**SUNRISE ONE TERM 1 EXAMINATION -2023**

***Kenya certificate of Secondary Education***

***FORM 4***

**233/2**

**CHEMISTRY**

**PAPER 2**

**NAME:…………………………………………………………………ADM NO:………………………..**

**CLASS: ……………………………………………………CANDIDATE’S SIGNATURE:…….............**

**DATE: …………………**

**233/2**

**CHEMISTRY**

**PAPER 2(Theory)**

**APRIL-2023**

**TIME: 2 HOURS**

**INSTRUCTIONS TO CANDIDATES**

* *Write your name , Adm No and Class in spaces provided above.*
* *Sign and write the date of examination in the spaces provided above*
* *Answer all the questions in the spaces provided below each question. .*
* *KNEC Mathematical tables and silent electronic calculators may be used.*
* *All working must be clearly shown where necessary.*
* *Candidates should answer the questions in English.*

**For Examiners Use Only**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidate’s score** |
| 1 | 08 |  |
| 2 | 12 |  |
| 3  | 12 |  |
| 4 | 12 |  |
| 5 | 10 |  |
| 6 | 13 |  |
| 7 | 13 |  |
| **Total score**  | **80** |  |

***This paper consists of 11 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.***

1. (a) The table below shows the atomic numbers of elements in the periodic table

 represented by the letters A to I. The letters are not the actual symbols of the elements.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Element | A | B | C | D | E | F | G | H | I |
| Atomic number | 3 | 7 | 8 | 9 | 11 | 12 | 13 | 14 | 16 |

1. Select two elements in the same group. (1 mk)

 …………………………………………………………………………………………………..

1. Select the non-metal and the metal that would react most vigorously with each

 other. (1 mk)

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(b)(i) Draw cross (X) and dots(●) diagram to show bonding in the compound formed between hydrogen and element **B** (1 mk)

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(ii) The compound formed in b(i) above does not conduct electric current in gaseous form but conducts in aqueous form. Explain. (2 mks)

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(c) Explain the difference between the melting points of the oxides of **H** and **I**  (2 mks)

 …………………………………………………………………………………………………………

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(d) Write an equation for the reaction that takes place between elements **G** and **C**. (1 mk)

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1. (a) When few drops of ammonia solution was added to hydroxides of zinc, copper and

 Iron(III), the following solution were obtained; colourless solution, deep blue

 solution and brown precipitate. Identify the substances responsible for;

1. Deep blue solution (1 mk)

 …………………………………………………………………………………………………..

1. Colourless solution (1 mk)

 ……………………………………………………………………………………………………..

1. Brown precipitate (1 mk)

 …………………………………………………………………………………………………..

(b) A saturated solution of potassium chloride is to be prepared at 40oC. Its solubility at 40oC is 34g/100g water and 27g/100g of water at 5oC .

 (i) What mass of water would be saturated with 8.5g of potassium chloride at 40oC?(1mk) …………………………..…………………………………………………………………………..

(ii) What mass of potassium chloride would crystallize out if the saturated solution at

 40oC is cooled to 5oC? (1 mk)

…………………………..………………………………………………………………………………

……………………………………..……………………………………………………………………

 (c) Given **two** samples of sodium carbonate and sodium hydrogen carbonate. Describe a

 chemical test that would distinguish them. (2 mks)

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(d) Two equal pieces of magnesium ribbon were placed in two separate test tubes, one containing 10cm3 of water and the other containing 10cm3 of methylbenzene. State and explain the observations made in the two test tubes. (2 mks)

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 (e) In an experiment, soap solution was added to three separate samples of water. The table

 below shows the volumes of soap solution required to form lather with 2 litres of each

 sample of water before and after boiling.

|  |  |  |  |
| --- | --- | --- | --- |
| Sample | Sample A | Sample B | Sample C |
| Volume of soap before water is boiled (cm3) | 30 | 3 | 13 |
| Volume of soap after water is boiled (cm3) | 30 | 3 | 3 |

1. Which sample is likely to be soft water? Explain. (2 mks) …………………………..…………………………………………………………………………..

 ……………………………………..………………………………………………………………..

1. Explain the change in volume of soap used in Sample C. (1 mk)

…………………………..…………………………………………………………………………..……………………………………..………………………………………………………………..

1. (a) 12.0cm3 of 0.05M hydrochloric acid reacted completely with calcium hydrogen

 carbonate solution.

1. Write the chemical equation for the reaction. (1 mk)

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1. Calculate the number of moles of hydrochloric acid used. (1 mk)

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1. Determine the number of moles of calcium hydrogen carbonate used. (1 mk)

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 (b) Study the flow chart below and answer the questions that follow.

Gas K

Sulphur

Step 2

Step I

Sulphur

Solution L + Gas M + Liquid N

Zinc metal

Step 4

Rhombic sulphur

Concentrated sulphuric (VI) acid

Step 3

Sulphur (VI) oxide

Sulphur (IV) oxide

1. Name
2. Gas K. (1 mk)

 …………………………..…………………………………………………………………………..

1. Gas M (1 mk)

 …………………………..…………………………………………………………………………..

1. Steps 1, 2 and 3 constitute the contact process. State optimum conditions necessary for step 2 to occur. (1 mk)

 …………………………..……………………………………………………………………………………………………………………………………………………………………………….

1. Explain what happens in step 4. (2 mks) …………………………..……………………………………………………………………………………………………………………………………………………………………………….
2. Explain why water is not used in step 3 . (1 mk)

………………………………………………………………………………………………………………………………………………………………………………………………………………

1. Write an equation to show how pollution effects of sulphur (IV) oxide is controlled in contact process. (1 mk)

………………………………………………………………………………………………………

1. State **two** uses of sulphur. (2 mks)

 …………………………..…………………………………………………………………………..

 ……………………………………..………………………………………………………………..

1. (a) Use the bond energies below to answer the questions that follow.

|  |  |
| --- | --- |
| Bond | Bond energy ( KJ/Mol) |
| H-H | 436 |
| C= C  | 612 |
| C- C  | 347 |
| C- H | 413 |

Determine the enthalpy for the following reaction

C4H8(g) + H2(g)  C4 H10(g) (3 mks) …………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

(b) Molar enthalpy of combustion of propanol is -1560Kjmol-1.

 (i) Write a thermochemical equation for the complete combustion of propanol. (1 mk)

 …………………………………………………………………………………………………..

(ii) Calculate the amount of energy in joules released when 10g of propanol is burnt in excess oxygen. (C=12, H = 1.0,O=16.0) (2 mks)

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(c) (i) State Hess’ law (1 mk)

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 (ii) Use the information below to answer the questions that follow.

 C(s) + O2(g) CO2(g) Δ Hθ = - 393Kjmol-1

 H2(g) + ½ O2 (g) H2O (l) ΔHθ = -287 Kjmol-1

 C3H8 + 5O2(g) 3CO2(g) + 4 H2O(l) ΔHθ = -2209kj mol-1

1. What does the symbol ΔHθ represent? (1 mk)

…………………………………………………………………………………………….

1. Write the equation for the formation of propane from its constituent elements.

 (1 mk)

 ……………………………………..………………………………………………………

1. With the aid of an energy cycle diagram, calculate the enthalpy of formation of propane. (3 mks)

 ……………………………………..……………………………………………………………….…………………………..…………………………………………………………………………..……………………………………..……………………………………………………………….…………………………..………………………………………………………………………………………………………………………………

1. The flow chart below shows an analysis of mixture **K** that contains two salts. Study it and answer the questions that follow.

White precipitate that dissolves

Add drops of NaOH till in excess

Mixture

K

Metal oxide + Carbon (I V)Oxide

Solution

N

Solid

M

Colourless solution A

+ Ammonia gas + liquid B

Add water

and filter

Step

1

Add

HNO3(aq)

Add silver nitrate solution followed by dilute nitric (v) acid

Add excess

NaOH(aq) and Heat

Add drops of ammonia solution

till in excess

White precipitate

Insoluble in excess

White precipitate

Solution L

1. Identify,

(i) Solution **L**: (1 mk)

 ……………………………………..………………………………………………………………..

(ii) Solid **M**: (1 mk)

 ……………………………………..………………………………………………………………….

(iii) Solution **N** : (1 mk)

 ……………………………………..………………………………………………………………….

1. What condition is necessary in step 1 (1 mk)

 ……………………………………..……………………………………………………………………

 ……………………………………..……………………………………………………………………

1. State the observations made in step 1 (1 mk)

 ……………………………………..…………………………………………………………………….

 ……………………………………..……………………………………………………………………

1. Write down an equation to show how;

(i) Solution **N** is formed. (1 mk)

 ……………………………………..……………………………………………………………………

(ii) Colourless solution **A** and Ammonia gas are formed. (1 mk)

 ……………………………………..……………………………………………………………………

1. When excess NaOH(aq) is added to solution **N**, a white precipitate is formed which dissolves. Give the name and formula of the ion formed. (2 mks)

Name:……………………………………………………………………………………………….

Formula: …………………………………………………………………………………………….

1. Explain why it is necessary to add water to mixture **K** and then filter. (1 mk)

 ……………………………………..……………………………………………………………………

 ……………………………………..……………………………………………………………………

1. A student set up the apparatus shown below to prepare and collect dry carbon (IV) oxide gas.

Calcium carbonate

Conc. H2SO4 (l)

Water

Dilute H2SO4 acid

(a) State a correction for three mistakes in the set up above (3 mks)

(i) …………………………………………………………………………………………………………

…………………………………………………………………………………………………………

(ii) …………………………………………………………………………………………………………

 …………………………………………………………………………………………………………

(iii)…………………………………………………………………………………………………………

…………………………………………………………………………………………………………

(b) Give two reasons why carbon (IV) oxide is used as a fire extinguisher (2 mks)

…………………………………………………………………………………………………………

…………………………………………………………………………………………………………

(c) The flow chart below is for the manufacture of sodium carbonate by the Solvay process. Use it to answer the questions that follow.

Brine

Ammoniacal

Brine

Tower P

Filter

Chamber G Solid X

Na2CO3

Heat

Heating limestone

Gas Q

Chamber K

L

Add water

Gas M

Solution F

(i) Name gas M: ………………………….. (1 mk)

 Q: …………………………..

(ii) Name solution F and solid X (1 mk)

 F: ………………………………………………………..

 X: ……………………………………………………….

 (iii) Name the product L formed and give one of its uses (2 mks)

………………………………………………………………………………………………………………………………………………………………………………………………………………

 (iv) Write equations of the reactions in (2 mks) Tower: …………………………………………………………………………………………….

 Chamber K: ……………………………………………………………………………………..

 (v) Name the two raw materials required in the manufacture of sodium carbonate (2 mks)

………………………………………………………………………………………………………………………………………………………………………………………………………………

1. A piece of marble chip (calcium carbonate) is put in a beaker containing excess of dilute hydrochloric acid which is placed on a reading balance. The mass of the beaker and its contents is recorded every two minutes as shown in the table.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time (min) | 0 | 2 | 4 | 6 | 8 | 10 | 12 |
| Mass (g) | 126.4 | 126.3 | 126.2 | 126.1 | 126.0 | 126.0 | 126.0 |

 i) Why is there a continuous loss of mass of the reaction mixture. (1 mk)

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 ii)Write an equation for the reaction taking place. (1 mk)

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 iii)State two different ways by which the reaction could have been made more rapid.

 (2 mks)

 ………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………......

 iv) Why does the mass remain constant after 8 minutes (1 mk)

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 v)State the observations that would be made if a few drops of lead II nitrate solution was added to 1cm3 of the resulting solution followed by excess ammonia solution. (2 mks)

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 vi) State one environmental effect that excess carbon (IV) oxide in the air causes. (1 mk)

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 vii)The energy profile for the forward direction of a reversible reaction is shown.



  Sketch on the diagram the path for a catalysed reaction. (1 mk)

 viii)What do you observe when you introduce the following substances in this equation



 2CrO2-4(aq) + 2H+(aq) Cr2O2-7(aq) + H2O(l) ΔH= -477Kj/Mol

 Yellow Orange

 i) Dilute hydrochloric acid solution. Explain (2 mks)

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 ii) Increase heat (2 mks)

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