ATTEMPT ANY FIVE QUESTIONS.

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

b) Explain how **relative atomic mass** can be determined by the **mass spectrometer**. [Diagram not required] (09 marks)

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)

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

e) Chlorine has **two** isotopes ^{35}**Cl** and ^{37}**Cl**. State the formula of each **ion** of the respective molecular peak formed. (01½ marks)

Molecular peak	Formula of ions
70	
72	
74	

f) Draw the **mass spectrum** of the above two isotopes. (01½ marks)

2.(a) Define what is meant by the term **ionization energy**. (02 marks)

ii. State and explain the **factors** that affect ionization energy. (@02½ marks)

b) The table below shows the first ionization energies of the elements in period 3 of the periodic table.

Elements	$_{11}$Na	$_{12}$Mg	$_{13}$Al	$_{14}$Si	$_{15}$P	$_{16}$S	$_{17}$Cl	$_{18}$Ar
1st I.E (kJ/mol)	496	738	578	786	1,012	1,000	1,251	1,521

Plot a graph of **first ionization energies** against **atomic numbers** of period 3 elements. (03 marks)

c) Explain the **shape** of the graph. (05 marks)

3.(a) Explain what is meant by the term isomerism? (08 marks)

b) Show how the followings synthesis below can be effected.

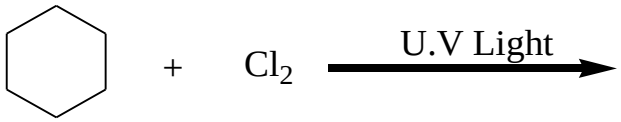
i. $H_2C=CH_2$ to CH_4 (02½ marks)

ii. $CH_3CH(Br)CH_3$ to $CH_3CH(CH_3)CH(CH_3)CH_3$ (01 mark)

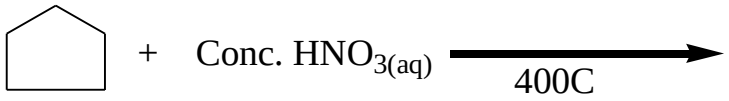
iii. $CH_3CH=CHCH_3$ to $CH_3CH_2CH_2CH_3$ (01 mark)

c) Complete the following equations and write their suggested mechanism. (@02½ marks)

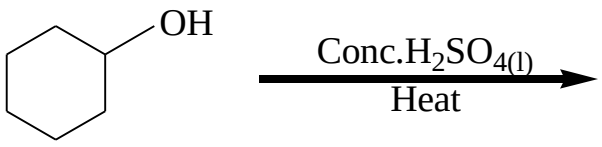
i.



ii.



iii.



4.(a) Describe the reactions of magnesium, calcium and barium with:

i. Air. (04½ marks)

ii. Water. (04½ marks)

b) Write the electronic configuration of chromium, copper, germanium. (01½ marks)

c) Discuss the solubility of sulphates of group (II) elements. (03½ marks)

d) Explain the following observations.

i. First ionization energy of magnesium is higher than that of aluminium. (03 marks)

ii. Atomic radius of sodium atom is **0.156nm** while the ionic radius of sodium ion is **0.095nm**. (03 marks)

5.(a) Define the following terms: (@01 mark)

i. Half-life.

ii. Radioactivity.

b) The activity of a radioactivity isotope falls to **12.5%** in **90** days.

i. Determine the decay constant and the half- life. (03½ marks)

ii. Thorium decays according to the equation below.

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

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

c) The table below shows the activity of Krypton with time.

Time (minutes)	20	40	60	80	100	120
Activity	92	85	78	72	66	61

i. Plot a graph of $\log_{10}$(activity) against time. (04½ marks)

ii. From the your graph, Determine:

iii. Rate constant. (02 marks)

iv. Half-life. (01½ marks)

v. Activity at time, t=0 minute. (01½ marks)

d) One of the reasons why isotopes of elements undergo radioactive decay is to achieve stability in the nuclei. The graph in figure 1 shows a plot of number of neutrons against number of protons for stable nuclei.

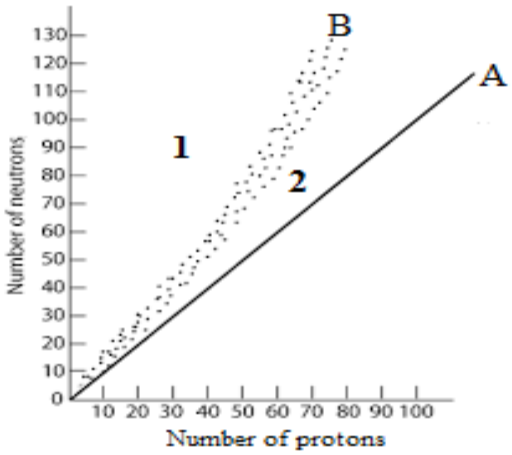


Figure 1

State:

(i) **Two** factors that determine the stability of a nucleus of an atom. (01 mark)

(ii) What line A represents. (0½ mark)

(iii) What region B represents. (0½ mark)

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 FIVE, YEAR 2024

This is the last page of the printed paper, Page 04