Term 2 - 2021

CHEMISTRY (233/1)

PAPER 1

FORM THREE (3)

Time: 2 Hours

Name: ……………………………………………………. **Adm No**: ……………….

School: …………………………………………………….. **Class**: …………………..

**Signature**: ……………………………………………..**Date**: …………………….

..**INSTRUCTIONS TO CANDIDATES**

a) Write your name, class and house in the spaces provided above

b) Sign and write the date of the examination in the spaces provided above.

c) Answer **ALL** the questions in the spaces provided in the question paper.

d) KNEC mathematical tables and electronic calculators may be used.

e) All working **MUST** be clearly shown where necessary.

f) **This paper consists of 11 printed pages**

g) **Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.**

h) **Candidates should answer the questions in English.**

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1 – 16	**80**	

1) The set up below can be used to prepare oxygen gas. Study it and answer the questions that follow:
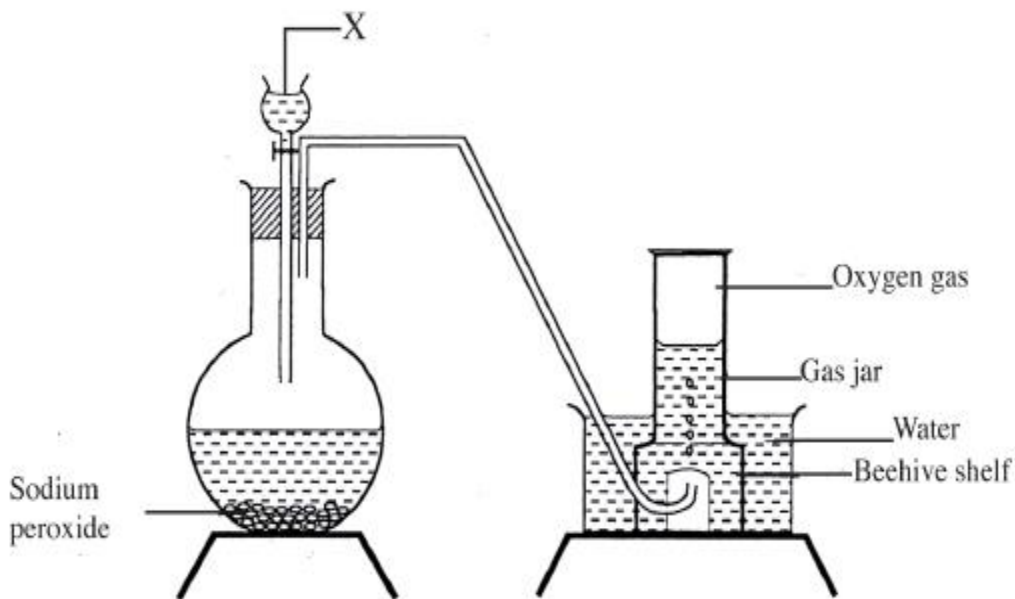
a) Identify **X**. _____ (1 mk)

b) What property of oxygen makes it possible for it to be collected as shown in the above set-up?

_____ (1mk)

c) State **two** uses of *oxygen gas*.   (1 mk)

_____

_____

2) Write equations to show the effect of heat on each of the following:

a)   *Sodium hydrogen carbonate*   (1mk)

_____

b)   *Silver nitrate*   (1 mk)

_____

c)   *Anhydrous Iron (II) Sulphate*   (1 mk)

3) Describe an experimental procedure that can be used to *extract oil from nut seeds*. (2 mks)
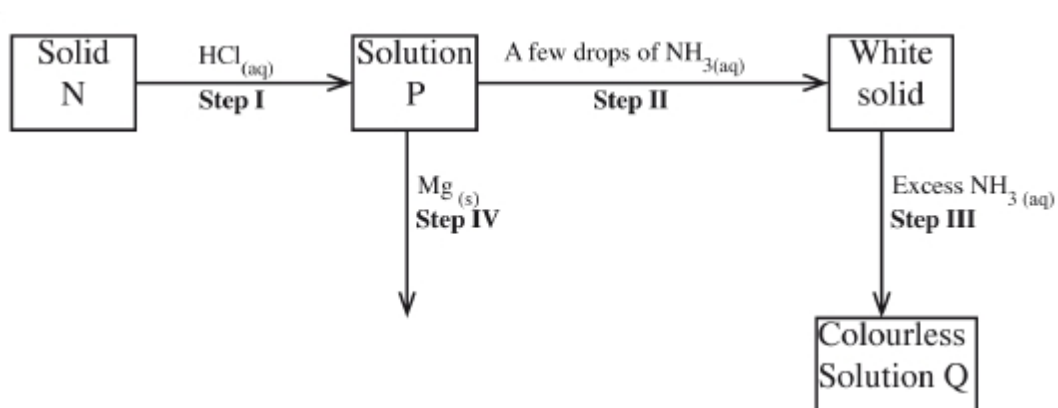
_____

_____

_____

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_____

4) In terms of *structure and bonding*, explain the following observations:

a) the *melting point* of Aluminium is higher than that of Sodium (1 ½ mks)

_____

_____

_____

b) the *melting point* of Chlorine is lower than that of Sulphur. (1 ½ mks)

_____

_____

_____

5) During welding of cracked railway lines by the Kenya Railways Corporation, 12.0g of oxide of iron is reduced by aluminium to 8.40g of iron. Determine the empirical formula of the oxide. (Fe = 56.0, O = 16.0)   (3 mks)

_____

_____

_____

6) The scheme below shows a reaction sequence starting with Solid **N**. Study it and answer the questions that follow.

| Solid N | $\xrightarrow[\textbf{Step I}]{HCl_{(aq)}}$ | Solution P | $\xrightarrow[\textbf{Step II}]{\text{A few drops of } NH_{3(aq)}}$ | White solid |

Solution P → $Mg_{(s)}$ **Step IV** ↓

White solid → Excess $NH_{3\,(aq)}$ **Step III** ↓ Colourless Solution Q

a) Write the formula of the complex ion in **Solution Q**.   (1 mk)

_____

b) Write a *stoichiometric equation* for the reaction in **Step (IV).**   (1 mk)

_____

7)   a)   State ***Charles' Law***.   (1 mk)

_____

_____

_____

b)   A certain mass of gas occupies **146 dm³** at **291K** and **98.31kPa**. What will be its temperature if its volume is reduced to **133 dm³** at **101.325kPa**?   (2 mks)

8) Diamond and graphite are *allotropes* of carbon.

a) What is meant by the term *allotrope*?   (1mk)

_____

b) Explain why graphite can be used as a lubricant while diamond cannot.   (2 mks)

_____

_____

_____

9) On heating a pale green solid **K**, Carbon (IV) oxide gas and a black solid **M** were formed. On reacting **K** with dilute Hydrochloric acid, Carbon (IV) oxide gas and a green solution **S** were formed. When excess aqueous ammonia was added to solution **S**, a deep blue solution was formed.

a) Identify the *cation* in Solid **K**.   (1 mk)

_____

b) Identify two *anions* in Solution **S**.   (2 mks)

_____

10) A student investigated the effect of an electric current on substances by passing a current through some substances.   The student used inert electrodes, and a bulb in the circuit. The table below shows the substances used and their states.

Experiment	Substance	State
1	Potassium carbonate	Solid
2	Copper (II) sulphate	Solution
3	Sugar	Solution
4	Lead (II) iodide	Molten

a) In which experiments did the bulb **not** light?   (1 mk)

_____

b) Explain your answer in (a) above. (2 mks)

_____

_____

11) Element **J** has two isotopes namely **J-39** and **J-40**. It's relative atomic mass is **39.07**.
Calculate the percentage relative abundance of each isotope. (3 mks)

12) Starting with Zinc carbonate describe how would you prepare hydrated Zinc sulphate.
(4 mks)

_____

_____

_____

_____

13) A Form 3 student was provided with the following solutions; Study the information and
answer the questions that follow.

Solution **A** was made by dissolving **10.6g** of a metal carbonate, **X₂CO₃** in distilled water and
made up to 1 litre of the solution.

Solution **B** is a **0.25M** of Hydrochloric acid.

20.0 cm³ portions of solution **A** were titrated with solution **B** from the burette and the following
results were obtained.

Volume of the pipette used   _____ cm³ (Solution **A**)   (1 mk)

Titration	1	2	3
Final burette reading (cm³)	16.6	32.6	
Initial burette reading (cm³)			
Volume of Solution B (cm³)	16.6	16.0	16.0

   a) Complete the table above   (4 mks)

b) Calculate the average volume of solution B used.   (1 mk)

c)Name a suitable indicator for this reaction.   (1 mk)

_____

d) Write a stoichiometric equation for the reaction taking place.   (1 mk)

_____

e) i) Calculate the moles of Solution **B** used.   (2 mks)

ii) Determine the number of moles of solution **A** used in the reaction. (2 mks)

_____

_____

_____

iii) Calculate the concentration of Solution **A** in **moles/litre**. (1 mk)

_____

_____

_____

iv) Calculate the **Relative Atomic mass** of **X** in Solution X_2CO_3 (H=1; C = 12; O = 16)
(2 mks)

14) The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of elements.

				N	P	T		
M								
R								

i)   Select a letter which represents an element that loses electrons most readily. Give a reason for your answer.   (2 mks)

_____

ii)   Explain why the atomic radius of P is found to be smaller than that of N. (2 mks)

_____

_____

b) Use the information in the table below to answer the questions that follow. The letters are not the symbols of the elements.

Element	State of oxide at room temperature	Type of oxide	Bonding in oxide
U	Solid	Acidic	Covalent
W	Solid	Basic	Ionic
X	Liquid	Neutral	Covalent
Y	Gas	Neutral	Covalent

Identify a letter which represents an element in the table that could be Calcium, Carbon or Sulphur. Give a reason in each case.

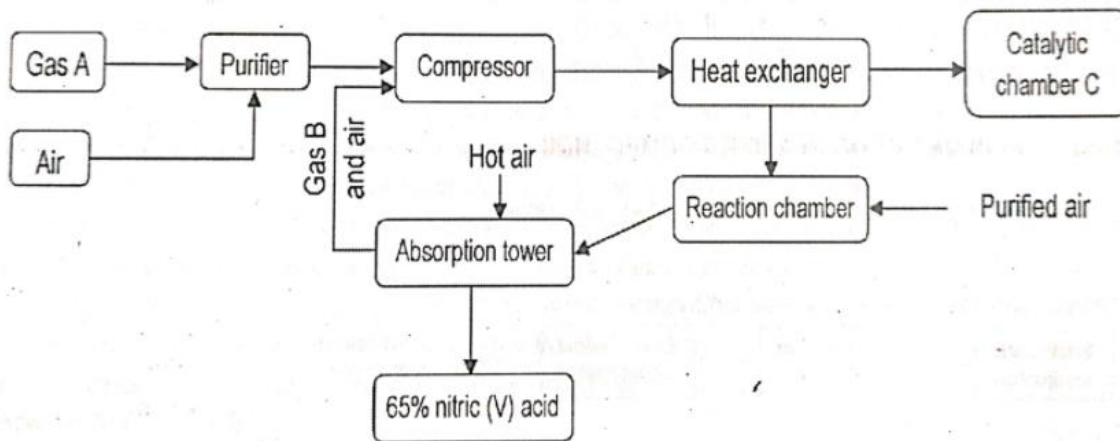   i)   **Calcium**   _____ (1 mk)

        Reason: _____(1 mk)

        ii)   **Carbon**   _____(1 mk)

        Reason: _____(1 mk)

        iii)   **Sulphur**   _____(1mk)

        Reason: _____(1mk)

15) The chart below shows how nitric acid is produced on a large scale. Study it and answer the questions that follow.

a) State the functions of the:

    i.   Purifier   (1 mk)

_____

    ii.   Heat exchanger   (1 mk)

_____

b) Identify:

    i.   Gas A   (1 mk)

_____

    ii.   Gas B   (1 mk)

_____

    iii.   Catalyst C   (1 mk)

_____

c) Write equations for the reaction that take place in the absorption tower.   (1 mk)

_____

_____

d) Mixture that comes out is 65% nitric (V) acid and 35% water. How would the concentration of nitric (V) acid be increased? (1 mk)

_____

_____

e) Calculate the molarity of commercial nitric (V) acid, that is 68% pure and has a density of 1.42 g/cm³ (N=14, H=1, O=16) (2 mks)

_____

f) Why does nitric (V) acid appear yellow? (1 mk)

_____

_____

g) Why is nitric (V) acid stored in brown bottles? (1 mk)

_____

_____

h) State and explain the observations made when copper metal is reacted with dilute nitric (V) acid. (2 mks)

_____

_____

_____

i) State three uses of nitric (V) acid (3 mks)

_____

_____

_____

16) A sample of **2.34 g** of a metal P displaced **3.20 g** of Copper from excess aqueous Copper (II) Sulphate (P = 69; Cu = 64)

a) Determine the charge on an ion of metal P.   (3 mks)

b) Write an ionic equation for the reaction.   (1 mk)