

## SECTION A (60 Marks)

Answer only **three** questions from this section.

- 1.(a) Explain what is meant by term “solubility product”. (02 marks)
- b) Silver ethanedioate is sparingly soluble salt.
- i) Write the equation for solubility of silver ethanedioate in water. (01 mark)
- ii) Describe an experiment that can be used to determine the solubility product of silver ethanedioate. (06 marks)
- c) The solubility of silver ethanedioate at **25°C** is  **$3.34 \times 10^{-2} \text{g/dm}^3$** .
- i) Determine the solubility product of silver ethanedioate at **25°C**. (03 marks)
- ii) Calculate the solubility of silver oxalate in **1litre** of a solution containing **3.04g** of potassium oxalate. (03 marks)
- iii) Explain what would happen to the solubility of silver oxalate when a few drops of sodium chloride solution is added. (03 marks)
- d) State what will be observed and write equation for the reaction that occurs when aqueous ammonia solution is added drop wise until in excess to a precipitate of silver chloride. (02 marks)
- 2.(a) An organic compound, **Z** contains by mass **51.90%** carbon, **4.86%** hydrogen and rest being bromine. Determine the empirical formula of compound, **Z**. (02½ marks)
- b) When **0.8g** of compound, **Z** was vaporized at a temperature of **80°C** and pressure of **700mmHg**, it occupied a volume of **136cm<sup>3</sup>**. Deduce the molecular formula of organic compound, **Z**. (05 marks)
- c) When organic compound, **Z** was heated with excess sodium hydroxide solution, it formed a compound, **Y**. On heating compound, **Y** with acidified manganese (IV) oxide, a substance **W** was formed. Substance **W** formed a yellow precipitate with 2,4-dinitrophenylhydrazine in presence of dilute sulphuric acid but gave no observable change with aqueous ammonia solution in the presence of silver nitrate solution. Write equations:
- (i).To show how organic compound, **Z** was converted to **W**.
- (ii).To show how substance, **W** reacted with 2,4-dinitrophenylhydrazine in the presence of dilute sulphuric acid. (04 marks)
- d) (i).Write the equation for the reaction between **substance, W** and semi-carbazide in presence of dilute sulphuric acid. Outline the mechanism for the reaction. (06 marks)

- ii) Write equation(s) to show how compound, Y can be synthesized from benzene. Indicate the necessary conditions and reagents.  
(02½ marks)

3. Chromium can form compound in +2, +3 & +6 oxidation states.

a) (i). Write the electronic configuration of chromium ions in each of the oxidation states above. (01½ marks)

(ii). Write the formula of a chloride of chromium in each of the oxidation states above. (01½ marks)

b) Chromium (III) potassium sulphate (chrome alum),  $K_2SO_4.Cr_2(SO_4)_3.24H_2O$  is a double salt formed by chromium. A few crystals of the salt were dissolved in water and divided into three equal portions.

i) To the first portion was added magnesium powder. State what was observed and explain your observation. (04 marks)

ii) To the second portion was added aqueous ammonia solution drop wise until a green precipitate was formed. The mixture was filtered and to the filtrate was added lead (II) nitrate solution. State what was observed and write an equation for the reaction. (02 marks)

iii) To the third portion was added sodium hydroxide solution drop wise until in excess. Hydrogen peroxide was then added to the resultant solution and the mixture warmed and allowed to cool. Then drops of silver nitrate solution were added to the resultant mixture. Explain the reactions that took place. State any observations made. (07 marks)

c) (i). Write the formulae of two known oxoanions of chromium. (01 mark)

(ii). Describe the reactions that can make the two oxoanions interchange in solution. (03 marks)

4. Explain the following observations.

a) Propene undergoes electrophilic addition reaction but propanone undergoes nucleophilic addition reaction. (04½ marks)

b) When separately added to copper (II) sulphate solution, potassium iodide forms a white precipitate in a brown solution while potassium chloride gives no observable change. (03 marks)

c) The boiling points of water and bromobenzene are 100°C and 156°C respectively. However, a mixture of water and bromobenzene boils below 100°C at atmospheric pressure. (04 marks)

- d) When aqueous ammoniacal silver nitrate solution is added to methanoic acid and the mixture heated, silver mirror is formed. When ethanoic acid is treated in a similar way, no precipitate is formed. (03½ marks)
- e) When sodium hydroxide solution was added to aluminium sulphate solution, a white precipitate was formed which dissolved to form a colourless solution. (05 marks)

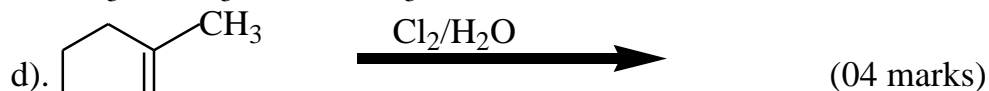
### SECTION B (40 Marks)

Answer only **two** questions from this section.

5. (a). Explain what is meant by the following terms:
- i) Electrolysis. (01 mark)
  - ii) Standard electrode potential. (02 marks)
- b) Describe an experiment that can be used to determine the standard electrode potential of the  $\text{Ag(s)}/\text{Ag}^+(\text{aq})$  electrode. Draw a labelled diagram to illustrate your answer. (05 marks)
- c) The standard electrode potential of  $\text{Ag(s)}/\text{Ag}^+(\text{aq})$  and  $\text{Fe}^{3+}(\text{aq})/\text{Fe}^{2+}(\text{aq})$  are **+0.81V** and **-0.75V** respectively.
- i) Write the cell convention of the cell made up of the two electrodes. (02 marks)
  - ii) Write equations for the reaction that took place at the positive and negative electrode respectively. (03 marks)
  - iii) Calculate the emf of the cell, and write equation for cell reaction. (03 marks)
- d) Explain why lithium has an abnormally more negative standard electrode potential compared to other group (I) elements of the periodic table. (04 marks)
- e) State any two applications of standard electrode potential. (02 marks)
6. (a). Write the outermost electronic configuration of group (II) elements.
- (b). Describe the reactions of group (II) elements with:
- i) Water (05½ marks)
  - ii) Sulphuric acid (07½ marks)
  - iii) Sodium hydroxide (02 marks)
- c) Potassium chromate solution was added to barium chloride solution followed by dilute nitric acid drop wise until in excess.
- i) State what was observed. (02 marks)
  - ii) Write equation(s) for the reaction(s) that took place. (02 marks)
- d) Dilute sulphuric acid was added to barium nitrate solution.

- i) State what was observed.
- ii) Write equation for the reaction.

7. Complete the following organic reactions and write the accepted mechanism for each reactions.



8.(a) Describe briefly:

- i) How concentrated sulphuric acid is manufactured starting from iron pyrites. (06 marks)
  - ii) How sulphuric acid reacts with carbon. (02½ marks)
  - iii) How sulphuric acid reacts with benzene. (02½ marks)
- b) Briefly describe how sulphuric acid can be converted to the superphosphate fertilizer. (03 marks)
- c) Bronze is an alloy of copper and tin. **9.40g** of powdered bronze was warmed with an excess dilute sulphuric acid. The mixture was filtered and the resultant solution made up to **250cm<sup>3</sup>** using distilled water. **25.0cm<sup>3</sup>** of the filtrate required **19.20cm<sup>3</sup>** of **0.02M** potassium manganate (VII) for oxidation.
- Explain why:
- i) The bronze was warmed with excess dilute sulphuric acid. (01 mark)
  - ii) The mixture obtained from bronze was filtered. (01 mark)
  - iii) Calculate the percentage by mass of tin in the bronze. (04 marks)

## THE PERIODIC TABLE

1	2											3	4	5	6	7	8
1.0 H 1															1.0 H 1	4.0 He 2	
6.9 Li 3	9.0 Be 4											10.8 B 5	12.0 C 6	14.0 N 7	16.0 O 8	19.0 F 9	20.2 Ne 10
23.0 Na 11	24.3 Mg 12											27.0 Al 13	28.1 Si 14	31.0 P 15	32.1 S 16	35.4 Cl 17	40.0 Ar 18
39.1 K 19	40.1 Ca 20	45.0 Sc 21	47.9 Ti 22	50.9 V 23	52.0 Cr 24	54.9 Mn 25	55.8 Fe 26	58.9 Co 27	58.7 Ni 28	63.5 Cu 29	65.7 Zn 30	69.7 Ga 31	72.6 Ge 32	74.9 As 33	79.0 Se 34	79.9 Br 35	83.8 Kr 36
85.5 Rb 37	87.6 Sr 38	88.9 Y 39	91.2 Zr 40	92.9 Nb 41	95.9 Mo 42	98.9 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	209 Po 84	210 At 85	222 Rn 86
223 Fr 87	226 Ra 88	227 Ac 89															
			139 La 57	140 Ce 58	141 Pr 59	144 Nd 60	147 Pm 61	150 Sm 62	152 Eu 63	157 Gd 64	159 Tb 65	162 Dy 66	165 Ho 67	167 Er 68	169 Tm 69	173 Yb 70	175 Lu 71
			227 Ac 89	232 Th 90	231 Pa 91	238 U 92	237 Np 93	244 Pu 94	243 Am 95	247 Cm 96	247 Bk 97	251 Cf 98	254 Es 99	257 Fm 100	256 Md 101	254 No 102	260 Lw 103

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