Name: ………………………………………………………… Index No. …………………………………..

Date: ………………………………………………………… Candidate’s Sign. ………….............................

**233/1**

**CHEMISTRY**

Paper 1

(Theory)

September, 2013

**Time: 2 Hours**

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

**233/1**

**CHEMISTRY**

Paper 1

September 2013

**Time: 2 Hours**

**INSTRUCTIONS TO THE CANDIDATES:**

1. Write your **name, admission numbers** in the spaces provided above.
2. Answer ***ALL*** *the*questions in the spaces provided.
3. All working **MUST**be clearly shown where necessary.
4. Mathematical tables and electrical calculators may be used.

**For Examiners’ Use Only**

|  |  |  |
| --- | --- | --- |
| **QUESTIONS** | **MAXIMUM SCORE** | **CANDIDATE’S SCORE** |
| **1-27** | 80 |  |

*This paper consists of 8 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*

1. (a)When magnesium is burnt in air, it reacts to form two products. Write the formulae of these

 products formed (1mk)

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

 (b)When water is added to one of the products, a gas with a chocking smell is produced. Write

 An equation for the reaction that took place, (1mk)

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

2. In temperate countries, salt is sprayed on roads to defrost and clear roads but the long term effect of

 this practice is costly to motorist.

1. Explain the role of salt in this practice (1mk)

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

1. Explain why the long term effect is costly to motorists (1mk)

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

3. Starting with lead (ii) carbonate, describe how you would prepare a sample of lead (ii) chloride. (3mks)

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4. Study the diagram below and use it to answer the questions that follow.



**Bulb**

**Cell**

**Dilute sodium chloride**

**solution**

**Graphite**

**Gas X**

**Gas Y**

(ii)Explain using equations how the volumes of the gases would compare when dilute

 sodium chloride solution is replaced with brine. (2mks)

 Anode ………………………………………………………………………………………………….

Cathode …………………………………………………………………………………………………

5. (a)State Graham’s Law of diffusion of gases (1mk)

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

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

(b)A certain volume of oxygen gas diffused from a given apparatus in 125 seconds. In the

 same conditions, the same volume of a gas **Y** diffused in 100 seconds. Calculate the relative molecular mass of **Y**. (0=16) (2mks)

6. The information on the table below refers to elements in the same group of the periodic table. Study

 it and answer the questions that follow. (2mks)

|  |  |
| --- | --- |
| **Element** | **Atomic Size (nm)** |
| **G1** | **0.19** |
| **G2** | **0.23** |
| **G3** | **0.15** |

 Which element has the highest ionization energy? Give a reason. (2mks)

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

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

7. In hard water areas, nitric acid (v) acid is sometimes added to irrigation water in green houses to clear scale from the piping system.

 (a) Explain how the scale is formed. (1mk)

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

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

 (b) Write a chemical equation to show how scale is removed. (1mk)

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

1. What is the other benefit of using nitric (v) acid in the irrigation system? (1mk)

…………………………………………………………………………………………………

8. State and explain the observations made when excess ammonia gas reacts with chlorine gas. (3mks)

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

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

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

9. A compound whose general formula is B(OH)3 reacts as shown by the equation below.

 B(OH)3(s) + OH-(aq) B(OH)4(aq)

 B(OH)3(s) + 3H+(aq) B3-(aq)  + 3H2O(I)

1. What name is given to compounds that behave like B(OH)3 in the two reactions? (1mk)

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

1. Name **two** elements whose hydroxides behave like that of **B**. (2mks)

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

10. (a) Give the chemical formula of rust. (1mk)

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

 (b) Name **two** conditions necessary for rusting. (1mk)

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

1. How does aluminum paint prevent rusting? (1mk)

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

11. A current of 0.75A passes through 300cm3 of 0.5M copper (ii) sulphate solution.

 (a) Determine the mass of copper in 300cm3 of 0.5M of the solution. (Cu = 63.5, IF = 96500C)

 (1½ mks)

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

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

 (b) Determine the time in seconds needed to deposit all the copper on the cathode. (1½ mks)

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

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

12. The arrangement below was used to compare the penetrating power of emissions in a radioactive

decay.

**M**

**Source**

**A**

**B**

**C**

**Zinc Plate**

**Paper**

**Lead Block**



1. Name all the radiations that can be detected at: (2mks)

**A** ……………………………………………………………………………………………………

**B** ……………………………………………………………………………………………………

**C** ……………………………………………………………………………………………………

1. Name the material **M** and state its use. (1mk)

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

235  **U**

 92

1. The half life of  is 4500 years.

The isotope decays by alpha emissions. Write a nuclear equation for its decay to form thorium (Th) ……………………………………………………………………………………….. (1mk)

13. When a few drops of ammonia solution were added to a colourless solution **Y**, a white precipitate was observed. On addition of more ammonia solution, the white precipitate dissolved.

 (a) Name the white precipitate. (1mk)

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

 (b) Write an ionic equation for the formation of the white precipitate. (1mk)

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

 (c) Write the formula of the complex ion formed when the white precipitate dissolves (1mk) …………………………………………………………………………………………………

14. Study the flow diagram below and use it to answer the questions that follow.

**Ethanol**

**H2SO4(l)**

**Colourless**

**Gas B**

**Colourless Gas A**

**160-1800C**

**Process** **X**

**H2(aq)**

H H

-C -C–

H H

n

1. Name:- (1mk)
2. Gas **A** …………………………………………………………………………………………..
3. Gas **B** …………………………………………………………………………………………..
4. What other condition apart from heating is necessary in the reaction between ethanol and

 concentrated H2SO4. (1mk)

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

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

1. Name process **X** (1mk)

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

15. Study the standard electrode potentials below and answer the questions that follow.

**ө**

 **E**

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

 Mg2+(aq) + 2e Mg(s) -2.38V

 Ag-(aq) + e- Ag(s) +0.08V

 Ca2-(aq) + 2e- Ca(s) -2.87V

1. State and explain the observation that would be made when magnesium metal is dipped in a solution of copper (ii) sulphate. (2mks)

……………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………… Calculate the **Eө** for the reaction that took place in (a) above (1mk)

16. The table below is a list of some chloride. Study it and answer the questions that follow.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Chloride** | **NaCl** | **AICl3** | **SiCl4** | **PCl3** |
| **Melting point (oC)** | **801** | **Sublimes (178)** | **-70** | **-91** |
| **Boiling Point (oC)** | **1413** | **-** | **58** | **76** |

1. Explain how the melting and boiling points of NaCI compare with those of SiCI4 (3mks)

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

17. 0.005 mole of ammonia gas was reacted with a tribasic acid as shown by the equation.

 3NH3(g) + H3PO4(aq) (NH4)PO4(aq)

1. What is meant by a tribasic acid? (1mk)

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

1. Calculate the mass of the product in the above reaction. (O =16, H=1, N=14, P=32) (2mks)

18. Atomic numbers of elements **W**, **X**, **Y** and **Z** are **16,** **12**, **11** and **18** respectively.

 (a) Which of the elements form a soluble carbonate (1mk)

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

1. Which element has the longest atomic radius? Explain (2mks)

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

19. The scheme below shows how lead can be obtained from its ore.

Roaster

Furnace

Gas X

Solid Y

Coke

Ore

1. Name the chief ore of lead and give its chemical formula (1mk)

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

1. Write a chemical equation to show the reaction in the:- (2mks)
2. Roaster ………………………………………………………………………………………….
3. Furnace …………………………………………………………………………………………
4. State one use of lead metal (1mk)

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

20. Diamond and graphite are both allotropes of carbon yet diamond is the hardest naturally occurring substance known while graphite is soft.

 (a)What is meant by allotropes? (1mk)

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

1. Explain the statement above (2mks)

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

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

21. The standard enthalpies of formation of CO2 and CO are – 3934 and -110.2 kJ/mol respectively.

 (a) What is the standard enthalpy of reaction? (1mk)

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

 (b) From the above information, calculate the enthalpy of combustion of CO. (2mks)

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

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

22. Compare the change in volume of air when repeatedly passed over heated copper and magnesium metals respectively. (3mks)

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

23. The diagram below illustrates a set up used to prepare a gas in the laboratory. Study it and answer the questions that follow.

**Conc.Sulphuric**

 **(vi) acid**

**Sodium Chloride**



1. Complete the diagram to show how the gas can be collected in the laboratory (2mks)
2. Write an equation for the reaction that takes place in the flask (1mk)

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

24. Hydrogen gas is usually prepared in the laboratory by a reaction between a metal and dilute acid. Why is it not possible to obtain the gas when the following are used? (2mks)

 (a) Copper metal …………………………………………………………………………………..

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

 (b) Nitric (v) acid ………………………………………………………………………………….

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

1. Hydrogen gas is used in the manufacture of margarine. What is the name of this process?

 ………………………………………………………………………………………... (1mk)

25. Calcium carbonate was reacted with IM hydrochloric acid to obtain carbon (iv) oxide gas.

(a) A part from grinding the carbonate, state **one** way in which the rate of production of the gas would be increased. (1mk)

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

(b) Using the grid below, sketch **two** graphs of mass of the reaction container and its contents against time (X-axis) that would be obtained when same quantity of IM hydrochloric acid was added to same mass of powdered calcium carbonate and unground carbonate respectively. (2mks)

26. The ionic dissociation of phenolphthalein indicator in aqueous solution can be represented as:

 HPh(aq) H-(aq) + Ph-(aq)

 Colourless Pink

What would be observed if a little alkali is added to the phenolphthalein indicator in aqueous solution? Explain. (2mks)

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

27. From the bond energies in the table below, determine the enthalpy change for the reaction. (3mks)

 C2H4(g) + H2(g) C2H6(g)

|  |  |
| --- | --- |
| **Bond Energy** | **Bond Energy (kj/mol)** |
| H-H | 432 |
| C=C | 610 |
| C-C | 346 |
| C-H | 413 |

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

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