**P525/2**

**CHEMISTRY**

**Paper 2**

**Jul/Aug 2016**

**2 ½ Hours**

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**MUKONO EXAMINATIONS COUNCIL**

**Uganda Advanced Certificate of Education**

**CHEMISTRY**

Paper 2

**2 Hours 30 Minutes**

**INSTRUCTIONS TO CANDIDATES**

* *Answer* ***five*** *questions including* ***three*** *questions from section* ***A*** *and any* ***two***  *from section* ***B****.*
* *Begin each question on a fresh page.*
* *Use equations where necessary to illustrate your answer.*

**SECTION A**

1. a) Define the term “Enthalpy of reaction.” ***(01mark)***

b) Excess zinc powder was added to 50cm3 of 1.0M copper (II) sulphate solution in a

plastic beaker and the temperature of the solution recorded at some time intervals.

The data obtained is shown in table below.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time (Minutes) | 0 | 2.5 | 3.0 | 3.5 | 5.0 | 6.0 | 7.0 |
| Temperature (°C) | 27.2 | 66.0 | 69.5 | 68.5 | 65.0 | 62.0 | 59.5 |

(i) Plot a graph of temperature against time. ***(3 ½ marks)***

(ii) Use the graph to determine the molar enthalpy of the reaction. (Assume specific heat

capacity of the solution is 4.2J/g/°C) ***(04marks)***

c) the standard electrode potentials of some half-cells are shown below

Half-cell standard electrode (v)

Zn2+(aq) / Zn(s) -0.76V

Cu2+(aq) / Cu(s) +0.34V

(i) Write the cell notation for cell formed by combining the half-cells. ***(01mark)***

(ii) Draw a labelled diagram for the cell. ***(3 ½ marks)***

(iii) Write equations for the reactions taking place at the anode and at the cathode of the

cell. ***(02marks)***

(iv) Calculate the maximum obtainable energy from the cell when one mole of copper (II)

ions is displaced by zinc (1 Faraday = 96500C) ***(3 ½ marks)***

d) Comment on the answers you have obtained in b(ii) and c(iv). ***(02marks)***

2. Beryllium, magnesium, calcium, strontium and barium are elements in group (II) of the

periodic table.

a) Describe the reaction of the elements with;

(i) water ***(2 ½ marks)***

(ii) dilute hydrochloric acid ***(2 ½ marks)***

(iii) Oxygen ***(2 ½ marks)***

(iv) Bromine ***(2 ½ marks)***

b) (i) State the reasons why beryllium differs from the rest of the group (II) elements.

***(03marks)***

(ii) State two properties in which beryllium differs from the rest of group (II)

elements. ***(02marks)***

c) (i) Name the reagent that can be used to distinguish between calcium and barium ions.

***(01mark)***

(ii) State what would be observed and write equation(s) for that reaction the would

take place if the reagent you have named in c(i) was treated separately with

calcium and barium ions. ***(04marks)***

3. a) Propanone undergoes nucleophilic addition whereas propene undergoes electrophilic

addition reaction.

(i) Distinguish between electrophilic addition and nucleophilic addition. ***(02marks)***

(ii) Explain why propanone undergoes nucleophilic addition whereas propene

undergoes electrophilic addition. ***(03marks)***

(iii) Give an example and outline a mechanism in each case for the addition reaction in

propanone and in propene. ***(06marks)***

b) Benzene undergoes electrophilic substitution whereas methylbenzene undergoes free

radical substitution under certain conditions.

(i) Distinguish between electrophilic substitution and free radical substitution.

***(02marks)***

(ii) Explain why benzene undergoes electrophilic substitution whereas cyclohexene

undergoes electrophilic addition. ***(02marks)***

c) Outline the mechanism for the reaction between benzene and ethanoyl chloride.

d) State the conditions and write equation in which methylbenzene undergoes free

radical substitution. ***(1 ½ marks)***

4. a) (i) Define the term transition element. ***(01mark)***

(ii) State two properties of chromium as a transition element. ***(02marks)***

b) Describe the reaction of chromium with

(i) water ***(02marks)***

(ii) Sulphuric acid ***(04marks)***

c) A solution of chrome alum, K2SO4.Cr2(SO4)3.24H2O was prepared and divided in two

portions.

(i) To the first portion was added sodium carbonate solution.

(ii) To the second portion sodium hydroxide solution was added dropwise till in excess

followed by hydrogen peroxide. State what was observed in each case and explain

your answer. ***(09marks)***

d) To a solution of potassium chromate, a few drops of dilute sulphuric acid was added

followed by a few drops of sodium hydroxide solution.

(i) State what observed. ***(01mark)***

(ii) Write an equation for the reaction in each case. ***(01mark)***

**SECTION B**

5. Write equations to show how the following compounds can be synthesized. Indicate the

reagents and conditions.

a)

NHCH3 from benzene ***(04marks)***

b) CH3CH2NH2 from 1-bromopropane ***(04marks)***

c) CH3CH2 SO3Na from benzene ***(04marks)***

d) (CH3)2C = N- NH from propanoic acid ***(04marks)***

e) Phenylmethanal from Aminobenzene. ***(04marks)***

6. a) Define the following terms.

(i) half-life of a reaction. ***(01mark)***

(ii) Order of a reaction. ***(01mark)***

b) A compound A decomposer according to the following equation.

2A products

The table below shows the concentration of A at various times.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Time (hours) | 5 | 10 | 15 | 25 | 35 | 40 | 48 |
| Concentration of A (moll-1) [A] | 0.776 | 0.617 | 0.479 | 0.302 | 0.186 | 0.148 | 0.100 |

Draw a graph of log10[A] against time. ***(05marks)***

c) Using the graph determine the;

(i) original concentration of A. ***(01mark)***

(ii) Order of reaction. ***(02marks)***

(iii) rate constant for the reaction. ***(02marks)***

(iv) half-life of the reaction. ***(1 ½ marks)***

d) (i) Using the same axes, draw a labelled energy-reaction coordinate for a catalyzed

and uncatalyzed reaction. ***(3 ½ marks)***

(ii) State the difference in your diagrams. ***(01mark)***

(iii) State how a catalyst increases the rate of the reaction. ***(02marks)***

7. Briefly explain each of the following observations

a) Aminobenzene is a weaker base than aminoethane. ***(04marks)***

b)Phosphine, PH3 boils at -88°C while ammonia boils at -33°C ***(04marks)***

c) Phenol is a stronger acid than cyclohexanol. ***(04marks)***

d) The bond angle in a water molecule is 104° whereas the bond angle in the ammonia

molecule is 107° ***(04marks)***

e) Iodine is sparingly soluble in water but very soluble in potassium iodide solution.

***(04marks)***

8. a) (i) Name the ore from which aluminium can be extracted.

(ii) State two main impurities in the ore. ***(01mark)***

b) Describe how;

(i) the ore of aluminium is purified. ***(09marks)***

(ii) pure aluminium is obtained from the purified ore. ***(03marks)***

c) Discuss the reactions of aluminium with;

(i) hydrochloric acid. ***(02marks)***

(ii) Concentrated sulphuric acid. ***(02marks)***

d) Explain why aluminium utensils should not be washed with soap solution.

***(03marks)***

***End -***