

Names..... Index

School Exam Number:.....Signature:.....

Candidates should **NOT** write their Centre Name or
Centre Number anywhere on this booklet

P525/1
CHEMISTRY
Paper 1
30 July 2018
2 ¾ hours

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Advanced Certificate of Education

CHEMISTRY

(PRINCIPAL SUBJECT)

Paper 1

2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES

Answer **all** questions in Part **A** and **six** questions from Part **B**

All questions are to be answered in the spaces provided.

The periodic table with relative atomic masses is provided at the back.

Illustrate your answers with equations where applicable.

Mathematical tables (3-figure tables) are adequate or non-programmable scientific electronic calculators may be used.

Illustrate your answers with equations where applicable.

Molar gas constant, **R** = $8.314 \text{ JK}^{-1} \text{ mol}^{-1}$.

Molar Volume of gas at s.t.p = 22.4 litres

Standard temperature = 273 K

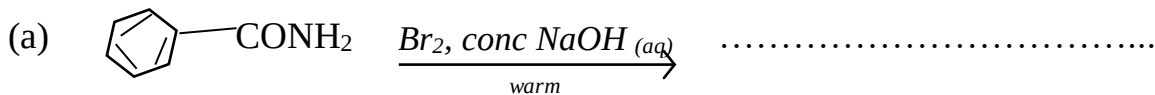
Standard pressure = 101325 Pa

FOR EXAMINER'S USE ONLY																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	TOTAL

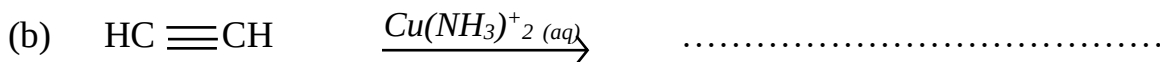
SECTION A: (46 Marks)

1. (a) Explain what is meant by **relative atomic mass**. (01 mark)
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- (b) The relative atomic mass of magnesium is 24.3. Naturally occurring, magnesium has three isotopes: Mg – 24, Mg – 25 and Mg – 26. If the percentage abundance of Mg – 24 is eight times that of Mg – 26, calculate the percentage abundance of all the isotopes of Magnesium in the sample. (03 marks)
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2. A solution containing 0.15 mol dm^{-3} of ammonia is 1.4% ionised.
- (a) Write equation for ionisation of ammonia in water. (1½ marks)
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- (b) Calculate the:
- (i) pH of ammonia solution. (2½ marks)
($K_w = 1.0 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ at 25°C)
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- (ii) base association constant, K_b (02 marks)
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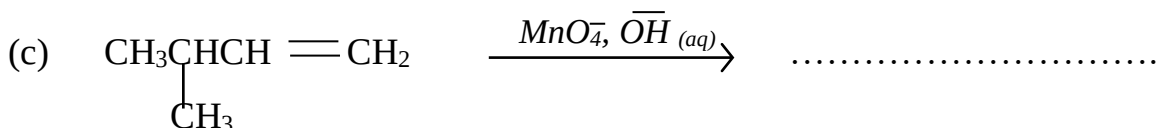
3. Complete the following equations and write the IUPAC name of the main organic product in each case. (1 ½ marks) each



Name of product:



Name of product:



Name of product:

4. State what would be observed and write equation(s) for the reaction(s) that would take place when dilute sodium hydroxide solution is added drop wise until in excess to an aqueous solution of

(a) tin(II) oxide (03 marks)

Observations

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Equation(s)

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(b) cobalt(II) sulphate (03 marks)

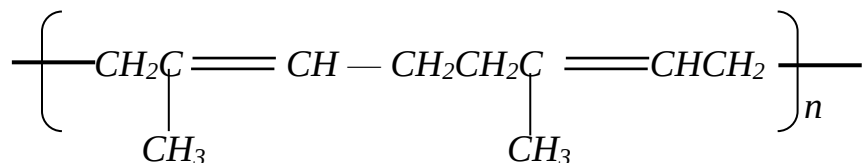
Observations

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Equation(s)

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5. Natural rubber has the following structure.



- (a) Write the structure and name of the monomer of natural rubber.

(1 ½ marks)

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- (b) (i) Name the type of polymerisation by which natural rubber is formed.

(1 ½ marks)

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- (ii) Give a reason for your answer in (b) (i) above.

(01 mark)

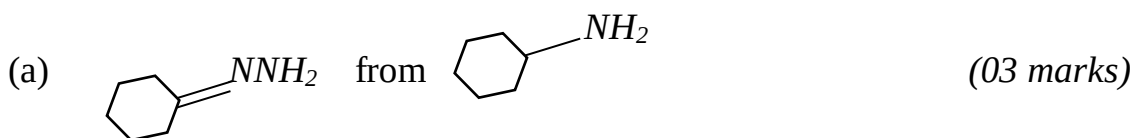
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- (c) When 135 g of the monomer was polymerised, 584×10^{-3} moles of natural rubber was formed. Calculate the relative molecular mass of natural rubber.

(02 marks)

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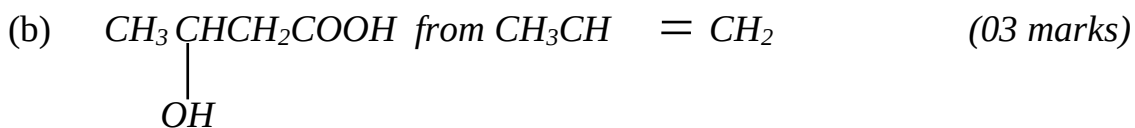
6. (a) State what is meant by the term **diagonal relationship**. (01 mark)
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- (b) Although boron belongs to group (III) of the Periodic Table, it resembles silicon in group(IV) in some of the properties.
- (i) State **three** chemical properties to show the diagonal relationship between boron and silicon. (03 marks)
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- (ii) Give **one** reason for the anomalous behavior of boron. (01 mark)
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7. Write equation to show how the following compounds can be synthesized. In each case, indicate the reagents and conditions for the reaction.



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8. (a) Explain what is meant by the term **ideal solution**. (02 marks)
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- (b) The vapour pressures of liquids **X** and **Y** are 473.5 Nm^{-2} and 139.8 Nm^{-2} respectively at 20°C . Calculate the composition of the vapour above an ideal solution containing 3 moles of **X** and 4 moles of **Y** at 20°C . (03 marks)
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9. (a) $[\text{Be}(\text{H}_2\text{O})_4]^{2+}$ and $[\text{Al}(\text{OH})_4]^{-}$ are complex ions formed by beryllium and aluminium respectively.
- (i) Name the complexes. (01 mark)
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- (ii) State the oxidation state of each element in the complex. (01 mark)
- Beryllium
-
-
- Aluminium
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- (b) Carbon dioxide gas was bubbled through a solution containing a complex ion formed by aluminium in (a) above.
- (i) State what was observed. ($\frac{1}{2}$ mark)
-
-
- (ii) Write equation for the reaction that took place. ($1\frac{1}{2}$ marks)
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SECTION B

Answer **six** questions from this Section

10. (a) When 2.3 g of a compound **P**, containing carbon, oxygen and hydrogen when burnt in excess air produced 2.2 g of carbon dioxide and 0.9 g of water. Calculate the empirical formula of **P**.

(2½ marks)

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- (b) The density of **P** is 2.0536 gl^{-1} at s.t.p. Determine the molecular formula of **P**.

(1 ½ marks)

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- (c) **P** dissolves in sodium hydrogen carbonate solution with effervescence. Write the structural formula of **P**.

(½ marks)

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(d) State what would be observed and write equation for the reaction that would take place when a solution of **P** is treated with:

(i) acidified potassium manganate(VII) solution (2 ½ marks)

Observation

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Equation

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(ii) Fehling's solution (02 marks)

Observation

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Equation

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11. (a) (i) Compare the reactivity of the hydrides of group (VII) elements with concentrated sulphuric acid. Write equation(s) for the reaction(s) that take place if any. (04 marks)

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(ii) Give a reason for the difference in reactivity shown by the hydrides in (a) (i) above. (01 mark)

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(b) The boiling points of the hydrides of group (VII) elements are given in the table below.

Hydride	HF	HCl	HBr	HI
Boiling points ($^{\circ}$ C)	+20	-85	-67	-35

- (i) State the trend in variation of boiling point of the hydrides. (01 mark)

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- (ii) Explain your answer in (b) (i) above. (03 marks)

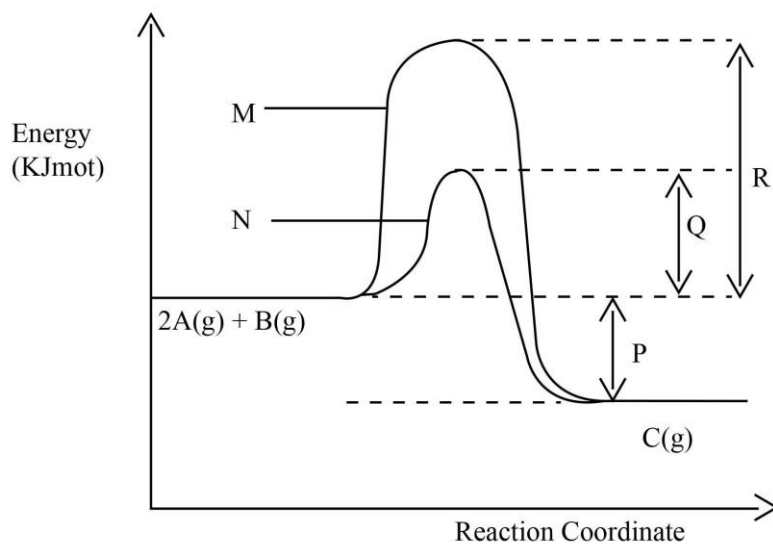
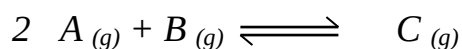
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12. (a) Figure I shows the variation of energy with reaction coordinate for the catalyzed and uncatalyzed reaction



Identify

- (i) the curve for catalyzed reaction (½ marks)

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- (ii) the curve for uncatalysed reaction (½ mark)

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- (iii) **P** (01 mark)
- (iv) **Q** (01 mark)
- (v) **R** (01 mark)

- (b) From the figure, state how a catalyst increases the rate of reaction.
(01 mark)

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- (c) The kinetic data for the reaction above are shown below.

<i>Expt</i>	<i>[A] (mol dm⁻³)</i>	<i>[B] mol dm⁻³</i>	<i>Rate (mol dm⁻³ s⁻¹)</i>
1	0.50	1.00	2.00
2	0.50	2.00	8.00
3	1.00	3.00	36.00
4	2.00	3.00	72.00

- (i) Deduce the rate equation. (2½ marks)

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- (ii) Calculate the rate constant for the reaction and state its units.
(1½ marks)

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13. Name a reagent that can be used to distinguish between the following compounds. In each case, state what would be observed when each compound is separately treated with the reagent.

(a) $HCOOH$ and CH_3COOH (03 marks)

Reagent

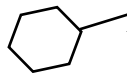
Observation

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(b)  and $CH_3CH_2NHCH_2CH_3$ (03 marks)

Reagent

Observation

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(c) $HOOCCH_2CH_2COOH$ and $HOOCCH=CHCOOH$ (03 marks)

Reagent

Observation

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14. During the manufacture of ammonia by Haber process, nitrogen reacts with hydrogen according to the following equation:



- (a) State the effect on the yield of ammonia and in each case give a reason for your answer if

(i) pressure of the system is lowered. (1½ marks)

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(ii) temperature of the system is lowered. (1 ½ marks)

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(b) At equilibrium, the percentage of ammonia was found to be 15% at 500° C. Calculate the value of equilibrium constant, K_c for the reaction at 500° C. (03 marks)

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(c) Write equations for the conversion of ammonia to nitric acid. (03 marks)

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

- (a) sodium bismuthate is added to manganese (II) chloride in presence of concentrated nitric acid. (02 marks)

Observation

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Equation

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- (b) dilute sulphuric acid is added to copper (I) oxide. (2½ marks)

Observation

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Equation

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- (c) iron(I) sulphate is added by acidified potassium chlorate (V) solution.

Observation

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Equation

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- (d) phenol is added to bromine water. (02 marks)

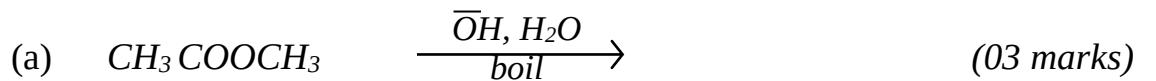
Observation

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Equation

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16. Complete the following equations and outline the mechanism in each case.



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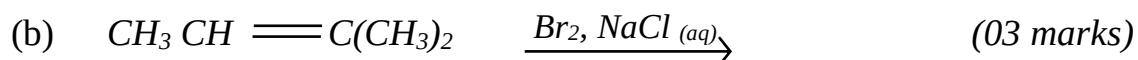
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17. (a) Write:

(i) equation for the solubility of silver chromate in water.

(1 ½ marks)

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(ii) expression for solubility product, K_{sp} , of silver chromate.

(½ mark)

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(b) The solubility of silver chromate at $25^{\circ}C$ is $3.207 \times 10^{-2} \text{ g l}^{-1}$. Calculate the solubility of silver chromate at $25^{\circ}C$.

(03 marks)

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- (c) Determine the concentration of silver ions required to precipitate silver chromate from an aqueous solution containing $5.0 \times 10^{-3} \text{ M}$ chromate ions. (02 marks)

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- (d) A solution containing silver ions was separately added to a solution containing $5 \times 10^{-3} \text{ M}$ chromate ions and $5 \times 10^{-3} \text{ M}$ chloride ions. State which of the salts AgCl or Ag_2CrO_4 would precipitate first. Give a reason for your answer. (K_{sp} for $\text{AgCl} = 1.96 \times 10^{-10} \text{ mol}^2\text{dm}^{-6}$) (02 marks)

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