P525/2
CHEMISTRY
Paper 2
July/August 2019
2½ hours

BUGANDA EXAMINATION COUNCIL MOCKS – 2019

CHEMISTRY

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

Answer **five** *questions, including* ***three*** *from section* ***A*** *and* ***any two*** *from section* ***B***.

Additional questions answered will ***not*** *be marked.*

Write the answers in the answer booklets provided.

Begin each question on a **fresh page**

Mathematical tables and graph papers are provided

Non-programmable scientific electronic calculators may be used

Use equations were necessary to illustrate your **answer**

[$H = 1;\ N = 14; O = 16;\ Cl = 35.5$]

Turn Over

SECTION A

Answer **three** questions in this section.

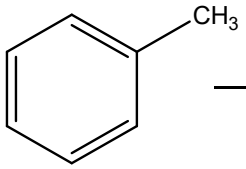
1. Beryllium, magnesium, calcium and barium are some of the elements that belong to Group II of the Periodic Table.
   (a) State what would be observed and write equation for the reaction when
      (i) magnesium is heated in steam. **(2½ mks)**
      (ii) calcium is added to water. **(2½ mks)**
   (b) Illustrating your answers with equations compare how beryllium and barium react with sulphuric acid.
   (7 mks)
   (c) (i) State how the solubility of the sulphates of group II elements vary down the group. **(01 mk)**
   (ii) Explain your answer in (c)(i). **(03 mks)**
   (d) Write equation for the reaction between
      (i) water and calcium carbide. **(1½ mks)**
      (ii) beryllium and hot concentrated sodium hydroxide solution. **(1½ mks)**
   (e) State the reasons why beryllium differs from the rest of the group II members in the Periodic Table. **(01 mk)**

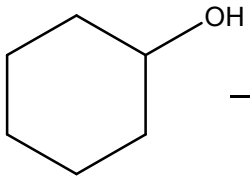
2. (a) Define the following term **relative atomic mass**. **(01 mk)**
   (b) (i) Briefly describe how the relative atomic mass can be determined using a mass spectrometer. (*No diagram required*) **(08 mks)**
      (ii) Copper has a relative atomic mass of 63.55 and consists of two isotopes ^{63}Cu and ^{65}Cu. Determine the percentage composition of the isotopes in the naturally occurring copper. **(03 mks)**
      (iii) When chlorine gas was analyzed in a mass spectrometer, peaks were recorded at mass number 70, 72 and 74. Explain this observation. **(2½ mks)**
      (iv) State **one** advantage of using a mass spectrometer in the determination of relative atomic masses. **(01 mk)**

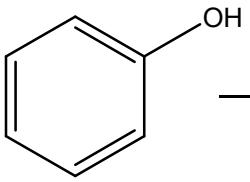
   (c) The first, second, third and fourth ionization energies of Y are 738, 1451, 7733 and 10541 respectively.
      (i) Write equation to show second ionization of element Y. **(01 mk)**
      (ii) State and explain the trend in the ionization energies of element Y. **(3½ mks)**

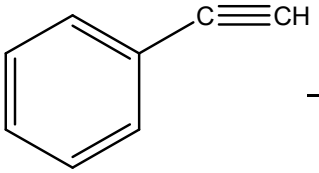
3. Complete the following equations and outline a possible mechanism for the reaction.

(a) $CH_3CHO \xrightarrow[H^+]{H_2NNHCONH_2}$ (05 mks)

(b)  $\xrightarrow[\text{heat}]{Cl_2/Fe}$ (04 mks)

(c)  $\xrightarrow[\text{heat}]{\text{conc. } H_3PO_4}$ (3.5 mks)

(d)  $\xrightarrow[NaOH(aq),\ heat]{CH_3C(=O)Cl}$ (3 mks)

(e)  $\xrightarrow{\text{excess HI(g)}}$ (2.5 mks)

(f) $CH_3CH_2Cl \xrightarrow[\text{heat}]{OH^-(aq)}$ (02 mks)

4. (a) State what is meant by the following terms.

(i) **Standard enthalpy of neutralization**. **(01 mk)**

(ii) **Enthalpy of solution**. **(01 mk)**

(b) Describe an experiment that can be carried out to determine the enthalpy change of neutralisation of hydrochloric acid by sodium hydroxide.
(*No diagram is required*) **(07 mks)**

(c) In an experiment to determine the heat of neutralisation of an acid Q by sodium hydroxide, 2 M acid solution was added in the intervals of 5 cm^3 into a plastic beaker containing 40.0 cm^3 of 2 M sodium hydroxide solution. After each addition, the mixture was stirred and highest temperature of solution recorded.

The data obtained is shown below.

Volume of acid added Q (cm^3)	0.0	5.0	10.0	15.0	20.0	25.0	30.0
Highest temperature of mixture (^oC)	28.0	34.0	39.0	43.0	45.0	42.0	40.0

(i) Plot a graph of highest temperature against volume of acid Q added. **(03 mks)**

(ii) Use the graph to determine the enthalpy of neutralisation of acid Q by sodium hydroxide solution. (*density of solution is 1* gcm^{-3} *and specific heat capacity of solution is 4.2* $Jg^{-1}K^{-1}$) **(03 mks)**

(d) (i) State **Hess' law**. **(01 mk)**

(ii) The table below shows some heats of combustion of some selected substances.

Substance	**Heat of combustion,** $\Delta H_{25}^{\theta}(kJ\ mol^{-1})$
Ethane	-1542
Ethyne	-1310
Hydrogen	-285

Calculate the heat of hydrogenation of ethyne to ethane. **(04 mks)**

SECTION B

Answer any **two** questions in this section.

5. Explain the following observations.

(a) The first electron affinity of phosphorous is less than that of sulphur. **(03 mks)**

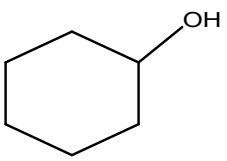
(b) The ionic conductivities of rubidium and sodium ions are 78.3 and $50.1\Omega^{-1}cm^{-2}$ mol^{-1} respectively. **(04 mks)**

(c) The boiling points of ethanoic acid and methylmethanoate are 118℃ and 32℃ respectively, yet the two compounds have the same molecular masses. **(3½ mks)**

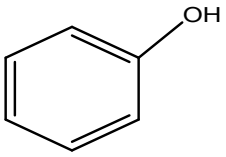
(d) Hydrogen iodide gives purple vapours when treated with hot concentrated sulphuric acid whereas hydrogen chloride does not give greenish-yellow gas under similar treatment. **(04 mks)**

(e) When magnesium ribbon is added to an aqueous solution of chromium(III) salt, a green precipitate and bubbles of a colourless gas were seen. **(5½ mks)**

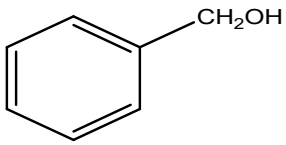
6. The structural formula of some compounds, **X, Y** and **Z** are shown below.



X



Y



Z

(a) For compounds **Y** and **Z**, name **one** reagent which;

(i) when reacted with **Y** and **Z** will show similar observations.

(ii) can be used to distinguish between **Y** and **Z**.

In each case state what would be observed when **Y** and **Z** is separately treated with the reagent you have named. **(05 mks)**

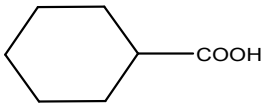
(b) (i) Write equation(s) to show how **Y** can be prepared from benzene. (*Your answer should include reagents and conditions*) **(03 mks)**

(ii) **Y** can be used in the manufacture of azo-dye. By means of equations only, show how **Y** can be used to make an azo-dye starting from phenylamine (aniline). **(02 mks)**

(c) Write

(i) equation for the reaction between **X** and acidified potassium dichromate. **(01 mk)**

(ii) equation(s) to show how **X** can be converted into cyclohexanecarboxylic acid,



(*Your answer should include reagents and conditions*). **(02 mks)**

(iii) the mechanism for the reaction between **X** and ethanoic acid in the presence of concentrated sulphuric acid. **(4½ mks)**

(d) **Y** is a stronger acid than **Z.** Explain this observation. **(2½ mks)**

7. (a) Define the following terms:

(i) **Eutectic mixture**. **(01 mk)**

(ii) **Eutectic temperature**. **(01 mk)**

(c) The melting points of mixtures of lead and tin of different compositions are shown below.

Percentage of tin	0	20	40	70	80	100
Melting point (ºC)	327	280	234	193	206	232

(i) Draw a fully labeled phase diagram for the tin-lead mixture. **(06mks)**

(ii) Determine the temperature and composition of the eutectic mixture. **(02mks)**

(iii) Using the diagram describe the changes that will take place if a liquid mixture containing 40% of zinc is cooled from 300ºC to 100ºC. **(05mks)**

(d) State

(i) **three** tests that can be carried out on a eutectic mixture to show that it is not a pure compound. **(03mks)**

(ii) **one** application of tin-sold eutectic mixture. **(01 mk)**

(d) Name **one** other pair of metals that can form a phase diagram similar to that in (b) above. **(01mk)**

8. (a) One of the ores from which zinc can be extracted is zinc blende.

Write the formula of zinc blende. **(01 mk)**

(b) During the extraction of zinc from zinc blende, the ore concentrated, roasted and finally zinc is formed.

(i) Describe how the zinc ore is concentrated. **(3½ mks)**

(ii) Write equation for the reaction which takes place during roasting of the ore. **(1½ mks)**

(iii) Briefly describe how the roasted product is converted into zinc. **(04 mks)**

(c) State what would be observed and write equation for the reaction that would take place when

(i) zinc powder is added to iron(III) sulphate solution. **(03 mks)**

(ii) dilute ammonia solution is added drop wise until in excess to an aqueous solution of zinc nitrate. **(04 mks)**

(iii) Zinc powder is added to hot concentrated sodium hydroxide solution. **(03 mks)**

END