SECTION A

ATTEMPT ONLY THREE QUESTIONS IN THIS SECTION.

1.a) Define the term **relative atomic mass**. (02 marks)

1.b) Explain how **relative atomic mass** can be determined by the **mass spectrometer**. (09 marks)

1.c) The mass spectrum of an element **Q** contained **four lines** at mass/charge of **54**, **56**, **57** & **58** with relative intensities of **5.84**, **91.68**, **2.17** & **0.31** respectively.

i. Explain what the term **relative intensities mean** and why the mass spectrum of element **Q** contains **4 lines**. (03 marks)

ii. Calculate the **relative atomic mass** of element **Q**. (02 marks)

1.d) Explain why the **values of relative atomic mass** have no units. (01 mark)

1.e) **Thorium decays** according to the equation below.

$$^{232}_{90}Th + \alpha \longrightarrow X + \beta \longrightarrow Y + \beta \longrightarrow Z$$

Determine the **mass numbers** and **atomic numbers** of **X**, **Y** & **Z**. (03 marks)

2.a) Explain the term **melting point**. (01 mark)

2.b) State the **factors** which **affect the melting point**: (@01 mark)

i. Metals.

ii. **Molecular substances**.

2.c) Explain the trend in melting points of the elements in **group (II)** and **group (VII)** of the periodic table. (05 marks)

2.d) Explain why transition metals of **period 4** tend to have **higher melting points** than non-transition metals of the same period. (02 marks)

2.e) The table below shows melting points of some compounds.

Compounds	Melting point/K
Aluminium oxide	2290
Aluminium chloride	451
Calcium oxide	2850
Calcium chloride	1051

Explain why:

i. The melting point of aluminium chloride is abnormally low compared to that of aluminium oxide. (02 marks)

ii. The melting point of calcium oxide is much higher than that of calcium chloride. (02 marks)

2.f) Determine the freezing point depression for a solution containing **0.025g** of sodium chloride in **200.0g** of water. (03 marks)
(Molar freezing point constant of water, K_f = 1.86°C/mol/k)

2.g) Explain why a solution of aluminium nitrate turns blue litmus paper red. (03 marks)

3. Be, Mg, Ca, Sr & Ba are elements in group (II) of the periodic table.

3.a) Describe and explain the trend in the reactivity of the elements with water down the group. (05 marks)

3.b) Compare the solubility and basicity of the hydroxides of group (II) elements with the hydroxides of group (I). (03½ marks)

3.c) (i).Explain why beryllium and aluminium show a diagonal relationship. (02 marks)

3.c) (ii).Write equations to show how beryllium and aluminium each react with concentrated sodium hydroxide solution. (03 marks)

3.d) G is a chloride of beryllium contains **11.25%** beryllium.

i. Calculate the empirical formula of G. (01½ marks)

ii. Determine the molecular formula of G. (01 mark)
(Vapour density of G = 80)

iii. Write the structural formula of G. (01 mark)

3.e) Explain why beryllium form more complexes compared to the rest of the group members. (03 marks)

4.a) Complete the following equations and in each case outline the mechanism for the reaction.

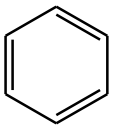
a. $CH_3CH_2OH \xrightarrow[140^0C]{Conc.H_2SO_4}$ (02½ marks)

b. $(CH_3)_3CCl \xrightarrow[Heat]{CH_3CH_2O^-K^+/CH_3CH_2OH}$ (03 marks)

c. $CH_3HC{=}CHCH_3 \xrightarrow[Warm]{Conc.H_2SO_4/H_2O}$ (03½ marks)

d. $CH_3CHO + NaHSO_3 \xrightarrow{H^+}$ (03 marks)

e. $CH_3CH_2CH_2CH_2OH \xrightarrow[180^0C]{Conc.H_3PO_4}$ (03 marks)

f.  $+ \quad Br_2 \xrightarrow{Fe_{(s)}}$ (03 marks)

4.b) Write the IUPAC names of the products in (a) and (b) above. (02 marks)

SECTION B

ATTEMPT ONLY TWO QUESTIONS IN THIS SECTION.

5.a). Explain each of the following observations.

5.a) Dimethylamine is a stronger base than phenylamine. (04 marks)

5.b) The first ionization energy of aluminium is less than that of magnesium. (03 marks)

5.c) The p^H of a solution of chromium (III) chloride in water is less than 7. (03 marks)

5.d) Carbon dioxide is a gas at room temperature while silicon dioxide is a high-melting solid. (03 marks)

5.e) 1-bromohexane undergoes nucleophilic substitution whereas bromobenzene does not. (04 marks)

5.f) When solid lead (IV) chloride is added to water, white fumes are observed and a brown precipitate is formed. (03 marks)

6.a). Write equations to show how the following conversions can be effected and indicate reagents and conditions for the reactions.

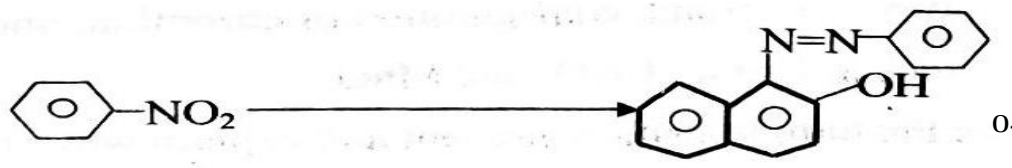
a. $CH_3CH_2OH \longrightarrow CH_3CH_2COOH$ (03 marks)

b. $C_6H_5CH_2OH \longrightarrow C_6H_6$ (02 marks)

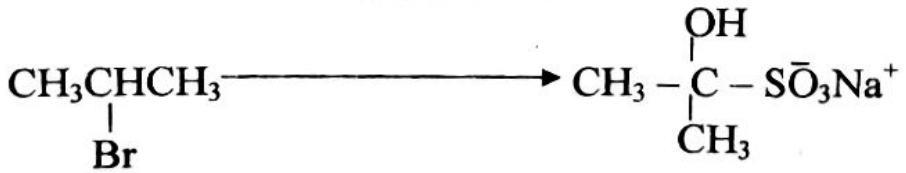
c. $CH_3CH_2CH_2OH \longrightarrow CH_3COCH_3$ (03 marks)

d. $CH_3CH_2CH_2OH \longrightarrow CH_3CH_2NH_2$ (02½ marks)

e. $CH_3CH_2OH \longrightarrow CH_3C{\equiv}CH$ (02½ marks)

f 

04 marks

g. 

03 marks)

7.a). (i).Explain the term colligative property. (01½ marks)

7.a). (ii).State four colligative properties of a solution. (02 marks)

7.b). (i).Describe how molecular mas of a substance can be determined by elevation boiling point method. (07 marks)

7.b). (ii)State three limitations of the methods. (01½ marks)

7.c). Calculate the boiling point of an aqueous solution of urea,$CO(NH_2)_2$ of concentration **12g/dm^3** at a pressure of 101.3kpa.assume that the volume of the solute is negligible compared to that of the solution. The melting point elevation constant for water is **0.52°C/mol/kg**) (04 marks)

7.d). (i).Explain the term mole fraction. (01 mark)

7.d). (ii).Calculate the mole fraction of sodium chloride in an aqueous solution containing 10.0g of sodium chloride per 100.0g water. (03 marks)

8.a) Chromium and manganese belongs to transition metal group of elements in the periodic table.

i. Write electronic configuration of chromium and manganese atoms respectively. (01 mark)

ii. Write electronic configuration of chromium and mangansese ions in $Cr_2O_7^{2-}$, Cr_2O_3 and MnO_4^-. (01½ marks)

8.b) Define the term transition element and explain why zinc ion is not considered transition. (04 marks)

8.c) (i).Write half-cell equation for the reduction of MnO_4^- to Mn^{2+} and oxidation of I^- to I_2 under acidic conditions. (03 marks)

8.c) (ii).State four properties of transition elements. (02 marks)

8.d) Briefly describe how the percentage purity of manganese may be determined from an ore containing manganese (IV) oxide. (06½ marks)

8.e) State the advantages and disadvantages of using potassium manganate (VII) in volumetric analysis. (02 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 TI 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

SUCCESS = END

WELCOME TO SENIOR SIX, YEAR 2023

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