P525/2

CHEMISTRY

Paper 2

2018

2 ½ Hours

RESOURCE EXAM 2018

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 2

2 Hours 30 Minutes

INSTRUCTIONS TO CANDIDATES

- *Answer **five** questions including **three** questions from section **A** and any **two** from section **B**.*
- *Begin each question on a fresh page.*
- *Use equations where necessary to illustrate your answer.*

SECTION A

Attempt three questions

1. a) Define the following terms;

   (i) Electrolytic conductivity *(01 mark)*

   (ii) Molar conductivity. *(01 mark)*

   b) Draw a sketch graph to show how the molar conductivity varies with concentration for;

   (i) Ethanoic acid *(01 mark)*

   (ii) Sodium ethanoate. *(01 mark)*

   Explain the shape of the curve in each case. *(06 marks)*

   c) 25cm^3 of 0.1M ethanoic acid was titrated with sodium hydroxide solution.

   (i) Draw a sketch graph to show how the conductivity of the solution changes when

   sodium hydroxide is added to the acid. *(01 mark)*

   (ii) Explain the shape of curve. *(04 marks)*

   d) At 25°C the molar conductivities of silver ions and chloride ions are 62 and 76Ω^{-1} cm^2mol^{-1} respectively. At the same temperature the conductivity of a saturated solution of silver chloride is 4.36 x 10^{-6} Ω^{-1} cm^{-1} and for water is 2.51 x 10^{-6} Ω^{-1} cm^{-1}.

   Calculate the solubility product of silver chloride. *(04 marks)*

   e) State two other applications of conductivity. *(01 mark)*

2. Flourine, chlorine, bromine and iodine belong to group (VII) of the periodic table. The table below shows the atomic radii and melting points of the elements.

Element	F	Cl	Br	I
Atomic radius (nm)	0.072	0.099	0.0114	0.133
Melting point (°C)	$^{-}188$	$^{-}35$	59	184

   a) Explain the trend in

(i) atomic radius *(03 marks)*

(ii) melting points *(03 marks)*

b) Describe the reactions of the elements with;

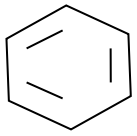
(i) water *(03 marks)*

(ii) sodium hydroxide *(06 marks)*

c) Describe how chlorine is prepared on a large scale. *(05 marks)*

3. a) Describe the reactions of methyl benzene and chlorine. *(10 marks)*

b) Complete the following equations and suggest suitable mechanisms of reaction.

(i)  $\xrightarrow[\text{Conc. } H_2SO_4,\ 60°C]{\text{Conc. } HNO_3}$ *(3 ½ marks)*

(ii) $CH_3CH_2CH_2OH \xrightarrow[180°C]{\text{Conc. } H_2SO_4}$ *(3 ½ marks)*

(iii) $CH_3CH_2Br + CH_3C \equiv CH \xrightarrow{\text{Na/ liquid ammonia}}$ *(03 marks)*

4. Explain the following observations

a) When chlorocyclohexane was treated with hot aqueous sodium hydroxide solution and the resulting solution nuetralised with nitric acid then tested with silver nitrate solution a white precipitate was formed. When chlorobenzene was treated in the same way no precipitate was formed.

b) The molar conductivities at infinite dilution of Lithium and sodium ions are 38.7 $\Omega^{-1} cm^2 mol^{-1}$ and 50.1$\Omega^{-1} cm^2 mol^{-1}$ respectively at 25°C. *(04 marks)*

c) Methanoic acid reacts with ammoniacal silver nitrate solution to form a grey solid whereas ethanoic acid does not. *(04 marks)*

d) When dilute hydrochloric acid is added to a solution of lead (II) ethanoate a white precipitate is formed. The precipitate is soluble in excess concentrated

hydrochloric

acid. *(04 marks)*

e) Ammonia boils at $^{-}33\,^{\circ}C$ whereas phosphine (PH_3) boils at $^{-}88\,^{\circ}C$. *(04 marks)*

SECTION B

*Attempt **two** questions from this section.*

5. a) Define the term "first ionization energy." *(01 mark)*

b) The first ionization energies of elements in period three of the periodic table and their atomic numbers are given in the table below.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
I.E ($KJmol^{-1}$)	495	740	580	790	1060	1000	1255	1520
Atomic number	11	12	13	14	15	16	17	18

(i) Plot a graph of ionization energy against atomic number. *(03 marks)*

(ii) Explain the shape of the graph. *(06 marks)*

c) The melting points of magnesium, silicon and Sulphur are 650°C, 1423°C and 120°C respectively.

Explain the differences in the melting points of the elements. *(03 marks)*

d) (i) Name the type of bonding that exists in the hydrides of sodium, silicon and Sulphur.

(ii) Write equations to show the reaction if any of the hydrides in (i) with water.

(4 ½ marks)

6. a) Define the following.

(i) Relative atomic mass. *(01 mark)*

(ii) Isotopes *(01 mark)*

b) The table below shows isotopic masses and their relative percentage abundance obtained from a mass spectrum of a lead sample.

Isotope	Percentage abundance

204	1.42
206	24.07
207	22.12
208	52.39

(i) Describe how the mass spectrum was obtained. ***(07 marks)***

(ii) Calculate the relative atomic mass of lead. ***(03 marks)***

c) State two advantages of using a mass spectrometer over the depression of freezing point method for determining relative atomic masses. ***(02 marks)***

d) The mass spectrum of chlorine shows peaks at masses 70, 72 and 74. The heights of the

peaks are in the ratio of 9:6:1 respectively.

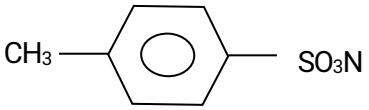
(i) State why the mass spectrum of chlorine shows three peaks. ***(1 ½ marks)***

(ii) Calculate the average atomic mass of chlorine. ***(2 ½ marks)***

(iii) Chlorine has two isotopes ^{35}Cl and ^{37}Cl . Determine the relative abundance of ^{35}Cl and ^{37}Cl . ***(02 marks)***

7. By means of equations, show how the following conversions could be carried out.

a) Benzene from nitrobenzene ***(04 marks)***

b)  from ethyne ***(04 marks)***

c) Ethanoic acid from propanoic acid ***(04 marks)***

d) 2 – methylbutan-2-ol from propene ***(04 marks)***

e) 2,2 dichloropropane from 1- chloropropane ***(04 marks)***

8. a) (i) State the basic raw materials used in the production of soap. ***(02 marks)***

(ii) Write the equation for the reaction leading to the formation of soap. ***(01 mark)***

(iii) Briefly describe how soap is separated from the reaction mixture. ***(03 marks)***

b) (i) Write equations to show how an alkybenzene- sulphonate can be prepared from duodecylbromide. ($C_{12}H_{25}Br$). ***(04 marks)***

(ii) Explain is the main advantage of using a detergent instead of soap in washing?

(04 marks)

c) Trisodiumphosphate and a little sodium perborate are usually added to some laundry detergents.

(i) State the function of trisodiumphosphate in the detergent. ***(02 marks)***

(ii) Explain how some detergents containing phosphates may cause pollution.

(02 marks)

(iii) State the role played by sodium perborate during washing. ***(01 mark)***

(iv) Sodium sulphate is usually added to detergents. State the role of sodium sulphate.

(01 mark)

END