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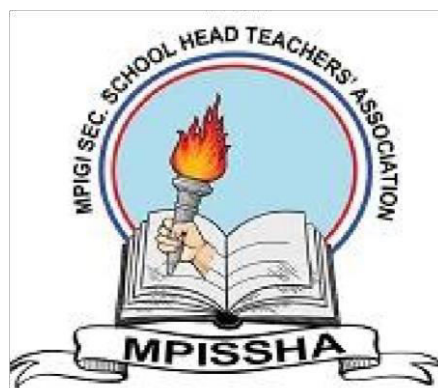
P525/1

Chemistry

Paper 1

July /August 2023

2¾ hours



MPISSHA JOINT MOCK EXAMINATIONS 2023

Uganda Advanced Certificate of Education

CHEMISTRY

PAPER 1

TIME: 2hours 45 minutes

Instructions to candidates;

- Answer **all** questions in section A and **six** questions in section B
- All questions must be answered in the spaces provided
- The periodic table, with relative atomic masses is attached at the end of the paper.
- Molar gas constant, $R=8.314\text{Jk}^{-1}\text{mol}^{-1}$
- Molar volume of a gas at stp is 22.4litres

FOR EXAMINERS USE ONLY																	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	

SECTION A: (46 MARKS)
All questions are compulsory

1a) Write the equation for the following reaction between water and

i) Ethyl ammonium chloride

(1 ½ marks)

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ii) Phosphorus (iii) Chloride

(1 ½ marks)

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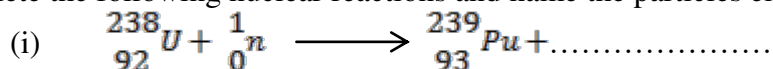
b) A few drops of aqueous sodium hydrogen carbonate was added to the solution in

(a) (i), state what was observed and write equation for the reaction that took place.

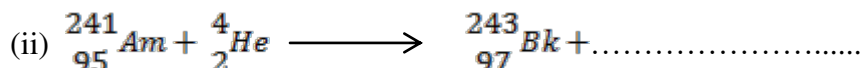
(2 marks)

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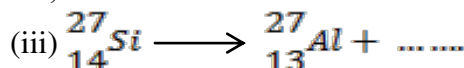
2. (a) Complete the following nuclear reactions and name the particles emitted in each case



Name of particle;



Name of particle;



Name of particle;

.....

(b) The mass of a radioisotope, T, reduced by 32% in 40 days. Calculate the half life of T.

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(2 ½ marks)

3. $\text{Cr}(\text{NH}_3)_6^{3+}_{(\text{aq})}$ and $\text{Co}(\text{CN})_4^{2-}_{(\text{aq})}$ are complexes formed when $\text{Cr}^{3+}_{(\text{aq})}$ ions and $\text{Co}^{2+}_{(\text{aq})}$ ions are respectively treated with excess aqueous ammonia and potassium thiocyanate.

a) Name the complexes (1 mark)

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b) State what would be observed when

i) $\text{Cr}^{3+}_{(\text{aq})}$ ions are treated with excess concentrated ammonia solution . (1 ½ marks)

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ii) $\text{Co}^{2+}_{(\text{aq})}$ ions are treated with excess concentrated hydrochloric acid. (1 mark)

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c) Write equation (s) for the reaction (s) that takes place in (b)(i) (2 marks)

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4. a) Steam distillation is one of the methods used for the separation of a component from a liquid mixture. State two requirements for the component to be separated by steam distillation.

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(2 marks)

b) A mixture containing a substance X was steam distilled at 760mmHg and 98°C. The distillate contained 85% by mass of water. If the saturated vapour pressure of water is 734 mmHg at 98°C, calculate the molar mass of X.

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(03 marks)

5. The molecular formula of a compound M is C_3H_6O . Compound M forms a yellow precipitate with Brady's reagent.

a) Write the structural formulae and names of all the possible isomers of M.

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(02 marks)

b) M reacted with Iodine in aqueous solution of sodium hydroxide to form a yellow precipitate.

i) Identify M (½ mark)

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ii) Write equation (s) to show how you would prepare M from an alkene. (2 ½ marks)

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6. Although boron is in Group (III) of the periodic table, it resembles silicon which is in Group (IV) in some of its properties.

a) State four properties in which boron resembles silicon. (04 marks)

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b) Give one reason for the anomalous behaviour of boron. (01 mark)

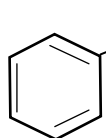
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7. a) Write

i) an equation for the hydrolysis of phenyl amine hydrochloride,



, when dissolved in water

(1 ½ marks)

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ii) The expression for the hydrolysis constant, K_h for phenyl amine hydrochloride.

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(01 marks)

b) A solution containing 0.4 moles of phenyl amine hydrochloride per litre has a P^H of 3.8.

Calculate

i) the molar concentration of hydrogen ions in solution.

(1½ marks)

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- ii) the hydrolysis constant, K_h of phenyl amine hydrochloride. (02 marks)

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8. State giving equations what would be observed when the following pairs of substances are mixed.

- i) $\text{CH}_3\text{CH}_2\text{CHO}$ and ammoniacal silver nitrate solution

Observation

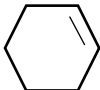
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Equation

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(1½ marks)

- (ii)  and alkaline potassium manganate (VII) solution

Observation.

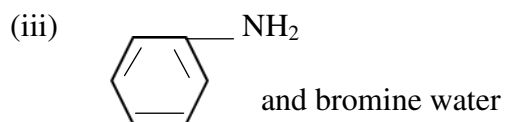
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Equation

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(1½marks)



Observation.

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Equation

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(1½ marks)

9. (a) Draw the structure and name the shape of the following compounds

Structure	Shape
i) PH_3	
ii) SF_4	

(03 marks)

b) Write equation for the reaction between ammonia and aluminium chloride.

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(01 marks)

SECTION B: (54 MARKS)

Attempt only six (6) questions

10. The standard electrode potentials for some half cells are shown below.

	E°/volts
A. $\text{Zn}^{2+}_{(\text{aq})} + 2\text{e} \longrightarrow \text{Zn}_{(\text{s})}$	- 0.76
B. $\text{SO}_4^{2-}_{(\text{aq})} + 2\text{H}^{+}_{(\text{aq})} + 2\text{e} \longrightarrow \text{SO}_3^{2-}_{(\text{aq})} + \text{H}_2\text{O}_{(\text{l})}$	+ 0.20
C. $\text{Fe}^{3+}_{(\text{aq})} + \text{e} \longrightarrow \text{Fe}^{2+}_{(\text{aq})}$	+ 0.77
D. $\text{Br}_{2(\text{aq})} + 2\text{e} \longrightarrow 2\text{Br}^{-}_{(\text{aq})}$	+1.07
E. $\text{Cr}_2\text{O}_7^{2-}_{(\text{aq})} + 14\text{H}^{+}_{(\text{aq})} + 6\text{e} \longrightarrow 2\text{Cr}^{3+}_{(\text{aq})} + 7\text{H}_2\text{O}_{(\text{l})}$	+1.33
F. $\text{Cl}_{2(\text{g})} + 2\text{e} \longrightarrow 2\text{Cl}^{-}_{(\text{aq})}$	+1.36
G. $\text{MnO}_4^{-}_{(\text{aq})} + 8\text{H}^{+}_{(\text{aq})} + 5\text{e} \longrightarrow \text{Mn}^{2+}_{(\text{aq})} + 4\text{H}_2\text{O}_{(\text{l})}$	+1.52

a) State what would be observed and write equation for the reaction that would take place if half cells

i) **A** and **E** are connected

Observation

.....

(½ mark)

Equation

(1 mark)

.....

ii) **B** and **G** are connected

Observation

(½ mark)

.....

Equation

(1 mark)

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b) Calculate the emf of the cell in (a) (i)

(1 ½ marks)

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c) Explain why hydrochloric acid is not used to acidify titrants in volumetric analysis involving potassium manganate (VII) solution.

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(02½ marks)

d) Write the cell convention when half cells C and D are combined

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(02 marks)

11. State what was observed and write equation for the reaction that would take place when

a) Carbon dioxide gas is bubbled through a solution of potassium manganate (VII)

Observation

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Equation

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(02½ marks)

b) Concentrated hydrochloric acid is added drop wise until in excess to aqueous copper (ii) sulphate solution.

Observation

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Equation

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(02½ mark)

c) Ethyne is bubbled through ammoniacal copper (ii) chloride solution.

Observation

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Equation

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(02 marks)

d) Hydrogen peroxide is added to acidified potassium manganate (VII) solution.

Observation

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Equation

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(02 marks)

12. a) A gaseous hydrocarbon Q contains 90% carbon. The density of Q is $1.785 \times 10^{-3} \text{ g cm}^{-3}$ at stp. Determine;

i) the empirical formula of Q

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(03 marks)

ii) the molecular formula of Q

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(02½ marks)

b) Q forms a white precipitate with ammoniacal silver nitrate solution.

Identify Q.

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(01 mark)

c) Using equations only, show how Q can be synthesized from propanoic acid.

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(03 marks)

13. a) Explain the term molar conductivity of an electrolyte.

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(01 mark)

b) Sketch a graph to show the variation of conductivity of a strong electrolyte with dilution

(02 marks)

c) Briefly explain the shape of the graph (b) above.

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(02½ marks)

d) The molar conductivities of nitric acid, potassium nitrate and potassium fluoride are 421, 145 and $129 \Omega^{-1}\text{cm}^2\text{mol}^{-1}$ respectively at infinite dilution.

Calculate the;

i) molar conductivity of hydrofluoric acid at infinite dilution. (1 ½ marks)

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ii) Dissociation constant of K_a , of 0.1M hydrofluoric acid solution (electrolytic conductivity of hydrofluoric acid is $3.15 \times 10^{-5} \Omega^{-1}\text{cm}^{-1}$).

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(02 marks)

14. (a) The elements Aluminium, silicon and phosphorus belong to Period 3 of the Periodic Table.

i) Write the formula of the chlorides of the elements

Element	Formula of chloride
Aluminium	
Silicon	
Phosphorus	

(1½ marks)

ii) State the condition and write equation for the reaction that takes place between each element and water.

Aluminium

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(1½ marks)

Silicon

.....

(1½ marks)

Phosphorus

.....

(1½ marks)

b) Sodium hydrogen carbonate solution was added to the solution of aluminium chloride in water.

i) State what was observed.

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ii) Write equation for the reaction.

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(1½ marks)

15. a) Explain;

i) the term acidic buffer.

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(1 mark)

ii) the mechanism of action of an acidic buffer.

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(03 marks)

b) Calculate the P^H of a solution formed by mixing 80cm^3 of 0.1M sulphuric acid with 120cm^3 of 0.1M potassium hydroxide.

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(05 marks)

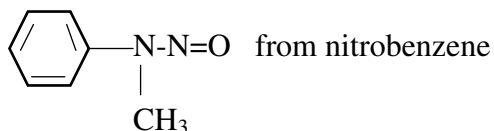
16. Write equations to show how the following compounds can be synthesized. Indicate conditions for the reactions.

a) $\text{CH}_3\text{CH}_2\text{NH}_2$ from ethanoic acid.

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(3½ marks)

b)



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(3½ marks)

c) $\text{CH}_3\text{CH}_2\text{COOH}$ from bromoethane.

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(02 marks)

17. In the extraction of zinc from its ores, the ore is first concentrated and then roasted in air. The roasted material is mixed with coke and limestone and heated by hot air in a blast furnace producing zinc.

i) Write the name of the ore from which zinc can be extracted.

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(½mark)

ii) Describe the process by which the ore named in (a) can be concentrated.

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(02 marks)

c) Write equation for the reaction;

i) that takes place when the ore is roasted in air.

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(01 mark)

ii) that leads to the formation of zinc in the blast furnace.

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(01 mark)

d) State what would be observed and write equation for the reaction when zinc metal is added to;

i) copper(ii) sulphate solution

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(2½ marks)

ii) aqueous sodium hydroxide solution.

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(02 marks)