Candidate's Name: .....Personal No. .....

Signature .....

P525/1
CHEMISTRY
Paper 1
JULY 2024
2¼ hrs

MUKONO EXAMINATION COUNCIL 2024
Uganda Advanced Certificate of Education

CHEMISTRY
Paper 1
2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES

- Answer all questions in Section A and six questions in Section B.
- All your answers must be written in the spaces provided.
- The periodic table, with relative atomic masses, is attached at the end of the paper.
- Mathematical tables (3 – figure tables) are adequate or non-programmable scientific electronic calculators may be used.
- Where necessary, use the following;
- Molar gas constant, R = 8.31JK^{-1}mol^{-1}.
- Molar volume of a gas at s.t.p is 22.4 litres.
- Standard temperature = 273K.
- Standard pressure = 101325NM^{-2}.

For Examiner's use only																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL

SECTION A (46 MARKS)

Answer all questions from this Section

1. Electrode potentials for some half-cells are given below

Half cell	E^{θ} (V)
$SO^{2-}_{4(aq)}, H^{+}_{(aq)}, SO^{2-}_{3(aq)}/Pt$	+0.20
$MnO^{-}_{4(aq)}, H^{+}_{(aq)}, Mn^{2+}_{(aq)}/Pt$	+1.51

a) Write the cell notation for the cell formed when the two half cells are connected. (01 mark)

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b) Write equation for the overall cell reaction. (1½ marks)

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c) i) Calculate the free energy of the cell. (1 Faraday = 96500C) (01 mark)

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ii) State whether the reaction is feasible or not. Give a reason for your answer. (01 mark)

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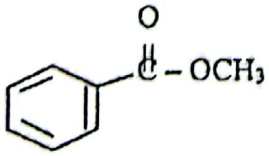
2. Write equations to show how the following conversions can be effected. Indicate the reagents and conditions for the reaction in each case.

a)  to  (2½ marks)

b) CH_3CHO to CH_3NH_2 (3½ marks)

3. a) Steam distillation is one of the methods used for the separation of a component from a liquid mixture. State three requirements for the component to be separated by steam distillation. (1½ marks)

b) A mixture containing substance X was steam distilled at 760mmHg and 98°C. The distillate contained 85% by mass of water. If the vapour pressure of water is 735mmHg at 98°C. Calculate the molecular masss of X. (03 marks)

4. A green powder Z was dissolved in dilute sulphuric acid to form a blue solution. When concentrated hydrochloric acid was added to the solution of Z dropwise until in excess a yellow solution was formed.

a) Identify the cation in Z. (½ mark)

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b) Name the species present in the solution

i) Before addition of hydrochloric acid. (½ mark)

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ii) After addition of excess hydrochloric acid. (½ mark)

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c) Excess potassium iodide solution was added to the blue solution.

i) State what was observed. (01 mark)

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ii) Write an equation for the reaction that took place. (1½ mark)

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5. a) Write

i) Equation for the hydrolysis of ammonium chloride in water. (01 mark)

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ii) The expression for the hydrolysis constant, K_h of ammonium chloride.

(01 mark)

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b) The PH of 0.1M ammonium chloride solution is 5.13 at 25^0C.

i) Calculate the hydrolysis constant of ammonium chloride. (03 marks)

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ii) State the assumptions you have made in b(i) above. (01 mark)

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6. a) Name one source of vegetable oil. (½ mark)

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b) Describe briefly how soap can be prepared from one of the sources of vegetable oil you have named in (a) above. (03 marks)

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c) Write the general equation for the

i) Formation of soap. (01 mark)

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ii) Reaction between hard water and soap. (01 mark)

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7. a) $10cm^3$ of a hydrocarbon R, (C_xH_y) was exploded with $95cm^3$ of oxygen. On cooling to room temperature, the residual gases occupied, $70cm^3$.

When the residual gases were passed through potassium hydroxide solution, the volume reduced to $30cm^3$.

i) Write equation for the reaction between R and oxygen. (01 mark)

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ii) Determine the molecular formula of R. (03 marks)

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b) Write equations to show how R can be synthesized from an alcohol. (02 marks)

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8. a) State three reasons why beryllium differs from the other elements in group (II) of the periodic table. (1½ marks)

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b) Write equation for the reaction between dilute hydrochloric acid and

i) beryllium carbide (1½ marks)

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ii) calcium carbide (1½ marks)

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9. a) State the trend of the thermal stability of the tetrachlorides of elements in group (IV) of the periodic table. (01 mark)

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b) Explain your answer in (a). (04 marks)

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SECTION B (54 MARKS)

Answer six questions from this Section.

10. Write a mechanism to show how each of the following conversions can be effected.

a) $CH_3\underset{\displaystyle OH}{C}HCH_2CH_3$ to $CH_3CH{=}CHCH_3$ (03 marks)

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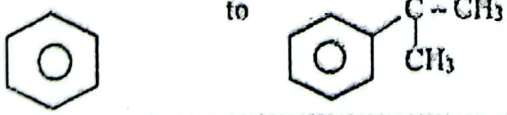
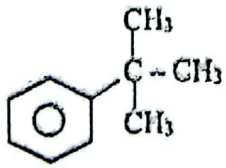
b)  to  (03 marks)

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c) $CH_3CH(Br)CH_2Br$ to $CH_3C{\equiv}CH$ (03 marks)

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11. Barium hydroxide is sparingly soluble in water

a) Write:

i) equation for the solubility of barium hydroxide in water. (01 mark)

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ii) an expression for the solubility product, Ksp of barium hydroxide.

(01 mark)

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b) The solubility of barium hydroxide is 0.675g per $100cm^3$ of water at 25^0C. calculate the:

i) solubility product of barium hydroxide at 25^0C and state its units.

(3½ marks)

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ii) volume of a 0.01M potassium chromate (VI) solution that must be added to 1dm^3 of a saturated solution of barium hydroxide to precipate barium chromate (VI).
(Ksp of barium chromate (VI) is 1.2 x 10^{-10}mol^3 dm^{-9} at 25^{0}C). (02 marks)

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c) Sodium hydroxide was added to a saturated solution of barium hydroxide.

i) State what happened to the solubility of barium hydroxide. (½ mark)

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ii) Give a reason for your answer in c(i) above. (01 mark)

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12. Ammonium dichromate dissolves in water to form an orange solution and decomposes on heating to form a green solid

a) Write equation to show the effect of heat on ammonium dichromate.

(1½ marks)

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b) State what would be observed and write equation for the reaction that would take place when the following substances are added to a solution of ammonium dichromate.

i) Acidified hydrogen peroxide solution (02 marks)

Observation

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Equation

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ii) Aqueous sodium hydroxide (02 marks)

Observation

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Equation

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iii) Acidified Iron (II) sulphate solution (02 marks)

Observation

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Equation

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c) To the resultant solution in b(ii) was added silver nitrate solution.

i) State what was observed. (½ mark)

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ii) Write equation for the reaction that took place. (1½ marks)

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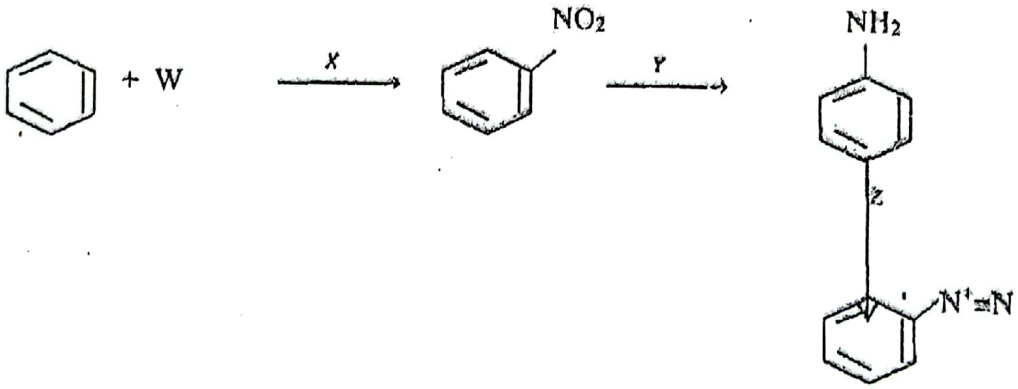
13. a) Consider the following reaction scheme:



i) Identify substance (01 mark)

W. .....

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X. .....

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ii) Name the reagent(s) (02 marks)

y. .....

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z. .....

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iii) State the condition for the reaction between aminobenzene and z.

(½ mark)

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iv) Write a mechanism for the reaction leading to the formation of nitrobenzene.

(04 marks)

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b) Benzene diazonium salt was reacted with 2 – naphthol in the presence of sodium hydroxide.

i) State what was observed. (½ mark)

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ii) Write the structural formula of the product. (01 mark)

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14. Compare the reactivity of fluorine and chlorine with the following compounds. (In each case illustrate your answer with equations)

a) water (03 marks)

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b) cold dilute sodium hydroxide solution. (03 marks)

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c) hot concentrated sodium hydroxide solution. (03 marks)

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15. State what would be observed and write equation for the reaction that would take place when

a) Cold concentrated hydrochloric acid is added to lead (IV) oxide (2½ marks)

Observation

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Equation

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b) Acidified potassium manganate (VII) solution is added to hot ethanedioic acid. (2½ marks)

Observation

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Equation

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c) Ammoniacal silver nitrate is added to methanoic acid. (02 marks)

Observation

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Equation

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d) Aqueous solution of iodine and sodium hydroxide is warmed with propane – 2 – ol (02 marks)

Observation

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Equation

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16. a) i) Sketch a graph to show the PH changes when ethanoic acid is titrated into sodium hydroxide solution. (1½ marks)

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ii) Explain the shape of your sketch graph in a(i). (3 ½ marks)

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b) Calculate the PH of the resultant solution formed when $20cm^3$ of 0.1Msodium hydroxide solution was added to $100cm^3$ of 0.1M ethanoic acid at 25^0C.
(Dissociation constant of ethanoic acid at 25^0C is 1.7×10^{-5} mol dm^{-3})

(04 marks)

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17. a) i) State what is meant by the term thermosetting plastic. (02 marks)

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ii) Give one example of a synthetic thermosetting plastic. (01 mark)

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b) Nylon – 6,10 can be formed by reacting hexane – 1,6 – diamine with decane dioyl dichloride, $ClOC(CH_2)_8COCl$.

i) Write an equation for the formation of nylon – 6,10. (02 marks)

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ii) State the type of polymerisation involved in the formation of nylon – 6,10.

(01 mark)

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c) The osmotic pressure of a solution containing $2gdm^{-3}$ of nylon – 6,10 at 25^0C was 0.188 mmHg. Calculate the relative molecular mass of nylon – 6,10.

(2½ marks)

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d) State one use of nylon – 6,10. (½ mark)

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END

GOOD LUCK