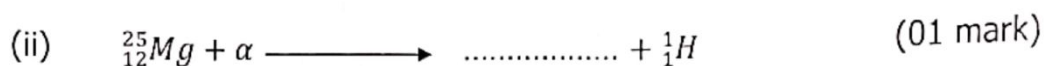# OLILA HIGH SCHOOL
INTERNAL MOCK EXAMINATION

Uganda Advanced Certificate of Education

CHEMISTRY

PAPER 1

2 Hours: 45 Minutes

INSTRUCTIONS TO CANDIDATES

- This paper consists of two section A and B
- Section A is compulsory
- Attempt Only six questions in section B
- Answers must be written in the spaces provided only
- The periodic table and its atomic masses are attached at the last page of this paper.

SECTION A (46 MARKS)

1. Complete the following equations of nuclear reactions

   a) (i) $^{223}_{91}Pa \longrightarrow \beta + \ldots\ldots\ldots \longrightarrow {}^{4}_{2}He + \ldots\ldots\ldots\ldots$

   (ii) $^{25}_{12}Mg + \alpha \longrightarrow \ldots\ldots\ldots\ldots + {}^{1}_{1}H$ (01 mark)
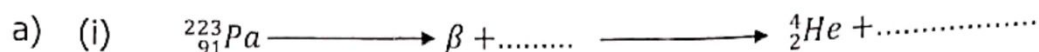
   b) A radioactive isotope decays from an initial count of 160 counts per minutes to 20 counts per minutes in 27 days. Calculate its half life.
   (03 marks)

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2. To an aqueous solution of Manganese (II) nitrate is added a few drops of concentrated nitric acid followed by solid sodium bismuthate and the mixture heated.

   a) (i) State what was observed   (01 mark)

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   (ii) Write an ionic equation for the reaction that took place (1 ½ marks)

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   b) Chlorine gas was bubbled through an aqueous solution of potassium Manganate (VI) solution.

   (i) State the observation (01 mark)

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   (ii) Write aqueous for the reaction that took place in b (i) above

   (1 ½ marks)

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3. Complete the equations below and each case outline an accepted mechanism for the reaction.

a)

$$CH_3\underset{\underset{CH_3}{|}}{\overset{\overset{Cl}{|}}{C}} - CH_3 \xrightarrow[Heat]{NaOH_{(aq)}}$$

(2 ½ marks)

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b) $HC \equiv CH \xrightarrow[H_2O,\ 60°]{HgSO_4\ /dil\ H+}$

(2 ½ marks)

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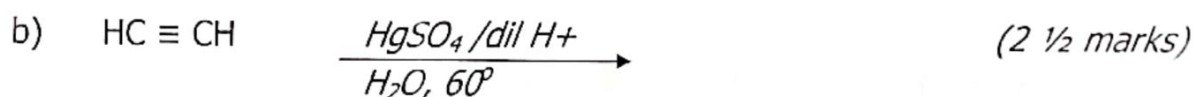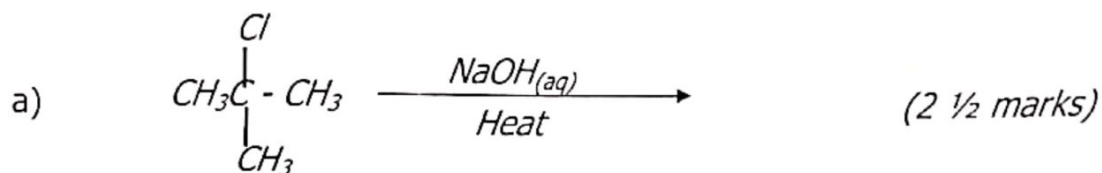
4. Calculate the pH of a 0.01M solution of sodium ethanoate if the dissociation constant of ethanoic acid is 1.8×10^{-5} moldm^{-3} ($Kw = 1.0\times10^{-14}$ mol^{2}dm^{-6})

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5. (a) When ice – cold concentrated hydrochloric acid was added to lead (IV) oxide, a yellow liquid was forms. On addition of excess hydrochloric

acid, a yellow solution was formed. Explain this observation with equation(s) that is/are necessary   (2 ½ marks)

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(b) Manganese (II) sulphate was added to sodium hydroxide solution and the resultant solution left to stand in the open for some 10 minutes. Write equations (s) to describe the reaction (s) that took place (2 ½ marks)

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6.   Reform the following synthesis reaction

a) $BrCH_2CH_2Br$ to

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b)   to

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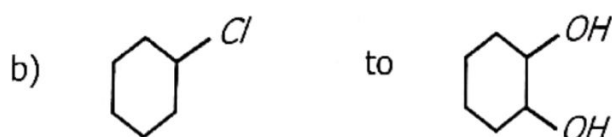
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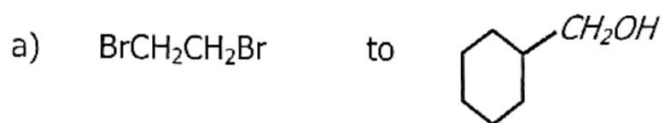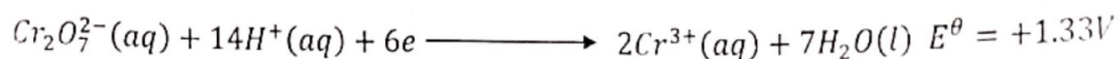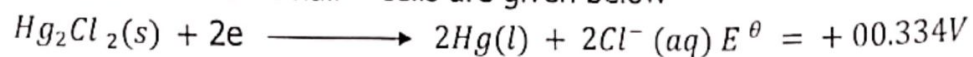
7. For the reaction $A_{(g)} + B_{(g)} \longrightarrow$ products

The following date was obtained

Experiment	[A] (moldm⁻³)	[B] (moldm⁻³)	Initial rate (moldm⁻³s⁻¹)
1	2.5×10^{-1}	4.0×10^{-1}	1.5×10^{-3}
2	2.5×10^{-1}	8.0×10^{-1}	3.0×10^{-3}
3	5.0×10^{-1}	4.0×10^{-1}	6.0×10^{-3}

a) Determine the order of reaction with respect to
   (i) A ....(1 mark)
   (ii) B .... (1 mark)

b) Write the rate equation   (½ mark)
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c) Calculate the rate constant and state its units   (2 marks)
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8. Using equations only, describe how sulphur can be converted to 98% concentrated sulphuric acid by the contact process.   (6 marks)
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9. Equations for some half – cells are given below

$$Hg_2Cl_2(s) + 2e \longrightarrow 2Hg(l) + 2Cl^-(aq)\ E^\theta = +00.334V$$

$$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e \longrightarrow 2Cr^{3+}(aq) + 7H_2O(l)\ E^\theta = +1.33V$$

    a)   Write the convention for the cell   (2 marks)

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    b)   Write equation for the overall reaction   (1 ½ marks)

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    c)   Calculate the cell voltage and state whether the reaction is spontaneous or not   (2 ½ marks)

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SECTION B (54 MARKS)

10. 20cm³ of a hydrocarbon Z was exploded with 200cm³ of oxygen. On cooling to room temperature, the residual gases occupied 160cm³. When the residual gases were passed through sodium hydroxide solution, the volume reduced to 20cm³.

    a)   Write equation for the reaction between Z and oxygen   (1 ½ marks)

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    b)   Determine the molecular formula of Z   (3 marks)

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c) Compound Z burns with a sooty flame. When Z was treated with hot alkaline potassium manganate (VII) solution followed by dilute Hydrochloric acid, compound R was formed R reacts with Magnesium ribbon liberating hydrogen gas.

(i) Identify Z and R (2 marks)

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(ii) Write equation to show how Z can be obtained from an alkyne

(2 ½ marks)

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11. Explain the following observations with relevant equations of reactions where necessary.

a) The bonds in carbon tetrachloride are polar yet carbon tetrachloride molecule is non-polar. (3 marks)

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b) Hydro fluoric acid is a weak acid in dilute solution but its strength increases with increasing concentration. (3 marks)

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c) When sodium carbonate solution was added to a solution of chromium (III) Sulphate, bubbles of a colorless gas and a green precipitate were observed (3 marks)

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12. a) (i) Define the term enthalpy of solution. (1 mark)

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(ii) Explain two factors that affect the enthalpy of hydration of a soluble salt. (3 marks)

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b) The enthalpies of formation of some selected compounds are shown in the table below

Compound	H_2O	$CO(g)$	$C_8H_{18}(g)$
ΔH_f^θ (KJmol-1)	-242	-111	-169

Calculate the enthalpy change for the following reaction

$$8CO(g) + 17H_{2(g)} \xrightarrow{Fe/CO\ Catalyst} C_8H_{18(g)} + 8H_2O(g)$$ (2 ½ marks)

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c) Explain why the enthalpy of neutralization of sodium hydroxide by nitric is -57.1 kJmol^{-1} whereas the enthalpy of neutralization of sodium hydroxide by hydrocyanic acid is -12.0kJmol^{-1} (2 ½ marks)

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13. Complete the following equations with an acceptable mechanism for reaction in each case.

a) CH_3COCH_3 $\xrightarrow{\quad NaHSO_3 \quad}$ (3 marks)

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b)
OH

$\bigodot$ $+CH_3Cl$ $\xrightarrow{\quad NaOH_{(aq)} \quad}$ (3 marks)

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c) $\bigodot$ $\xrightarrow[\quad H_2SO_4 \text{ heat} \quad]{\quad Concentrated \quad}$ (3 marks)

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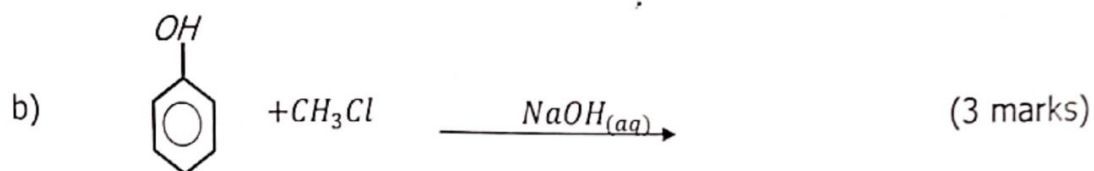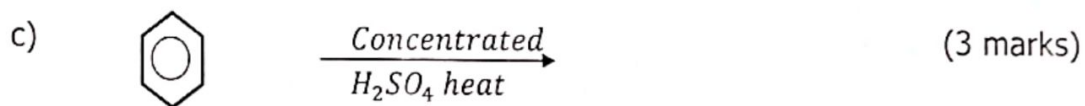
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14. State what was observed and in each case write the equation of reaction below
   a) Acidified potassium dichromate (VI) solution was added to hydrogen peroxide solution.
   Observation   (1 mark)

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Equation   (2 marks)
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b) To an aqueous solution of Iron (II) sulphate was added dilute sulphuric acid and concentrated nitric acid and the resultant solution heated.
Observation.   (1 mark)
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Equation   (2 marks)
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c) Sulphur dioxide gas was bubbled through acidified potassium dichromate (VI) solution.
Observation   (1 mark)
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Equation   (2 marks)
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15. a) What is meant by the term
    (i)   Specific conductivity?   (1 mark)
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    (ii) Calculate the mass of ethanoic acid that be dissolved in a litre of water to make a solution of molar conductivity $75.08\Omega^{-1}cm^2\ mol^{-1}$ and electrolytic conductivity $0.027\Omega^{-1}cm^{-1}$ (2
    ½ marks)
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b) The electrolytic conductivity of a saturated solution of silver bromide at $25°C$ is $8.486 \times 10^{-7}\Omega^{-1}cm^{-1}$. The electrolytic conductivity of pure water at $25°C$ is $7.5 \times 10^{-7}\Omega^{-1}cm^{-1}$, Calculate the solubility product of silver bromide. (The molar conductivities at infinite dilution of potassium bromide, silver nitrate and potassium nitrate at infinite dilution are 137.4, 133 and $131\Omega^{-1}cm^{-2}mol^{-1}$ respectively at $25°C$)

(4 ½ marks)

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c) State Kolrausch's law independent migration of ions   (1 mark)

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16. Name one reagent that can be used to distinguish between the following pairs of compounds. In each case state what would be observed if each member of the pair is treated with the named reagent.

a)   and

Reagent   (1 marks)

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Observation   (2 marks)

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b) HCOOH   and   CH₃COOH

Reagent   (1 marks)

(ii)   The solubility of lead (II) Chloride in cold water decreases on addition of dilute hydrochloric acid but increases on addition of concentrated hydrochloric acid.

(2 marks)

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