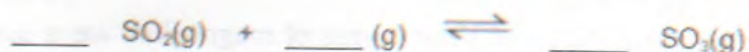
c) Calculate the mole ratio of the acid with the base? (1M)

d) Calculate the concentration of sodium hydroxide? (1M)

3- The equation below represents the production of sulphur trioxide.



a) Complete and balance the equation for the reaction. (3M)



b) For making sulphuric acid, name ;

i) Process _____ (1M)

ii) Raw materials _____ (3M)

Question 3: (9 marks)

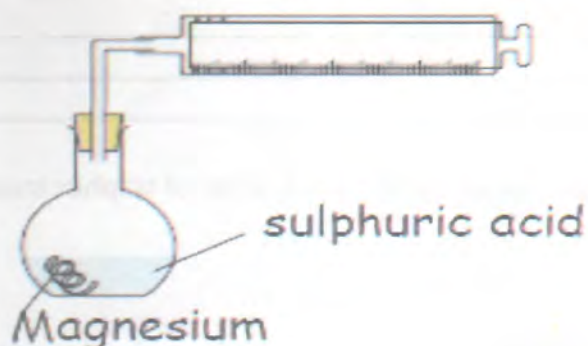
1- a) Lead can be produced by heating lead oxide with carbon.
Complete the word equation for this reaction.

Lead oxide + _____ → lead + _____ (2M)

b) In this reaction, lead oxide is reduced. Complete the sentence.

Lead oxide has been reduced because it has lost _____ (1M)

2- A student investigated the rate of a reaction between magnesium and dilute sulfuric acid. The products are magnesium sulfate, $MgSO_4$, and hydrogen.



a) Write three factors that affect the rate of a reaction. (3M)

b) The student carried out two experiments. (3M)

The same mass of magnesium and the same sized pieces of magnesium were used in each experiment.

The results are shown in the table.

| | Experiment 1 | Experiment 2 |
|---|--------------|--------------|
| Concentration of sulfuric acid / mol dm^{-3} | 0.5 | 1.5 |
| Temperature / $^{\circ}\text{C}$ | 20 | 40 |
| Rate of reaction | Slow | Fast |

a) Evaluate these results, explaining the reasons why the rate of reaction in experiment 2 is faster than the rate of reaction in experiment 1.

In your answer you should refer to the energy and collisions between particles.



Question 4: (12 marks)

- 1- An experiment is carried out to measure the temperature change when solid ammonium chloride is dissolved in water.

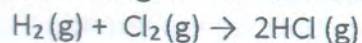
Initial temperature of water = 19 °C

Final temperature of solution = 15 °C

- a) Explain what the temperature readings show about the type of heat change occurring when ammonium chloride dissolves in water. (2M)

- b) Is the reaction exothermic or endothermic? (1M)

- 2- The reaction between 1mol of hydrogen gas and 1mol of chlorine gas forms 2moles of hydrogen chloride gas. The reaction is exothermic.



Energies of some bonds are shown below.

| Bond | Energy of bond kJmol ⁻¹ |
|------------|------------------------------------|
| H ---- H | 346 |
| Cl ---- Cl | 243 |
| H ---- Cl | 432 |

- a) i) Use the data in the table to calculate the total amount of energy to break the bonds in reactants. (1M)

- ii) Use the data in the table to calculate the total amount of energy released when the bonds in the product are formed. (1M)



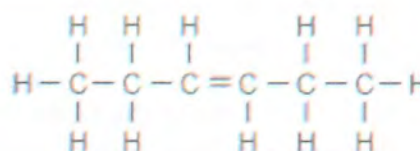
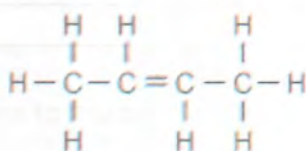
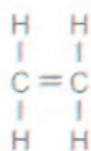
- iii) Calculate the enthalpy change of the reaction in kJmol^{-1} . Include a sign in your answer. (2M)

- b) Draw the enthalpy profile of the above reaction. (3M)

- c) Explain, in terms of the energy involved in the breaking of bonds and in the making of bonds, why the reaction is exothermic. (2M)

Question 5: (12 marks)

1- The structures of three compounds are shown below.



- a) Why do these compounds all belong to the same homologous series? (1M)

b) Write the names of the above three compounds. (3M)

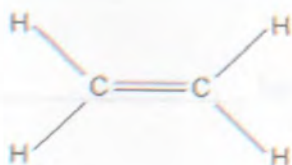
2- Alcohols form a homologous series

a) What does the term homologous series mean? (2M)

b) Write two characteristics of ethanol. (2M)

c) Is ethanol solid, liquid or gas? (1M)

3- Ethene is an unsaturated hydrocarbon.



a) Which family of organic compound does ethene belong? (1M)

b) Calculate the molecular mass of ethene? (2M)

c) Write the structural formula of ethene. (1M)

Question 6: (9 marks)

Complete the sentences below. (9M)

Choose the answer from the box.

| | | | | |
|-----------------------|---------------|--------------------------|-------------------------|------|
| Electrostatic bonding | Mole decrease | electro-negativity slide | inter molecular conduct | lone |
|-----------------------|---------------|--------------------------|-------------------------|------|

- b) Metals can be stretched into wires because the layers of atoms can _____
- c) Delocalised electrons allow graphite to _____ electricity.
- d) The relative formula mass of a substance, in grams is called _____
- e) The ions in sodium chloride are held together by _____ force
- f) Atomic radii increase down the group, but _____ across the period.
- g) Ammonia has three _____ pairs and one _____ pair.
- h) Polar covalent bonds are caused by a difference in _____
Between the elements.
- i) Weak attractive force between molecules area called _____ force.

End