

P525/1

CHEMISTRY

Paper 1

Jul/Aug 2016

2 $\frac{3}{4}$ Hours



MUKONO EXAMINATIONS COUNCIL
Uganda Advanced Certificate of Education
CHEMISTRY

Paper 1

Time: 2 Hours 45 Minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** questions in section **A** and **six** questions from section **B**.
- All answers **MUST** be written in the spaces provided.

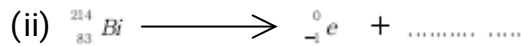
SECTION A (46MARKS)

Attempt ***all*** questions in this section.

1. a) Complete the following equations.



(01mark)



(01mark)

b) The half-life of a radioactive isotope is 234days. Determine the time taken for the radioactive isotope to decay by 12.5% of its original amount. **(2 ½ marks)**

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2. a) Write an equation for the reaction between water and

(i) Ammonium sulphate. **(1 ½ marks)**

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(ii) Sodium propanoate **(1 ½ marks)**

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b) A few drops of aqueous sodium sulphite was added to the solution in a(i). State what was observed and write equation for the reaction that took place.

Observation. **(2 ½ marks)**

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Equation.

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3. a) Nylon 6,6 is a synthetic polymer $-(CO(CH_2)_4 - CONH - (CH_2)_6 - NH)_n$

(i) Name the type of the polymer. **(01mark)**

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(ii) Write the structures and give the names of the monomers.

(02marks)

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b) An aqueous solution containing 1.5% of Nylon6,6 was found to exert an osmotic pressure

of 3.6×10^{-4} atmospheres at 25°C. Calculate;

(i) the relative molecular mass of Nylon6,6

(2 ½ marks)

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4. State what would be observed and write equation for the reaction that would take place when sodium hydroxide is added dropwise until in excess to

a) Aluminium nitrate solution.

(3 ½ marks)

Observation

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Equation(s)

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b) Nickel sulphate solution.

(02marks)

Observation

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Equation

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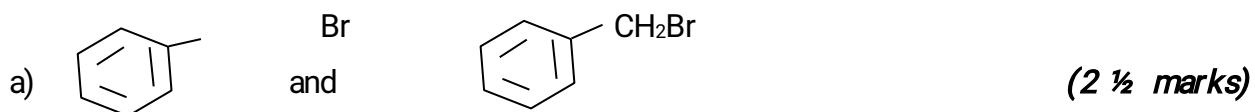
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5. Name the reagent that can be used to distinguish between the following pairs of compounds and state what would be observed in each case if each member of the pair is

separately treated with the reagent you have named.



Reagent:

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Observation

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Reagent

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Observations

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6. The kinetics data for the reaction between nitrogen monoxide and oxygen are shown in the table below

Experiment	[NO] moldm ⁻³	[O ₂] moldm ⁻³	Rate of reaction moldm ⁻³ s ⁻¹
1	0.03	0.03	2.7 x 10 ⁻⁵
2	0.03	0.06	5.4 x 10 ⁻⁵
3	0.06	0.03	10.8 x 10 ⁻⁵

a) Determine the order of reaction with respect to;

(i) nitrogen monoxide.

(01mark)

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(ii) Oxygen

(01mark)

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(01mark)

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(1 ½ marks)

[illegible]

Element	Mg	Ca	Sr	Ba
Standard Electrode potential, E°/V	-2.34	-2.87	-2.89	-2.91

a) (i) Identify the element which is the most powerful reducing agent. (½ mark)

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

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b) (i) State the trend in the standard electrode potentials of the elements. (01mark)

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(ii) Explain your answer in b(i) (2 ½ marks)

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8. Thermochemical data of some processes are shown in the table below;

Process	Energy (KJmol ⁻¹)
Atomization of calcium	+178
First ionization energy of calcium	+590
Second ionization energy of calcium	+1146
Formation of calcium fluoride	-1220
Bond dissociation energy of fluorine	+242.7

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(ii) the expression for the ionization constant, K_a of chloroethanoic acid. ($\frac{1}{2}$ mark)

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b) The pH of 0.2M aqueous solution of chloroethanoic acid is 1.8. Calculate the ionization constant of the acid. ($2\frac{1}{2}$ marks)

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10. a) What is meant by the term "common ion effect." (01mark)

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b) Magnesium hydroxide is sparingly soluble in water. Write;

(i) the equation for the solubility of magnesium hydroxide in water. ($1\frac{1}{2}$ mark)

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(ii) the expression for the solubility product, K_{sp} of magnesium hydroxide. ($\frac{1}{2}$ mark)

Calculate the solubility in mol dm^{-3} at 25°C of magnesium hydroxide in;

(2 ½ marks)

 $(2 \frac{1}{2})$

d) Comment on your answer in (c) above.

(01mark)

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11. a) Write an equation for the reaction between water and the chloride of

(i) aluminium

(1 ½ marks)

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(ii) Sulphur

(1 ½ marks)

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(iii) Phosphorous

(1 ½

marks)

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b) Write an equation for the reaction between hot concentrated sodium hydroxide and

(i) Aluminium

(1 ½ marks)

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(ii) Chlorine

(1 ½ marks)

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(iii) Beryllium oxide

(1 ½ marks)

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12. A compound Y contains 52.2% carbon, 13.0% hydrogen and the rest oxygen.

a) Determine the empirical formula of Y.

(02marks)

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b) When vapourised 0.1g of Y occupied 78.8cm^3 at 107°C and 654mmHg .

(i) Calculate the formula mass of Y.

(2 ½ marks)

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(ii) Determine the molecular formula of Y. (01mark)

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(iii) Write the structural formulae of all possible isomers of Y. (01mark)

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c) (i) Y does not react with sodium. Identify Y. (½ mark)

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(ii) Write equations to show how Y can be prepared from methanol. (1 ½ marks)

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13. a) Define the term "Partition coefficient."

(01mark)

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b) 50cm³ of 0.8M ammonia solution was added to 50cm³ of trichloromethane in a flask. To the resultant mixture was added 0.1M cobalt (II) chloride solution. The mixture was shaken and allowed to stand at constant temperature.

When the layers had separated, 25cm³ of the trichloromethane layer required 20cm³ of

0.01M hydrochloric acid for complete reaction. (K_D of ammonia between water and trichloromethane is 25)

Calculate the molar concentration of;

(i) ammonia in the trichloromethane layer.

(02marks)

(ii) free ammonia in the aqueous layer.

(1 ½ marks)

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(iii) ammonia fixed in the complex $\text{Co}(\text{NH}_3)_n^{2+}$

(03marks)

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c) Determine the value of n in the complex in b(iii) .

(1 ½

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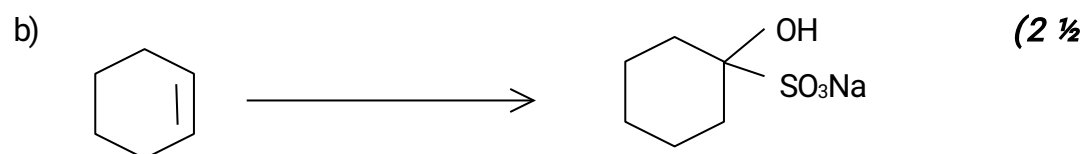
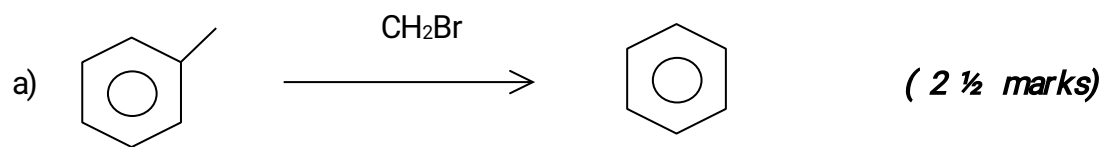
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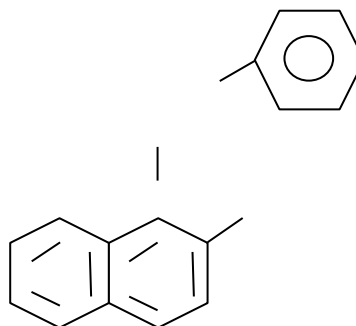
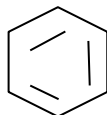
14. Using equations only show how each of the following conversations could be effected.



N=N

OH

c)



(04marks)

15. a) Explain what is meant by the terms

(i) Standard electrode potential

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(ii) Standard hydrogen electrode

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b) The standard electrode potentials for some half-cells are shown below.

Half-cell	E°/V
$\text{MnO}_4^- (\text{aq}), \text{H}^+ (\text{aq}) / \text{Mn}^{2+} (\text{aq})$	+ 1.52V
$\text{I}_2 (\text{aq}) / \text{I}^- (\text{aq})$	+ 0.54V

State what is observed at the

(i) Positive electrode (½ mark)

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(ii) Negative electrode. (½ marks)

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c) Write;

(i) the cell convention for the combined cell. (1 ½ marks)

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(ii) the equation for the cell reaction that would take place if the half-cells are

combined.

(1 ½

marks)

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d) Calculate;

(i) the overall electrode potential for the cell.

(1 ½ marks)

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(ii) the work that can be done by the cell.

(1 ½

marks)

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16. 2- bromo- 2- methylpropane reacts with aqueous sodium hydroxide to form an organic compound Z.

a) (i) Write equation and suggest a mechanism for the reaction.

(3 ½ marks)

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(ii) Name one reagent that can be used to identify the functional group in Z.

(01mark)

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b) Sodium metal was dissolved in excess ethanol. Write equation for the reaction.

(1 ½ marks)

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c) 2-bromo-2-methylpropane was added to a solution in (b) and the mixture heated. Write equation and indicate a mechanism for the reaction that took place.

(03marks)

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17. a) Nitrogen reacts with hydrogen to form ammonia .

Write

(i) equation for the reaction that takes place.

(1 ½ marks)

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(ii) the expression for the equilibrium constant, K_c

(½ mark)

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b) The percentage of ammonia in the equilibrium mixture of gases was found to be 18% at 600°C. Calculate the equilibrium constant, K_c for the reaction at 600°C.

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(1 ½ marks)

End -