**NAME…………..………………ADMNO……………CLASS………….………..DATE...............**

**CHEMISTRY THEORY 233/2**

**MARCH/APRIL 2017**

**TIME: 2 HOURS**

**SACHO HIGH SCHOOL**

**Instructions to students:**

Answer **ALL** questions in the spaces provided

Mathematical tables or electronic calculators **may** be used.

**ALL** working must be clearly shown where necessary.

**FOR EXAMINER’S USE ONLY**

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| **QUESTION** | **MAXIMUM SCORE** | **CANDIDATE’S SCORE** |
| **1** | **12** |  |
| **2** | **13** |  |
| **3** | **11** |  |
| **4** | **11** |  |
| **5** | **10** |  |
| **6** | **08** |  |
| **7** | **11** |  |
|  **8** | **11** |  |
| **TOTAL SCORE** | **80** |  |

***This paper consists of 15printed pages. Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing.***

1. Use the grid below to answer the questions that follow. Letters do not represent actual symbol of elements

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| F | I |  |  |  | M |  | O |  |
| G | J |  | K | L |  | N | P |  |
| H |  |  |  |  |  |  |  | Q |

a) What family name is given to elements I and J **(1 mark)**

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b) State and explain the difference in reactivity between.

i) G and J **(2 marks)**

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ii) N and P **(2 marks)**

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c) How does atomic radius of K compare to that of L? Explain. **(2 marks)**

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d) Explain the trend in melting points down the group of elements to which I and J belong**. (2 marks)**

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e) Write down an equation for the reaction between K and P.  **(1 mark)**

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f) Give one use of element Q. **(1 mark)**

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i) Write down the electronic arrangement of a stable ion of H. **(1 mark)**

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2. The set-up below was used during the electrolysis of aqueous magnesium sulphate using inert electrodes.



1. Name a suitable pair of electrodes for this experiment. **(1 mark)**

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1. Identify the anions and cations in the solution. **(1 mark)**

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1. On the diagram label the cathode**. (1 mark)**
2. Write an equation for the reaction that took place at the cathode**. (1 mark)**

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1. Explain the change that occurred to the concentration of magnesium sulphate solution during the experiment**. (2 marks)**

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1. During the electrolysis, a current of 2 amperes was passed through the solution for 4 hours. Calculate the volume of the gas produced at the cathode. (1 Faraday= 96500 coulombs , molar volume of a gas at room temperature = 24000cm3).

**(3 marks)**

v) One of the uses of electrolysis is electroplating. (1mark)

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vi) Give two reasons why electroplating is necessary. **(1 mark)** ………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………

b) The diagram below is a cross- section of a dry cell. Study it and answer the questions that follow.



1. On the diagram, show with a (+) sign the positive terminal **(1 mark)**

ii) Write the equation for the reaction in which electrons are produced. **(1 mark)**

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iii) Give one disadvantage of dry cells. **(1 mark)**

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3. The scheme below shows the industrial manufacture of sulphuric (VI) acid. Study it and answer the questions that follow.



1. State two functions of the chamber A. **(1mark)**

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1. Explain why concentrated Sulphuric (VI) acid is used in the absorption chamber and not water. **(1mark)**

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1. Write the equation for the reaction that takes place at the absorption chamber **(1mark)**

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 iv) Name two catalysts that can be used in the catalytic chamber. **(1mark)**

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(b) Sulphuric (VI) acid is used in making fertilizers. What volume of ammonia gas will be required to make 25kg of ammonium sulphate? N = 14, H = 1.0, S = 32, O = 16.0 Molar gas volume at r.t.p=24.0dm3) **(3marks)**

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c) The equation below shows the oxidation of Sulphur (IV) oxide to Sulphur (VI) oxide in the contact process.

2SO2(g) + O2(g) 2SO3(g)∆H = -196kJ/mol-

i) State and explain the effect on the yield of Sulphur (IV) oxide when.

 a) the temperature increased. **(2marks)**

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 b) the amount of oxygen is increase **(2marks)**

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4. Study the following table and then use it to answer the questions that follow.

|  |  |
| --- | --- |
| **Hydrocarbon** | **Boiling point (k)** |
| CH4C2H6C3H8C4H10C5H12C6H14 | 112184231273309342 |

a) These organic compounds belong to the same homologous series.

i) What is meant by the term homologous series? **(1mark)**

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1. To which homologous series do the above hydrocarbons belong? **(1mark)**

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1. Select one hydrocarbon that would be a liquid at room temperature.

**(2marks)**

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iv) Compare the boiling point of CH4 and C6H14 ? Explain your answer **(2marks)**

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1. Give one chemical test to distinguish between C2H6 and C2H4 **(2marks)**

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b) Study the scheme below and answer the questions that follow.

C2H5COONa

CH≡CH

C2H6

Complete

combustion

Step IV

CH2 = CHCI

Step II

(CH2-CHCl)n

Step III

Step V

1. Name the reagents used in

Step I ……………………………………………………………………..…**(1/2 Mark)**

Step II ……………………………………………………………..…….. **(1/2 Mark)**

ii) Write an equation for the complete combustion of CH≡CH **( 1 Mark)**

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iii) Explain one disadvantage of the continued use of items made from the compound formed in Step III **(1 Mark)**

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5 .Study the flow diagram below and answer the questions that follow:-

acidifiedWater

Air

Electrolysis

Step 2

Step 1

N2(g)

M

Step 2

Ammonia

Step 4

Rhodium/Platinum

Temperature 9000C

Colourless gas Q

Step 5

Nitrogen (IV) Oxide

Step 6

Nitric Acid

Step 7

Ammonium Nitrate

(i) Describe how nitrogen is obtained from air **(3 marks)**

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1. Name the element M **(1 Mark)**

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(iii) Why is it necessary to use excess air in step 4 **(1 Mark)**

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1. Write an equation for the reaction in step 7 **(1 Mark)**

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(IV) State two uses of ammonia gas **(2 Marks)**

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(c) State and explain the observations made if a sample of sulphur is heated in concentrated

Nitric(V) Acid **(2 Marks)**

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6 a). State Hess’ law of summation **(1mark)**

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Use the information below to answer the questions that follow:

H2(g) + ½ O2(g) H2O(l) ∆H1= -286kJmol-1

C(s) + O2(g) CO2(g) ∆H2= -394kJmol-1

2C(s) + 3H2(g) + ½ O2(g) C2H5OH(l) ∆H3= -277kJmol-1

1. Write a balanced chemical equation for complete combustion of ethanol

**(1mark)**

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1. Draw an energy level diagram to using the heat of combustion of carbon, hydrogen and ethanol**. (1mark)**
2. Calculate the molar enthalpy of combustion of ethanol**.**

 **(2marks)**

b) Given the following bond energies. Use it to answer questions below.

**Bonds Bond energies**

C – C (347kJ molˉ¹)

C – H (413kJ molˉ¹)

C = C (612kJ molˉ¹)

H – H (435.9kJ molˉ¹)

Calculate enthalpy formation of ethyne from its constituent elements. **(3marks)**

7 a) A student was provided with an ore suspected to contain Fe2+ ions, describe an experiment to show how the student can confirm the presence of Fe2+ ions in the ore**.**

**(2 marks)**

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b) The chart below represents the extraction of iron and some of its uses.


i) Name the chief ore fed into the blast furnace.  **(1 mark)**

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ii) Name 2 exhaust gases emitted from the blast furnace.  **(1 mark)**

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iii) Why is it necessary to convert pig iron into wrought iron **(l mark)**

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iv) Name  **(1 mark)**
Solid B ………………………………………………………………………………………………
Solid X ………………………………………………………………………………………………

v) Write equations for reaction in step II **(1 mark)**

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vi) Write an ionic equation for the reaction in step I. **(l mark)**

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 vii) What observations are made in steps I and IV?  **(1 mark)**

I…………………………………………………………………………………………………………………………………………………………………

IV……………………………………………………………………………………………………………………………………………………………….

viii) State one commercial use of iron**. (1 mark)**

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8 a) Other concentration, name two other factors that affect the rate of a reaction**. (1 mark)**

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b) In an experiment to determine the rate of reaction between duralumin (an alloy of aluminium, copper and magnesium) and dilute hydrochloric acid, 0.55g of the alloy were reacted with excess 4 M hydrochloric acid. The data in the table below was recorded. Use it to answer the questions that follow.

|  |  |
| --- | --- |
| Time (seconds) | Total volume of hydrogen gas produced (cm3) |
| 0 | 0 |
| 60 | 220 |
| 120 | 420 |
| 180 | 540 |
| 240 | 620 |
| 300 | 640 |
| 360 | 640 |
| 420 | 640 |

i) On the grid provided, plot a graph of total volume of hydrogen gas produced (vertical axis) against time**. (3 marks)**

ii) From the graph, determine the volume of gas produced at the end of 135 seconds**. (1 mark)**

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c) Determine the rate of reaction between the 4th and the 5th minute**. (2 marks)**

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d) Explain why the volume of the gas remain constant after the 300th second**. (1 mark)**

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