

Name:Stream:

P525/1

CHEMISTRY (theory)

Paper 1

2½ hours

MENGO SENIOR SCHOOL

Uganda advanced certificate of education

END OF TERM 1 EXAMINATIONS APRIL 2025

S.5 CHEMISTRY

Paper 1

TIME; 2½ hours

INSTRUCTIONS TO LEARNERS:

- This paper consists of **two** sections A and B.
- Section A contains **two** items which are compulsory.
- Section B has **three** items; attempt only **two** items from this section.
- Answer to Section A must be written in the spaces provided and for Section B should be written in the answer sheets provided.
- The periodic table, with relative atomic masses, is attached at the end of the paper.
- Mathematical tables (3 -figure tables) are adequate or non-programmable scientific electronic calculators may be used.
- Illustrate your answers with equation(s) where applicable.

Where necessary, use the following:

Molar volume of gas at s.t.p is 22.4dm^3 Or 22400cm^3

Standard temperature= 273K. Standard pressure = 101325Nm^{-2}

FOR SCORER'S USE ONLY

ITEMS	1	2	3	4	5	TOTAL
SCORES						

ITEM 1

Tyramine is the organic base in the venom of wasps stings that is responsible for causing severe pain and swelling when one is stung by a wasp. An inquisitive student of S.5 who wanted to know the composition and molecular formula of the base was instructed by the laboratory technician to extract the venom and use different masses of it for experimentation as follows;

First he was instructed to mix **0.210g** of the Venom with excess oxygen, explode the mixture and then pass the products over **anhydrous calcium chloride** in a U-tube and then into **concentrated potassium hydroxide solution** placed in a wash bottle. He was able to record a **0.152g** difference in mass of content in the U-tube and a **0.540g** difference in mass of content in the wash bottle.

In another experiment he exploded **0.135g** of the venom and liberated **11.04cm³** of nitrogen gas at s.t.p. The laboratory technician informed the student that the molecular mass of the base was **137g**.

TASK:

Help the student to;

i) Explain the differences in masses he obtained in the U-tube and in the wash bottle.

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ii) Identify the role of anhydrous calcium chloride and potassium hydroxide solution and write balanced equation(s) of reaction where necessary.

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Item 2:

During an agricultural research at National Agricultural Research Organisation (**NARO**), investigations were carried out to analyse an unusual soil pH which was affecting crop health in Arua district. Soil samples were taken to the laboratory and analysed and found out to contain a sodium salt with a formula $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$. The following procedure was carried out. 8.58g of $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$ was dissolved in water and made to one liter. 20cm³ of this solution needed 12cm³ of 0.1M hydrochloric acid for complete neutralization.

Task; As a student help the organization to discover the actual formula of salt by;

- a) Writing down a balanced chemical equation for the reaction.

.....(1½scores)

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- b) Calculating the moles of hydrochloric acid used. (2scores)

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- c) Calculating the;

- i) Molarity of the carbonate. (2½scores)

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ii) Formula mass of $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$. (1½ scores)

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iii) Value of x . (1 score)

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d) Write the chemical formula for the sodium salt and comment on its nature. (1½ score)

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SECTION B

(Answer **TWO** items from this section)

ITEM 3.

(20 scores)

(a) A nuclear reaction involving **Thorium-232** leads to release of two alpha particles to form **W**. **W** undergoes beta decay to form **Z**.

i) Write a well-balanced nuclear reaction and determine the identity of **W** and **Z**.

ii) Compare the properties of beta and alpha particles.

(b) (i) An archaeologist discovered a wooden art-craft and used carbon-14 to determine its age. The art-craft was found to contain **35%** of its original carbon-14 content. If the half-life of carbon-14 is **5600 years**. Determine the age of the art-craft.

(ii) Compare nuclear and chemical reactions

(c) A sample of a radioactive substance was analysed in a Geiger-Muller counter and its activity measured over a period of time.

Time (s)	0	10	20	30	40	50	60
Activity (counts per second)	800	565	380	283	190	141	95

(i) Plot a graph of Activity against time

(ii) Use your graph to determine half-life of the substance and the decay constant

ITEM 4

Recently, in a high school newly constructed chemistry laboratory, new shipment of elements arrived, and the labels on their bottles were partially removed. The only visible information was the atomic numbers which were 11, 13, 24, 17, and 18.

Your teacher is responsible for ensuring that laboratory safety is a priority and chemicals are stored properly to prevent accidents.

Task;

The teacher has asked you to identify the elements, determine the electronic configurations of the elements and their ions, clarify on their position in the Periodic Table (Group, Period and Block) hence predict and analyze their reactivity.

Comment on the behavior of the compound formed when elements with atomic number 11 and 17 combine. Also explain how the compound is formed.

Write a brief message to respond to the teacher's assignment.

(20scores)

ITEM 5.

During an agricultural research at National Agricultural Research Organisation (NARO), a mini-handheld spectrometer was used to analyse an unusual soil nutrient which was affecting crop health in Luwero district. When a small sample was vaporised and analysed, four amplified bars of ratio of **0.29:4.95:**

4.54:10.22 with isotopic masses **204, 206, 207** and **208** respectively where obtained. The research officer produced a report but the District leader could not interpret it and did not know how it comes about.

Task:

As a S.5 Chemistry learner with knowledge about mass spectrometry;

- Describe how the device was operated to come up with the report.
- Calculate the relative atomic mass of the soil nutrient and identify it.
- State the advantages of the method used by the researchers.

A group of researchers used a mass spectrometer to determine the relative atomic mass of chlorine. In their findings, chlorine had two isotopes Cl-35 and Cl-37 and mass spectrum had three significant peaks at 70, 72 and 74. The report shows that the relative atomic mass of chlorine is 35.5.

Peter a new comer in senior five chemistry class is inquisitive about this machine and the mass spectrum obtained.

Task: Using the knowledge of chemistry, you have obtained;

(a) Explain to him:

(i) Why only three peaks were observed on the mass spectrum

(ii) Two other uses of the machine in daily life.

(b) Calculate the percentage abundance of each isotope of chlorine from the data and hence sketch the mass spectrum of chlorine.

(20scores)

END

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	