NAME..... Index Number: .....

P525/ 1
CHEMISTRY
Paper 1
July 2024
2 ½ hours

ACEITEKA JOINT MOCK EXAMINATIONS
2024
Uganda Advanced Certificate of Education
CHEMISTRY
Paper One
Time: 2hours 30minutes

I

INSTRUCTIONS

- *Answer **all** questions in section A and **six** questions in section B.*
- *Any **extra** question answered will not be marked.*
- *All questions must be answered in the spaces provided*
- *The Periodic Table with relative atomic masses will be provided**Illustrate your answers with equations where applicable** Molar gas constant $R = 8.314\ Jmol^{-1}K^{-1}$*
- *Molar volume of gas at s.t.p is 22.4 litres*
- *Molar volume of gas at room temperature is 24 litres .*

For Examiners 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** the questions)

(1) a) (i) Explain what is meant by enthalpy of atomization.

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..... (1 mark)

ii) Draw a born haber cycle showing the enthalpy changes that occur during enthalpy offormation of silicon (IV) chloride. Indicate all the energy terms involved.

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..... (2 marks)

b) The following enthalpy changes are given;

Enthalpies of atomization of chlorine is **+121**kj mol^{-}

.The bond energy of Si-Cl = **402** kj mol^{-}

Enthalpy of formation of silicon (IV) chloride = **-640** kj mol^{-1}

Calculate the enthalpy of atomization of silicon.

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..... (2 marks)

(2) An organic compound W has molecular formula $C_8H_{10}O$. Compound W burns with yellow sooty flame and forms misty fumes with phosphorous pentachloride.

(a) Write the structural formulae of the possible isomers of W.

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

(b) When compound W is heated together with acidified potassium dichromate solution the orange colour of the solution turns green and forms another organic compound X.

Compound X forms yellow precipitate with both bradys reagent in acidic media and aqueous alkaline sodium hydroxide solution.

Name compound X.

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..... (1 mark)

(c) Outline the reaction mechanism leading towards formation of yellow precipitate with bradys reagent in acidic media.

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..... (5 marks)

(3) (a) Aqueous solution of magnesium nitrate has a P^H of 6 whereas that of barium nitrate has a P^H of 7. Explain.

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..... ($3\frac{1}{2}$ marks)

(4) A 0.01M aqueous solution of phenol has a PH of 5.95 at 25^0C.

(a) Write an equation for dissociation of phenol in water.

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..... (1 mark)

(b) Calculate the acid dissociation constant K_a for phenol

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..... (2 marks)

(c) Determine the degree of dissociation for phenol.

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

(5) (a)Write equation to show how silicon tetrahydride;

(i) can be prepared.

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..... (1 mark)

(ii) reacts with sodium hydroxide solution.

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..... (1 mark)

(b) Explain why silicon tetrachloride is hydrolyzed by water whereas carbon tetrachloride is not. (3 marks)

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(6) (a) Distinguish between ionization energy and electron affinity. (2 marks)

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(b) The first ionization energy of calcium is lower than that of magnesium. Explain.

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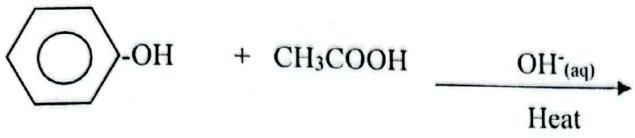
..... (2 marks)

(7) Complete the following reaction and outline the reaction mechanism.



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..... (4 marks)

(8) During manufacture of ammonia by Haber process nitrogen reacts with hydrogen as shown in the equation below;

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ ΔH = **-ve**

(a) State the **specific** optimum conditions for the reaction.

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

(b) State what would happen to the position of the equilibrium in the reaction above and in **each case** give **a reason** when;

(i) the temperature is increased

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..... (1 mark)

(ii) little amount of hydrogen chloride gas is added to the reaction vessel.

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..... (1 mark).

(c) 1.0 mole and 3.0 moles each of hydrogen and nitrogen gas **respectively** were placed in a 2.0 litre vessel and heated until equilibrium was reached. When equilibrium was established 27% of the hydrogen had reacted. Calculate the equilibrium constant K_c for the reaction.

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..... (3 marks)

(9) Soap was prepared from 9.5g of an oil containing mainly hexadecanoic acid $CH_3(CH_2)_{14}CO_2H$ as the main component of the oil.

(i) Explain briefly how pure soap was obtained from the oil.

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..... (2 marks)

(ii) Write equation for the reaction leading to the formation of the soap.

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..... (1 mark)

(iii) Calculate the mass of the soap formed.

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..... (3 marks)

SECTION B (54 MARKS)

Answer **six** questions.

(10) Complete the following organic reactions and outline the reaction mechanism.

(a) $CH_3CONHCH_2CH_3 \xrightarrow[\text{Heat}]{H_2O/H^+}$

Mechanism

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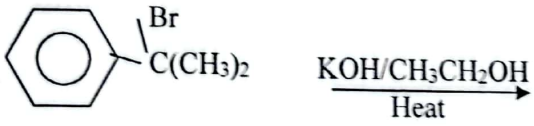
..... (5 marks)



Mechanism.

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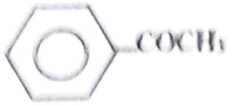
(11) Name the reagent that can be used to distinguish between the following pair of organic compounds' each case state the observations made.

(a)  and 

Reagent

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..... (1 mark)

Observations

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..... (2 marks)

(b) $Sn^{2+}_{(aq)}$ and Al^{3+}

Reagent

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..... (1 mark)

Observations

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..... (2 marks)

(c) $NO_2^-{}_{(aq)}$ and $SO_3^{2-}{}_{(aq)}$

Reagent

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..... (1 mark)

Observations

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..... (2 marks)

(12)(a) Write the general outer electronic configuration for group VII elements.

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..... (½ mark)

(b) Write equations to show how chlorine can be prepared and state the conditions.

Equation

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..... (1 mark)

Conditions

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..... (1 mark)

(c) Write equations to show how the following hydrogen halides can be prepared.

(i) Hydrogen chloride

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..... (1 mark)

(ii) Hydrogen iodide.

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..... (1 mark)

(iii) Explain why the above mentioned hydrogen halides cannot be prepared using the same method.

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..... (2½ marks)

(d) Name the reagent that can be used to distinguish sodium iodide solution from sodium bromide solution, State the observations made.

Reagent

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..... (1 mark)

Observation.

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..... (1 mark)

(13) (a) An oxide of chromium Q contains by mass 48% oxygen. Determine the empirical formula of Q.

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..... (2 marks)

(b) A solution containing 17.34g per litre of compound Q in ethanol boils at 78.27^{0}C. The boiling point of ethanol is 78^{0}C and has boiling point constant of 1.23^{0}C per mol per 1000g.The density of ethanol is 0.79gcm^{-3}. Determine the molecular formula of compound Q.

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..... (4 marks)

(c) Concentrated sodium hydroxide solution was added to solid Q. Write equation for the reaction that takes place.

..... (1 mark)

(d) To the resultant solution formed in (c) was added dilute sulphuric acid. State what was observed and write equation for the reaction that takes place.

Observation

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..... (1 mark)

Equation

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..... (1 mark)

(14) (a) The melting point of phosphorous (V) oxide, silicon(iv) oxide and aluminium oxide are ;563, 1728 and 2300 ^{0}C respectively. Explain this observation.

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..... (3½ marks)

(b) Write equation for the reaction that takes place when each of the above oxides are reacted with concentrated sodium hydroxide solution.

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..... (3 marks)

(c) Magnesium powder was added to aqueous solution of aluminium nitrate solution.
State what was observed.

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..... (1 mark)

Write equation for the reaction that takes place.

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..... (1½ marks)

(15) (a) Excess dilute nitric acid was added to dilead(II)oxide lead(IV)oxide (Pb_3O_4).
Write equation for the reaction that took place..

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..... (1½ marks)

(b) The mixture formed in (a) was filtered.
(i) To the filtrate was added potassium chromate solution.
State what was observed and write equation for the reaction that took place.
Observation

..... (½ mark)

Equation

.....
..... (1 marks)

(c) To the residue obtained in (b) was added **excess** cold concentrated hydrochloric acid.
State what was observed and write equations for the reactions that took place.
Observation

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..... (1 mark)

Equations

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..... (2 marks)

(d) To the solution formed in (c) was added concentrated solution of ammonium chloride then followed by concentrated sulphuric acid. State what was observed and write equations

for the reactions that took place.
Observation
.....
..... (1 mark)

Equations
.....
..... (2 marks)

(16) During extraction of copper, the ore is concentrated and then roasted in limited supply of air.
(a) Write the formula and name of the ore from which copper is extracted.
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..... (1 mark)

(b) Name the process by which the ore is concentrated.
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..... (1 mark)

(c) Explain briefly what happens during the smelting of the ore. (Equation(s) is/are notrequired)
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..... ($1\frac{1}{2}$ marks)

(d) Write equations to show how blister copper is obtained after the ore has been roasted in limited amount of air
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..... (3 marks)

(e) Dilute sulphuric acid was added to copper (I) oxide.
State what was observed.
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..... ($1\frac{1}{2}$ marks)

Write equation for the reaction that takes place.
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..... (1 mark)

(17) The standard electrode potentials for some half cell reactions are given below;

Half cell reaction	$E^{\theta}(v)$
$PbO_2(s) + 4H^+(aq) + 2e \rightarrow Pb^{2+}(aq) + 2H_2O(l)$	+ 1.46
$Sn^{2+}(aq) \rightarrow 2e \rightarrow Sn(s)$	− 0.14
$Cr^{3+}(aq) + e \rightarrow Cr^{2+}(aq)$	− 0.41

(a) Write;
(i) the cell convention for the cell formed by combining two half cells, one containing acidified lead (IV) oxide and another one containing chromium (II) ions

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..... (1½marks)

(ii) equation for the reaction that takes place at the anode.

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(b) State what will be observed at the cathode.

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..... (1 mark)

(c)(i) Calculate the e.m.f of the cell formed in a(i) above. (1½marks)

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..... (1 mark)

(ii) State whether the reaction is feasible or not. Give a reason for your answer (1½marks)

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(d) State what would happen when tin powder was added to an aqueous solution of chromium (III) salt. Give reason for your answer

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..... (2½marks)

END.