P525/2
Chemistry
Paper 2
2½ Hours

# STANDARD HIGH SCHOOL ZZANA

**Uganda Advanced Certificate of Education**
**MID TERM I EXAMINATIONS, 2020**
**CHEMISTRY**
**PAPER 2**
**TIME: 2Hours 30 Minutes**

## INSTRUCTIONS

- Answer **five** questions including **three** questions from section **A** and any **two** from section **B**.
- Write answers in the answer booklet provided.
- Mathematical tables and graph papers are provided.
- Non-programmable scientific electronic calculators may be used.
- Use equations where necessary to illustrate your answers.
- Where necessary use (Cu = 64, S = 32, O = 16, Br = 79.9, H = 1)
- Faraday's constant is 96500c.
- FORWARD SCANNED ANSWERS TO stahiza2020@gmail.com

## SECTION A

**(Answer three questions from this section)**

1. (a) State Hess's law of constant heat summation. (01mark)

   (b) Explain what is meant by each of the following terms and in each case write an equation to illustrate your answer.
   (i) Hydration energy. (02marks)
   (ii) Lattice energy. (02marks)
   (c) Explain two factors that affect the value of lattice energy of a compound. (03marks)
   (d) In an experiment to determine lattice energy of anhydrous copper (II) sulphate, 4.0g anhydrous copper (II) sulphate was added to 50g of water and the temperature rose by $8.0^0$C. When 4.0g hydrated copper(II) Sulphate was added to 50g of water dropped from $24.5^0$C to $23.6^0$C.
   [*S.H.C of solution = 4.2Jg$^{-1}$K$^{-1}$*]
   Calculate the enthalpy of solution of;
   (i) Anhydrous copper (II) sulphate. (03marks)
   (ii) Copper (II) sulphate-5-water. (03marks)

   (e) (i) State which one of the two copper (II) salts in (d) is more soluble in water and explain your answer. (03marks)

   (iii) Using a Born-Haber cycle determine the hydration energy of hydrous copper (II) sulphate. (03marks)

2. (a) Both phenol and ethanol contain the same functional group.
   (i) Name one reagent that can be used to distinguish between the two compounds. (01mark)
   (ii) State what would be observed if each of the compounds is treated with the reagent you have named and write the equation for the reaction that occurs if any. (03marks)
   (iii) Describe three ways in which the chemistry of phenol is similar to that of ethanol. (03marks)
   (iv) Mention two uses of phenol. (02marks)
   (b) An aqueous solution of phenol turns blue litmus paper red whereas that of ethanol has no effect. Explain this observation. (04½ marks)
   (c) Write the equation and mechanism for the reaction between
   (i) Phenol and 2-chloropropane in alkaline conditions. (02marks)
   (ii) Ethanol and methanoic acid in presence of sulphuric acid. (04½ marks)

3. The elements beryllium, magnesium, calcium, strontium and barium belong to group (II) of the periodic table.
   (a) Write the equation and state the conditions under which group (II) elements react with.
   (i) air (04marks)
   (ii) water (04marks)
   (iii) dilute sulphuric acid (04marks)
   (b) The atomic radii and melting points of group (II) elements in the periodic Table is given in the table below:

| **Element** | **Atomic radius (nm)** | **Melting point $^0$C** |
|---|---|---|
| Beryllium | 0.112 | 1283 |
| Magnesium | 0.160 | 650 |
| Calcium | 0.197 | 848 |
| Strontium | 0.215 | 770 |
| Barium | 0.222 | 710 |

   Explain the trend in
   (i) Atomic radii (03marks)
   (ii) Melting points of group (II) elements. (03marks)
   (c) Although beryllium is in group (II) in the Periodic Table, in some of its properties resemble aluminum in group (III).
   State the reasons why beryllium differs in some of its properties from the rest of the elements in group (II). (02marks)

4. (a)(i) Describe how the molecular mass of a substance can be determined using the freezing point depression method.
   (Diagram not required). (07marks)
   (ii)Explain why the method you have described in a(i) is not suitable for determining the molecular mass of a polymer. (02marks)
   (b) Calculate the freezing point of a solution containing 4.2g of ethane -1,2 – diol. (Molecular mass = 62) in 30g of water
   ($K_f$ of water = $1.86^0$C mol$^{-1}$kg$^{-1}$) (4marks)
   (c) The osmotic pressure of various concentrations of solute X in methyl benzene at $25^0$C are given in the table below.

| Concentration /g dm$^{-3}$ | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 |
|---|---|---|---|---|---|---|
| Osmotic pressure/ Nm$^{-2}$ | 23 | 37 | 53 | 75 | 92 | 99 |

   (i) Plot a graph of osmotic pressure against concentration. (03marks)

(ii) Use the graph you have drawn to determine the molecular mass of X (R= 8.3, 4KJmol$^{-1}$. (04marks)

## SECTION B (40MARKRS)

**(Answer two questions from this section)**

5. The boiling points of chlorides of period 3 elements are shown in the table below.

| Formula of the chloride | NaCl | $MgCl_2$ | $AlCl_3$ | $SiCl_4$ | $PCl_3$ | $S_2Cl_2$ | $Cl_2$ |
|---|---|---|---|---|---|---|---|
| Boiling points **(**$^0$C) | 1465 | 1418 | 423 | 57 | 74 | 136 | -35 |

(a) Explain the trend in boiling points. (10marks)

(b) State the conditions and write the equation for the reaction between

i. $AlCl_3$ and water. (02marks)

ii. $S_2Cl_2$ and dilute sodium hydroxide solution. (02marks)

iii. Chlorine and iron. (02marks)

iv. $SiCl_4$ and calcium hydroxide powder. (02marks)

v. $MgCl_2$ and sulphuric acid. (02marks)

6. Describe how aluminium can be extracted from bauxite.
Your answer should include equations for the reactions that take place. (diagram not required) (10marks)

(b) (i)Briefly describe how hydrated aluminium chloride; $AlCl_3.6H_2O$ can be prepared from aluminium.

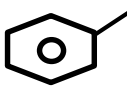
(ii) State what would be observed when hydrated aluminium is strongly heated and write equation for reaction. (2½ marks)

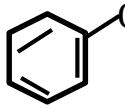
(iii) State what would be observed when sodium carbonate solution is added to concentrated solution of aluminium chloride. (4½ marks)

7. Complete and write a mechanism for

(a)  + $CH_3COBr$ $\xrightarrow{FeCl_3}$ (04marks)

(b) $CH_3\,CH_2\,OH$ + Conc. $H_2SO_4$ $\xrightarrow{140^0C}$ (04marks)

(c)  $\xrightarrow[\text{heat}]{NaOH_{(aq)}}$ (02marks )

(d)  $+CH_3CH_2Cl$ $\xrightarrow{KOH_{(aq)}}$ (04marks)

(e) $CH_3CH_2C \equiv CNa + CH_3Br \xrightarrow{\text{liq.}NH_3}$ (02marks)

(f) $CH_3C \equiv CH \xrightarrow[H_gS0_4,\ 60^0C]{H_2S0_4/H_2O}$ (04marks)

8. (a) The standard electrode potential for some half cells are shown below

| | |
|---|---|
| $Fe^{3+}{}_{(aq)}/Fe^{2+}{}_{(aq)}$ | + 0.76V |
| $I_{2(aq)}/I^{-1}{}_{(aq)}$ | +0.54V |

(i) What is meant by the term standard electrode potential? (01mark)
(ii) Using a well labeled diagram,describe how the standard electrode potential of iron (III) sulphate can be determined. (06marks)
(iii) Why is it not possible to measure the standard electrode potential of iron (III) sulphate absolutely? (02marks)

(c)(i) Write the cell convention and equation for the overall reaction that occurs when the electrode potentials in (a) above are combined. (2½ marks)
(ii) Calculate the overall electrode potential for the cell. (1½ mark)

(iii) State whether the reaction in c (i) is feasible or not. Give a reason for your answer.

(d) A current of 40.5A was passed through molten lead(II) bromide for 4 hours and the bromine liberated reacted with 94.0g of hydroxyl benzene. Calculate the number of moles of;
(i) Bromine liberated.
(ii) Hydroxybenzene that reacted. (04marks)
(e) State what is observed and write equation for the reaction that took place between Bromine and hydroxyl benezene in (d) above. (02marks)

**END**