P525/2

CHEMISTRY

Paper 2

MARCH 2024

2½ hours

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**DIVINE SS KITALA**

**MID TERM I EXAMINATIONS 2024,**

**CHEMISTRY DEPARTMENT**

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 scientificelectronic calculators may be used*

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

*[]*

**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.
2. State what would be observed and write equation for the reaction when
3. magnesium is heated in steam. **(2½ mks)**
4. calcium is added to water. **(2½ mks)**
5. Illustrating your answers with equations compare how beryllium and barium react with sulphuric acid. (7 mks)
6. (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)**

1. Write equation for the reaction between
2. water and calcium carbide. **(1½ mks)**
3. beryllium and hot concentrated sodium hydroxide solution. **(1½ mks)**
4. State the reasons why beryllium differs from the rest of the group II members in the Periodic Table. **(01 mk)**
5. (a) Define the following term **relative atomic mass**. **(01 mk)**
6. (i) Briefly describe how the relative atomic mass can be determined using a mass spectrometer. (*No diagram required*)  **(08 mks)**
7. Copper has a relative atomic mass of 63.55 and consists of two isotopes

and . Determine the percentage composition of the isotopes in the naturally occurring copper.  **(03 mks)**

1. When chlorine gas was analyzed in a mass spectrometer, peaks were recorded at mass number 70, 72 and 74. Explain this observation.

**(2½ mks)**

1. State **one** advantage of using a mass spectrometer in the determination of relative atomic masses. **(01 mk)**
2. The first, second, third and fourth ionization energies of Y are 738, 1451, 7733 and 10541 respectively.
3. Write equation to show second ionization of element Y. **(01 mk)**
4. State and explain the trend in the ionization energies of element Y.

**(3½ mks)**

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











1. (a)Define the term **buffer solution**.(01mark)

(b) Explain the action of an **acid buffer**. (05marks)

(c) **50cm3** of **0.05M**ethanoic acid was added to **50cm3** of a **0.02M** of sodium hydroxide solution.

(i) Write an equation for the reaction that took place. (01mark)

(ii) Calculate the **pH** of the resultant solution at **250C**. ( The acid dissociation constant ka, of ethanoic is **1.8x10-5** at **250C)**.(05marks)

1. Ammonium chloride solution gives effervescence with magnesium ribbon, whereas sodium ethanoate solution gives a blue precipitate with aqueous copper(ii) chloride solution. Explain the observation. (08marks)

**SECTION B**

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

1. Explain the following observations.
2. The first electron affinity of phosphorous is less than that of sulphur. **(03 mks)**
3. The ionic conductivities of rubidium and sodium ions are 78.3 and 50.1 respectively. **(04 mks)**
4. The boiling points of ethanoic acid and methylmethanoate are 118 and 32respectively, yet the two compounds have the same molecular masses. **(3½ mks)**
5. 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)**
6. 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)**
7. The structural formula of some compounds, **X, Y** and **Z** are shown below.



1. For compounds **Y** and **Z**, name **one** reagent which;
2. when reacted with **Y**and **Z** will show similar observations.
3. 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)**

1. (i) Write equation(s) to show how **Y** can be prepared from benzene. (*Your answer should include reagents and conditions*) **(03 mks)**
2. **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)**
3. Write
4. equation for the reaction between **X** and acidified potassium dichromate. **(01 mk)**
5. equation(s) to show how **X** can be converted into cyclohexanecarboxylic acid,



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

1. the mechanism for the reaction between **X** and ethanoic acid in the presence of concentrated sulphuric acid. **(4½ mks)**
2. **Y** is a stronger acid than **Z.** Explain this observation. **(2½ mks)**
3. (a) Define the following terms:
4. **Eutectic mixture**. **(01 mk)**
5. **Eutectic temperature**. **(01 mk)**
6. The melting points of mixtures of lead and tin of different compositions areshown below.

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

1. Draw a fully labeled phase diagram for the tin-lead mixture. **(06mks)**
2. Determine the temperature and composition of the eutectic mixture.

**(02mks)**

1. 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)**
2. State
3. **three** tests that can be carried out on a eutectic mixture to show that it is not a pure compound. **(03mks)**
4. **one** application of tin-sold eutectic mixture. **(01 mk)**
5. Name **one** other pair of metals that can form a phase diagram similar to that in (b) above.  **(01mk)**
6. Carbon, silicon, tin and lead are elements in Group IV of the periodic table.
7. State:
8. The common oxidation state shown by elements in Group IV of the periodic table (01mark)
9. How the stability of the oxidation states of the Group IV elements vary down the group. (Illustrate your answer with the chlorides of carbon and lead.) (03marks)
10. Give a reason for your answer (a)(ii) (01mark)
11. Discuss the reaction of the chlorides of each element with water. (06marks)
12. Write equation for the reaction between:
13. the oxide of each element and sodium hydroxide. (06marks)
14. lead(IV) oxide and concentrated hydrochloric acid. (1.5marks)
15. lead(IV) oxide and warm concentrated hydrochloric acid.(1.5marks)

**END**

**What men have done, man can do.**