Name of School:…………………………………………………….......……..

Name of Student:…………………………………………………….......……

Signature:…………………….….....…........…….**Personal No**.…….............……………….
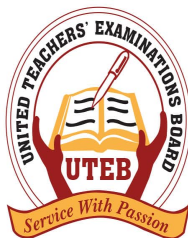
UTEB JOINT MOCK EXAMINATIONS, 2019

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 1

2 hours 45 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** questions in Section **A** and any **six** questions from Section **B**.

- All questions must be answered in the spaces provided.

- Molar gas constant R = 8.31JK^{-1}mol^{-1}.

- Molar gas volume at s.t.p = 22.4 dm^3.

Answer **all** questions from this section.

1. Potassium manganate (**VII**) is often used in volumetric analysis.

    (a) Write equation for the reaction between potassium manganate (VII) and hydrogen peroxide in solution.   **(01 ½ marks)**

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    (b) Explain why potassium manganate (VII) is not used as a primary standard in volume in analysis.   **(02 marks)**

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    (c) Name one compound that is used to standardize potassium manganate (VII).

    (½ mark)

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2. Complete the following equations and in each case name the main organic product
    (01 ½ marks each)

    (a) $\xrightarrow[\text{Warm}]{CONH_2Br_2/KOH \text{ (aq)}}$

    Name of product   ....

    (b) $-N_2Cl^-$ $\xrightarrow[100^0C]{\text{ConcHCl/Cucl}}$

    Name of product   ....

    (c) $(CH_3)_2C = CH_2$ $\xrightarrow{Br_2(aq)}$

    Name of product   ....

(d)
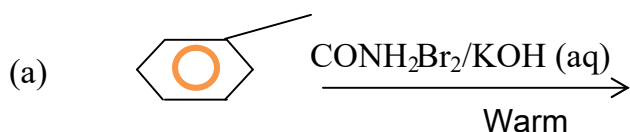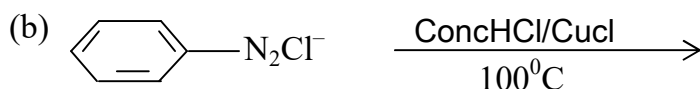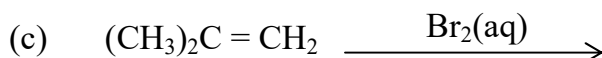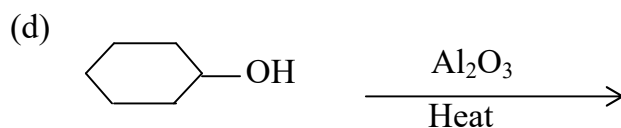
Name of product ....

3. (a) Explain what is meant by the term solvent extraction.   **(01 mark)**

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(b) A crude sample of lead contained 2% of Silver by mass. Calculate the mass of

silver left in 1 kg of lead if it was thoroughly agitates with 1 kg of zinc at 800^0c.

The solubility of silver in a given mass of zinc is 300 times its solubility in an

equal mass of lead at 800^0C.   **(03 marks)**

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4. State what would be observed and write equation for the reaction that takes

place when the following compounds are reacted.

(a) Acidified potassium dichromate solution with tin (II) chloride solution.

                                                                      (02 marks each)

Observation

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Equation

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(b)   Aqueous aluminium chloride with sodium sulphite crystals.

Observation

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Equation

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(c)   Red lead oxide with dilute nitric acid.

Observation

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Equation

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5.   (a)   What is meant by the term rate constant?   (01 ½ marks)

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(b)   The following results were obtained for two compounds A and B reacting to

give product C.

A + B → C

Initial concentration (moldm – 3)	Initial concentration [B] (moldm – 3)	Initial rate [moldm^{-3} S –]
0.2	0.24	2.0 x 10 $^{-4}$
0.4	0.24	8.0 x 10 $^{-4}$
0.6	0.48	3.63 x 10 $^{-2}$

(i)   Deduce the rate equation.   (01 mark)

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(ii)   Calculate the rate constant and give units.   (01 ½ marks)

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6.   In the extraction of aluminium from its ores, the ores is first roasted in air,

crushed into a powder and mixed with concentrated sodium hydroxide solution

and finally filtered.

(a)   (i)   Explain what is meant by the term ore.   (01 mark)

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(ii)   Write the name and formula of one ore from which aluminium can be extracted.

(01 mark)

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(iii)   State why the powdered ore is reacted with sodium hydroxide solution and

filtered.   (01 mark)

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(b)   Write equation for the reaction between the powdered ore and sodium

hydroxide solution.   (02 marks)

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7.   4.1 g of bromo alkane B was reacted with excess sodium hydroxide solution.

The resulting solution was acidified with excess nitric acid and dilute to exactly 250

cm^3 in a volumetric flask. 25.0 cm^3 of this solution required 33.25 cm^3 of 0.1 M silver

nitrate solution for complete reaction.

(a)   Determine the molecular formula of B.   (03marks)

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(b)   Write the structural formulae and names of the possible isomers of B.

(02 marks)

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8.   Draw diagrams to show the approximate change in pH for each of the following and explain why the resulting solution is not neutral in both cases.

(a)   0.1 M sodium hydroxide solution is added in portions to 25 cm^3 of 0.1 M ethanoic acid.   **(03 marks)**

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(b) 0.1 M hydrochloric acid is added in portions to 20 cm^3 of 0.1 M ammonia solution

(03 marks)

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9. Name a reagent that can be used to distinguish the following pairs of compounds. State what is observed when each member of the pair is separately treated with the reagent.

(a) Sodium ethanedioate solution and sodium ethanoate. (02 marks)

Reagent

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Observation

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(b) Tin (II) solution and zinc chloride solution. (02 marks)

Reagent

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Observation

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SECTION B

Answer any six questions from this section.

10. (a) State three reasons as to why fluorine differs in properties from other elements in group VII of the periodic table. (01 ½ marks)

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(b) Write equations for the reactions between

(i) Fluorine and cold dilute potassium hydroxide. **(01 ½ marks)**

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(ii) Bromine and hot concentrated potassium hydroxide. **(01 ½ marks)**

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(iii) Fluorine and water. **(01 ½ marks)**

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(c) The values of the lattice energies of potassium halides are given in the

table below.

Compound	KF	KCl	KI
Lattice energy KJmol^{-1}	-813	-710	-643

Explain the trend in these values for potassium halides. **(03 marks)**

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11. (a) Liquid P (bp 92.5°C) and liquid Q (bp 90.8°C) from an azeotropic mixture of boiling point 73°C.

(i) What is meant by azeotropic mixture? **(01 mark)**

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(ii) Draw a boiling point – composition diagram for the P – Q mixture. **(04 marks)**

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(b) A solution containing 60 g of RCOOH and 50 g of water was boiled.

(i) Calculate the boiling point of the solution. **(03 marks)**

$(R = 43, H = 1, C = 12, O = 16, K_b \text{ of water} = 0.54 \text{ Kmol}^{-1} \text{kg}^{-1})$

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(ii)   State any assumption you made in the calculation.   (01 mark)

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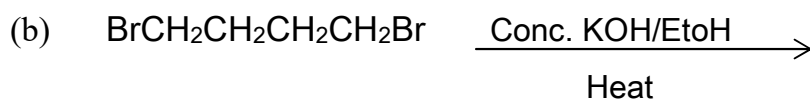
12.   Complete the following equations and in each case write the accepted mechanism for

the reaction.

(a)   —CHO Conc. NaOH (aq)   (03 marks each)

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(b) $BrCH_2CH_2CH_2CH_2Br$ $\underset{Heat}{\underline{Conc.\ KOH/EtOH}} \longrightarrow$

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(c)

$$\langle \overline{} \rangle + (CH_3)_2C = CH_2 \xrightarrow[H^+]{}$$

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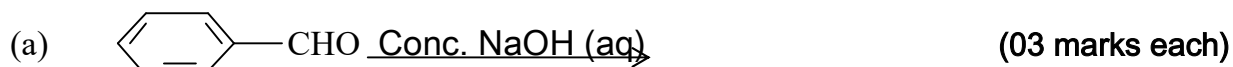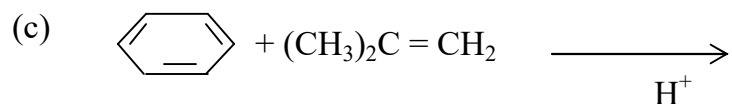
13. Ethyl bromide reacts with aqueous sodium hydroxide as in the equation.

$CH_3CH_2Br + NaOH \rightarrow CH_3CH_2OH + NaBr$
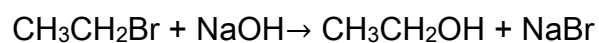
(a) Name the reaction.   (01 mark)

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(b) (i) Write the rate equation for the reaction between the hydroxide and

ethyl bromide.   (01 mark)

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(ii) Outline a mechanism for reaction involved.   (02 marks)

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(iii)   Sketch a labelled diagram to show an energy profile for the reaction. **(03 marks)**

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(c)   Write equation to show how CH_3CH_2Br can be converted to $HOCH_2CH_2Br$.

(02 marks)

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14.   (a)   A compound K contains 63.7% lead, 14.8% carbon, 1.8% of hydrogen and the

rest being oxygen. When vapourised, 0.225g of K occupies 15.5 cm³ at 760

mmHg and 273k.

(i)   Calculate the empirical formula of K.   **(02 marks)**

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(ii)   Deduce the molecular formula of K.   **(03 marks)**

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(b)   Compound K decomposed on heating forming yellow residue on cooling and a

colourless vapour that turned limewater milky and formed yellow precipitate

with 2, 4 – dinitrophenyl hydrazine in presence of sulphuric acid.

(i)   Write the name and structural formula of compound K.   **(01 mark)**

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(ii)   Write equation leading to the formation of the yellow precipitate. **(01 ½ marks)**

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15. Water boiled at 100^0 at a pressure of 760 mmHg.

(a)   When atmospheric pressure is reduced to 660 mmHg, water boiled at

96^0C. explain why the boiling point is reduced.   **(03 marks)**

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(b)   When 0.746g of potassium chloride is dissolved in 100 g of water, the solution

boiled at 100.11^0C at a pressure of 760 mmHg.

(i)   Explain why the boiling point changes on adding potassium chloride.

(03 marks)

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(ii)   From the information given, calculate the boiling point constant, Kb. **(03 marks)**

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16. The table below shows the decomposition temperature of carbonates of elements of group (II) in the periodic table.

Carbonate	BeC_3	$MgCO_3$	$CaCO_3$	$BaCO_3$
Decomposition temperature (0^0)	100	350	900	1350

(a) (i) State how the thermal stability of carbonates of the element vary in the group. **(01 mark)**

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(ii) Explain your answer in (a) (i) above. **(03 marks)**

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(b) State three properties in which magnesium resembles lithium in group (I).

(03 marks)

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(c) Name a reagent(s) can be used to distinguish between Ca^{2+} and Ba^{2+} and state what would be observed if each of the ions is treated with the reagents you have named.

Reagent(s)

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Observation

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17. Write equations to show how the following compounds can be synthesized. In each case indicate the conditions and reagents for the reaction.
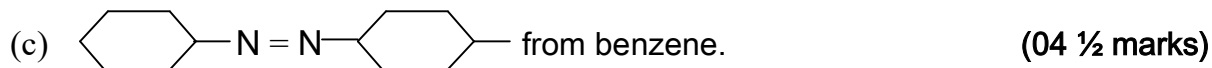
(a)   NH$_2$ from cyclohexene   (02 ½ marks)

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(b) $CH_3CH_2OCH_2CH_3$ from ethane.   (02 marks)

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(c) N = N from benzene.   (04 ½ marks)

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End