



## Our country, our future

525/1

## S6 CHEMISTRY

## Exam 7

## PAPER 1

**DURATION: 2 HOUR 45 MINUTES**

*Instructions:*

- This paper consists of two sections A and B
- Section A is compulsory.
- Attempt only six questions in section B
- Answers must be written in the spaces provided only

[illegible]

# SECTION A

Answer all questions from this section.

1. The standard reduction electrode potentials ( $E^\ominus$ ) for some half cells are given in the table below.

Half cell	$E^\ominus$ (V)
$\text{Fe}^{3+}_{(\text{aq})} \rightarrow \text{Fe}^{2+}_{(\text{aq})}$	+0.77
$\text{S}_{(\text{s})}/\text{H}_2\text{S}_{(\text{g})}$ <i><math>\text{S}_{(\text{s})} + \text{H}_2 \rightarrow \text{H}_2\text{S}_{(\text{g})}</math></i>	+0.14

a) Write the

i) Cell notation

(1mk)

.....

.....

(ii) Equation of reaction that takes place at the anode and cathode

(2mks)

Anode

.....

.....

Cathode

.....

.....

ii) Equation for the overall cell reaction.

(1 ½ mks)

.....

.....

(b) State whether the reaction is feasible or not and give a reason for your answer. (1mk)

.....

.....

2. (a) State what is observed and write equation of reaction in each case when the following compounds are mixed.

a) Methanoic acid and ammoniacal silver nitrate solution heated

Observation

.....

.....

Equation

.....

.....

(b) Benzoic acid and aqueous sodium bicarbonate solution.

Observation;

.....

.....

Equation;

.....

.....

c) Propanone and Brady's solution.

Observation;

.....

.....

Equation;

.....

.....

3. Calculate the boiling point of a solution formed by mixing 8g of glucose with 120g of water. ( $K_b$  for water =  $5.2^{\circ}\text{Cmol}^{-1}\text{kg}^{-1}$ )

4. a) State three reasons for the difference in properties between fluorine and other group(VII) elements. (3mks)

.....

.....

.....

- b) Write equation for the reaction that takes place between the following compounds.

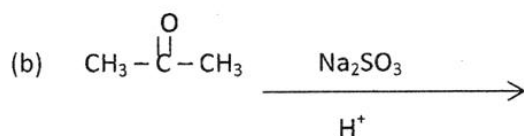
i) Silicon (iv) oxide and hydrofluoric acid. (1 ½ mks)

.....

.....

ii) Fluorine and water (1 ½ mks)

5. Complete the following reactions and write the accepted mechanism.



6. State what would be observed and write equation(s) for the reaction(s) that would take place:

(a) When aqueous sodium sulphite solution is added to acidified potassium manganate (vii) solution

Observation.

.....

.....

Equation

(b) When aluminium powder is added to iron (iii) chloride.

Observation.

Equation.

7. a) Write the electronic configuration of

i) Nitrogen

(1mk)

ii) Phosphorus

(1mk)

b) Explain why nitrogen only forms ( $\text{NCl}_3$ ) whereas phosphorus forms the chlorides  $\text{PCl}_3$  and  $\text{PCl}_5$ .

c) Write equation(s) for the hydrolysis of phosphorus chlorides by water.

i) phosphorus chloride

(3mks)

equation

ii) phosphorus (III) chloride

equation

8. (a) When  $20\text{cm}^3$  of a hydrocarbon Z was exploded in  $200\text{cm}^3$  of oxygen (excess), it completely burnt with a sooty flame. The volume of residual gas after cooling to room temperature was  $160\text{cm}^3$ . On addition of aqueous potassium hydroxide to the residual gas, the final volume of gas was  $20\text{cm}^3$ . Calculate the molecular formula of Z. (3mks)

(b) When Z was heated with alkaline potassium manganate (VII) solution forms a colourless solution which cooled in the presence of dilute sulphuric acid to form a crystalline solid P.

i) identify;

Z

(1mk)

P

(ii) Write equations to show how P is formed.

(1 ½ mks)

9. (a) Explain why diffusion in solution is very much slower than in gases.

(b)  $141.4\text{cm}^3$  of gas X diffused through a porous plug in the same time as it took  $50\text{cm}^3$  of oxygen to diffuse through the same plug under identical conditions.  
Calculate the relative molecular mass of X

## SECTION B

Attempt only six questions in this section

10. State what is observed and write equation for the reaction that takes place when

a) Potassium iodide is added to acidified hydrogen peroxide solution

Observation;

Equation;

(b) Concentrated hydrochloric acid is added drop wise until in excess to aqueous solution containing cobalt (II) ions.

Observation;

Equation;

(c) Aqueous sodium hydroxide is added drop wise to aqueous solution containing beryllium (II) ions.

Observation;

Equation;

11. a) A compound Y contains mass of 22.86% oxygen, 8.57% hydrogen and the rest is carbon. (2 ½ mks)

i) Calculate the empirical formula of Y.

ii) When 0.30g of Y is vaporized at 80°C and 700mmHg pressure, it occupied a volume of 134.77cm<sup>3</sup>. Determine the molecular formula of Y. (3 ¼ mks)

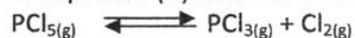
b) Y forms a yellow precipitate with 2, 4-dinitrophenyl-hydrazine and does not react with Tollen's reagent. (1mk)



c) Write equation for the formation of a yellow precipitate in (b). (2mks)

12. a) State three characteristics of chemical equilibrium. (1 ½ mks)

c) Phosphorus (V) chloride when heated decomposed according to the following equation.



i) Write the expression for the equilibrium constant  $K_c$ . (1mk)

ii) When 1 mole of phosphorus (V) chloride was heated in a closed vessel at  $350^\circ\text{C}$ , the equilibrium mixture was found to contain 38.4% of chlorine. Calculate the equilibrium constant  $K_c$  at  $350^\circ\text{C}$ . (3 ½ mks)

iii) the equilibrium constant of  $250^\circ\text{C}$  is 1.54. State whether the reaction is exothermic or endothermic. Give a reason for your answer. (1 ½ mks)

c) State what would happen to the concentration of chlorine if the pressure in the vessel was decreased while the temperature is maintained at 350°C. Give a reason for your answer.

(1 ½ mks)

13. Write equation to show the following conversions can be effected. (Include conditions for the reactions.) (3mks)

a) Benzoic acid to phenylamine

b) Ethene to Butan-2-ol

c) 1-chloro ethane to ethanamide

14. a) i) Explain what is meant by an acid-base indicator. (1mk)

ii) Explain why titration experiments only one or two drops of are used (1mk)

b) The table gives data obtained when 100cm<sup>3</sup> of propanoic acid was titrated with 1.0M sodium hydroxide solution.

Volume of NaOH(1M) added (cm <sup>3</sup> )	0.0	1.0	5.0	9.0	9.5	10.5	11.0	15.0
PH of solution	2.94	3.92	4.87	5.82	6.15	11.70	12.00	12.70

i) Draw a graph of PH against the volume of sodium hydroxide. (2 ½ mks)

ii) Explain the shape of the graph, you have drawn in b(i). (2 ½ mks)

iii) Determine the  $P^H$  of the solution at equivalence point. (1mk)

iv) Which of following indicators would be suitable for the titration? Give a reason for your answer.

Indicator	Methyl red	Bromothymol blue	Phenol red
PH range	4.2 – 6.3	6.0 – 7.6	6.8 – 8.4

Indicator;..... ( ½ mk)

Reason ( ½ mk)

15. a) Compare the following properties of group (U) and group (I) elements. In each case give a reason for your answer. (1 ½ mks)

i) first ionization energy

ii) melting points

iii) electro positivity

b) The decomposition temperatures of the carbonates of group (II) elements are given below

Carbonate	MgCO <sub>3</sub>	CaCO <sub>3</sub>	SrCO <sub>3</sub>	BaCO <sub>3</sub>
Decomposition temperature (°C)	404	826	1098	1370

i) State how the decomposition temperatures vary. (1mk)

ii) Explain your answer in b(i). (3 ½ mks)

16. Name a reagent that can be used to differentiate between the following pairs of compounds. State what would be observed if each compound is treated with the reagent you have named.

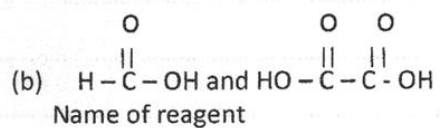
Name of reagent (s)



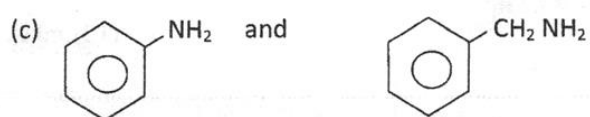
and



Observation(s)



Observation(s)



Name of reagent;

Observations

17. Ethanol can be produced by fermentation of molasses.

a) i) Name two other raw materials from which ethanol can be produced by fermentation.

iii) Write equations to show how crude ethanol can be obtained from the materials named above. (3mks)

- b) Describe how 100% (absolute) ethanol can be produced from crude ethanol produced in (a) (ii). (2mks)

- c) Write equation(s) to show each of the following compounds could be obtained from ethanol.

i) polyethene

(1 ½ mks)

iii) ethoxyethane

(1 ½ mks)

END