**NAME……………………………………………………….…… INDEX NO.:………………………...**

**STREAM: .…..…………………………………………………… ADM NO: …………………………**

 **DATE: …………………….………**

**233/2**

**CHEMISTRY**

**PAPER 2**

**(THEORY)**

**AUG-2022**

**TIME: 2 HOURS**

**MINCKS GROUP OF SCHOOLS**

**FORM FOUR EXAM**

***Kenya Certificate of Secondary Education.(K.C.S.E)***

**233/2**

**CHEMISTRY**

**PAPER 2**

**(THEORY)**

**AUG-2022**

**TIME: 2 HOURS**

**INSTRUCTIONS TO CANDIDATES**

* -Write your name, class and admission number in the spaces provided above.
* -Answer all questions in the spaces provided.
* -This paper consists of Question 1 to 7
* -Students should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.

**FOR EXAMINER’S USE ONLY**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum Score**  | **Candidate’s score**  |
| **1**  | **12** |  |
| **2** | **12** |  |
| **3** | **13** |  |
| **4** | **11** |  |
| **5** | **11** |  |
| **6** | **11** |  |
| **7** | **10** |  |
| **TOTAL** | **80** |  |

***This paper consists of 12 printed pages. Candidates should check the question paper to ensure that all the pages are printed as indicated and no questions are missing.***

1(a) Draw the structures of the following compounds. (2mks)

1. 2-methylbut-2-ene
2. Heptanoic acid

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

 Cl2(g)

Product

M

Prop-I-ene

 Step I

 Sodium metal

Propan-I-oI

 Step III

 Step II

Organic compound K

CH3CH2COOH

 Na2CO3

H2O(l)

CO2(g)

CH3CH2COONa(aq)

 Mixture of NaOH and

 Step IV Ca(OH)2 (Sodalime)

1. Identify the organic compound K. (1mk)

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

1. Write the formula of M. (1mk)

…………………………………………………………………………………………………

1. Give one reagent that can be used in:

Step I (1mk)

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

Step II (1mk)

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

1. Write the equation of the reaction in Step III. (1mk)

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

(c) Name the process that occurs in: (2mks)

 Step II

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

 Step IV

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

(d) The structure below represents a type of cleansing agent



Describe how the cleansing agent removes grease from a piece of cloth. (3mks)

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

2. Below is part of the periodic table. The letters are not the actual symbols of the elements. Study it and answer the questions that follow.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | **Q** |
| **C** | **E** |  | **G** |  |  | **L** | **N** |  |
| **D** | **F** |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

a(i) State and explain the differences in the melting point of D and F. (2mks)

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 (ii) Explain the difference in the atomic radii of G and N. (2mks)

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1. Select the element that is the strongest reducing agent. Explain. (2mks)

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1. Compare the nature of the aqueous solution of the oxide of C and that of L.

 Explain. (2mks)

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(b) Study the table below and answer the questions that follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Substance** | **MP(k)** | **BP (k)** | **Electrical conductivity** |
|  |  |  | **Solid** | **Molten** |
| J | 365 | 463 | NIL | NIL |
| K | 1323 | 2773 | Good | Good |
| L | 1046 | 1680 | NIL | Good |
| M | 2156 | 2776 | NIL | NIL |

(c) Which of the substance J, K, L and M represents the following:

 (i) Silicon (IV) Oxide (1mk)

…………………………………………………………………………………………………

 (ii) Barium Sulphate (1mk)

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1. In terms of structure and bonding, explain why Silicon (IV) Chloride (SiCl4) is a liquid at room temperature while Magnesium chloride (MgCl2) is a solid. (2mks)

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3(a(i) What is meant by the term ‘Enthalpy of formation’. (1mk)

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(ii) The enthalpies of combustion of Carbon, Methane and Hydrogen are indicated below:

 C(s) + O2(g) CO2(g) ; $∆$H = -393kJmol-1

 H2(g) + ½ O2(g) H2O(l) ; $∆$H = -286kJmol-1

 Enthalpy of combustion of CH4 = -890kJ/mol.

I Draw an energy cycle diagram that links the enthalpy of formation of methane to enthalpies of combustion of carbon, hydrogen and methane. (2mks)

II Determine the enthalpy of formation of methane. (2mks)

(b) An experiment was carried out where different volumes of dilute hydrochloric acid and aqueous sodium hydroxide both at 25oC were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table below.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Volume of Hydrochloric acid (cm3) | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| Volume of sodium hydroxide (cm3) | 45 | 40 | 35 | 30 | 25 | 20 | 15 | 10 | 5 |
| Highest temperature of mixture (oC) | 27.2 | 29.4 | 31.6 | 33.8 | 33.6 | 31.8 | 30.0 | 28.4 | 26.6 |

1. On the grid provided, plot a graph of highest temperature (vertical axis) against

 volume of hydrochloric acid (horizontal axis). (3mks)



1. Using your graph, determine the
2. Highest temperature reached. (½mk)

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1. Volume of acid and base reacting when highest temperature is reached. (1mk)

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1. Calculate the amount of heat liberated during the neutralization process. (Specific heat capacity 4.2Jg-1k- and the density of solution is 1.0g/cm3. (1½mks)

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1. The molar enthalpy of neutralization between hydrochloric acid and ammonia solution was found to be -52.2kJ/mol-, while that of hydrochloric acid and sodium hydroxide was -57kJmol-1. Explain the difference in these values. (2mks)

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4(a) What is meant by rate of reaction. (1mk)

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(b) In the space provided sketch the diagram of a set-up that can be used to determine the rate of reaction between manganese (IV) oxide and hydrogen peroxide. (3mks)

(c) A state of equilibrium between dichromate ions is established as shown below:

 Cr2$O\_{7}^{2-}$(aq) + 2OH- 2Cr$O\_{4}^{2-}$(aq) + 4H2O(l)

 Orange Yellow

1. What is meant by dynamic equilibrium. (1mk)

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1. State and explain observation made, when a few drops of hydrochloric acid are

 added to the equilibrium mixture. (2mks)

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1. Some plants have seeds that contain vegetable oil.
2. Describe how the oil can be obtained from the seeds. (3mks)

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1. Explain how it could be confirmed that the liquid obtained from the seeds in oil. (1mk)

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5. Use the standard electrode potential given below to answer the questions that follows:

 **Half reaction** **Eθ volts**

 Zn2+(aq) + 2e- Zn(s) -0.76

 Pb2+(aq) + 2e- Pb(s) -0.13

 Ag+(aq) + e- Ag(s) +0.80

 Cu2+(aq) + 2e- Cu(s) +0.34

(a)(i) Choose a pair that will form a cell with the higher Eθ value. (1mk)

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1. Draw a diagram to represent the cell formed by the pair in (i) above

 (3mks)

1. Give a cell representation for the cell in (I) above (1mk)

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1. State two functions of the salt – bridge. (2mk)

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b(i) Using a well labelled diagram, explain how an iron spoon can be electroplated with silver.

 (2mks)

ii) 2.34g of metal Q were deposited when a current of 4.0 amperes was passed through a salt of Q for 30 minutes. (RAM of Q = 65, 1 Faraday = 96,500C) calculate the amount of electricity in coulomb:

1. Used to deposit 2.34g of metal Q. (1mk)

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1. Needed to deposit one mole of Q. (1mk)

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6(a) Two reagents that can be used to prepare chlorine gas are Manganese (IV) oxide and concentrated hydrochloric acid.

1. Write an equation for reaction. (1mk)

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1. Give the formula of another reagent that can be reacted with concentrated hydrochloric

 acid to produce chlorine gas. (1mk)

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1. Describe how the chlorine gas would be dried in the laboratory. (2mks)

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(b) In an experiment, dry chlorine gas was reacted with aluminium as shown in figure below 

1. Name substance A. (1mk)

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1. Write an equation for the reaction that took place in the combustion tube. (1mk)

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1. 0.84g of aluminium reacted completely with chlorine gas. Calculate the volume of

 chlorine gas used (Molar gas volume is 24dm3 Al=27) (3mks)

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1. Give two reasons why Calcium oxide is used in the set up. (2mks)

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7. Extraction of iron involves two main processes, smelting and refining. Below is the blast furnace which is used to smelt iron from its ore.



(a(i) The chief ore is Hamematite. Name one other ore used in extraction iron. (1mk)

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ii) Name the reducing agent in the process. (1mk)

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1. What is the role of the hot air blast in the process. (1mk)

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

(b) Write equations for the reaction that took place of the region marked A, B and C. (3mks)

 A ………………………………………………………………………………….

 B ………………………………………………………………………………….

 C ………………………………………………………………………………….

(c) What is the purpose of limestone in the extraction process. (1mk)

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(d) Write equations to show how impurities are removed from the ore. (2mks)

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(e) State one environmental effect of the process. (1mk)

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