Candidates Name:_____

Stream:_____

545/1
Chemistry
Paper 1
Apr, 2026
2¹/₂ hours

TAIBAH INTERNATIONAL SCHOOL

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TEST 2 EXAMINATION

S.5 CHEMISTRY

2¹/₂ HOURS

INSTRUCTIONS TO CANDIDATES

» *This examination paper consists of **two** sections: **A** and **B***

» *It has **six** examination items.*

» *Section **A** has **two compulsory** items. Responses to section **A must** be written in the spaces provided*

» *Section **B** has two **parts; I** and **II**. Respond to only **one** item from **each** part.*

» *Responses to Section **B must** be written in the answer booklet(s) provided.*

» *Respond to **four** items in all.*

» *Responses to each item in section **B** should start from a fresh page.*

» *Any additional item(s) responded to will **not** be scored.*

For Scorers' Use Only

Item No.	*Score*	*Scorers' Initials*
1		
2		
___(3/4)		
___(5/6)		
Total Weighed score		

SECTION A

ATTEMPT ***ALL*** ITEMS IN THIS SECTION.

Item 1

A water treatment laboratory in Jinja is responsible for monitoring the quality of chemicals used in purification processes. One of the chemicals used is hydrochloric acid (HCl), but its exact concentration is unknown and must be determined before use.

A laboratory technician decides to standardise the acid using a primary standard, anhydrous sodium carbonate (Na_2CO_3). The technician carefully weighs 1.50 g of anhydrous sodium carbonate, dissolves it in distilled water, and makes the solution up to 250 cm^3 in a volumetric flask. He then pipettes 20.0 cm^3 of this solution into a conical flask and titrates it with the hydrochloric acid using methyl orange indicator. The average volume of hydrochloric acid required for complete neutralisation is found to be 27.50 cm^3.

Task.

As a chemistry student, use your knowledge to assist the laboratory technician.

(a). Analyse the experimental setup and:

(i). justify why anhydrous sodium carbonate is suitable as a primary standard

(ii). formulate a balanced equation for the reaction between sodium carbonate and hydrochloric acid.

(iii). examine and interpret the role of methyl orange indicator in this titration

(b). Using the given data:

(i). determine the concentration of the sodium carbonate solution

(ii). calculate the number of moles of sodium carbonate in 20.0 cm^3

(iii). analyse the stoichiometry and evaluate the molarity of the hydrochloric acid solution

(c). Assess the reliability of the experimental procedure and:

(i). propose two precautions to improve accuracy

(ii). evaluate the importance of standardising hydrochloric acid before its use in water treatment

Item 2

In an industrial area in Hoima, a company uses a gaseous hydrocarbon fuel (substance P) to power machines. The management is concerned about both the efficiency of the fuel and its environmental impact. A laboratory technician carries out an experiment to determine the identity of substance P.

A sample of 20 cm^3 of substance P is exploded with 155 cm^3 of excess oxygen. After cooling to room temperature, the total gas volume reduces to 105 cm^3. The remaining gas is then passed through concentrated sodium hydroxide solution, and the volume further decreases by 80 cm^3. The results are recorded for analysis.

Task.

As a knowledgeable chemist, analyse the experimental data and advise the community.

(a). Analyse the combustion data and:

(i). determine the molecular formula of substance P

(ii). justify your answer using appropriate calculations and reasoning

(b). Substance P belongs to the homologous series $C_nH_{2n+2.}$

(i). construct the structural formulae of all possible isomers of P

(ii). classify and name them according to IUPAC nomenclature

(c). Evaluate the use of substance P in the community by:

(i). explaining the environmental impact of excessive use of the substance, proposing practical measures to mitigate these effects

(ii). assessing the benefits of using the substance in industrial applications

SECTION B
Part I

ATTEMPT ***ONE*** ITEM FROM THIS PART.

Item 3

In Buliisa village, a new gaseous fuel (Substance J) has been introduced for domestic cooking. The fuel is advertised as a clean-burning hydrocarbon, and its composition is given as 83.7% carbon with a vapour density of 43.

A group of Senior Five learners attempts to determine the identity of the fuel and investigate how it reacts with chlorine during storage and usage, especially under sunlight. However, they are unable to fully explain its structure and reaction behaviour.

Task.

As an organic chemist, assist the learners in analysing the substance and its reactions.

(a). Analyse the given data and:

(i). determine the molecular formula of substance J.

(ii). justify your answer with appropriate calculations

(b). Substance J is an alkane.

(i). construct all possible structural isomers of J

(ii). name them according to IUPAC nomenclature

(iii). distinguish between the isomers based on their structural features

(c). Substance J was reacted with chlorine in the presence of sunlight:

(i). formulate the overall equation for the reaction

(ii). analyse and describe the mechanism of the reaction.

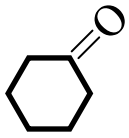
(iii). identify the type of reaction taking place

(d). Evaluate the environmental impact of excessive use of substance J and propose practical measures to reduce these effects. Assess the benefits of using substance J as a fuel

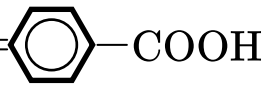
Item 4

In Wakiso district, the community police department, working together with environmental inspectors, is investigating a suspected illegal chemical processing site. During the operation, several containers labelled (i) to (vi) containing unknown organic compounds were recovered. Preliminary laboratory analysis revealed the structural formulae of the compounds as shown.

i). $(CH)_3CCH_2CH = CH_2$

ii). 

iii). $CH_3CH(CH_3)CH_2CH_3$

iv). 

v). $CH_3C \equiv CCH_2C(CH_3)_3$

vi). $(CH_3)_4C$

However, the officers lack sufficient chemical knowledge to interpret the structures, understand their properties, and assess their potential risks and uses in the community.

Task

As a Senior Five student with knowledge of organic chemistry, assist the investigation team in analysing the substances.

(a). Analyse the given structures and:

(i). identify the functional group(s) present in each of the compounds.
(ii). classify each compound into its respective homologous series
(iii). distinguish the key structural features responsible for their chemical properties

(b). Using your knowledge of organic chemistry:

(i). identify and name each of the compounds using IUPAC nomenclature.
(ii). interpret the structural differences among the compounds and relate them to their chemical behaviour.
(iii). deduce the specific class of organic compound to which substance (ii) belongs.

(c). Evaluate the potential implications of the identified compounds by:

(i). analysing and comparing the physical properties (such as boiling points and volatility) of compounds in the homologous series to which substance (iii) and (vi) belong.
(ii). predicting and justifying the order of boiling points among selected compounds based on their structures,
(iii). assessing possible uses and risks associated with these compounds, proposing appropriate safety and environmental measures for handling and disposal of such substances.

PART II

ATTEMPT ***ONE*** ITEM FROM THIS PART.

Item 5

A research team working at a mineral analysis laboratory in Tororo is studying a group of elements obtained from rock samples. The scientists are interested in understanding how the atomic structure of the elements influences their chemical behaviour and reactivity.

The laboratory provides the following data: A set of elements from the third period with their atomic radii and first ionisation energies.

Element	**Na**	**Mg**	**Al**	**Si**	**P**	**S**	**Cl**
Atomic Radius	**186**	**160**	**143**	**117**	**110**	**104**	**99**
First Ionisation Energy. ($kJmol^{-1}$)	**496**	**738**	**577**	**787**	**1012**	**1000**	**1251**

Another unknown element Q, whose first five ionisation energies are recorded as: **1086, 2353, 4620, 6223** and **37831 kJ mol^{-1}.**

The team is unable to fully interpret the trends and seeks your help as a chemistry student.

Task

As a Senior Five student with knowledge of chemistry, assist the research team in:

(a). Analysing the data and

(i). describe how atomic radius varies across the period and relate this to the trend in first ionisation energy
(ii). explain the observed trends in the table above.

(b). Investigate the ionisation energy data for element Q and:

(i). explain the term first ionisation energy
(ii). identify the group of the periodic table to which element Q belongs
(iii). deduce the number of valence electrons in Q, explain your reasonin

(c). Using your understanding of periodic trends:

(i). evaluate how ionisation energy influences the reactivity of elements across a period
(ii). predict the type of ions likely to be formed by element Q and justify your answer
assess the relationship between atomic structure and chemical behaviour of elements in the periodic table

Item 6

The Ministry of Works and Transport is piloting a road stabilisation project in Karamoja to reduce dust and improve road durability. The region experiences high temperatures (up to 45°C) and dry, loose soils. Engineers are considering three chloride salts as soil stabilisers:

- Sodium chloride (NaCl)
- Magnesium chloride ($MgCl_2$)
- Aluminium chloride ($AlCl_3$)

Laboratory data obtained is shown below:

Chloride	NaCl	$MgCl_2$	$AlCl_3$
Melting Point °C	801	712	180

Additional observations:

- $MgCl_2$ is hygroscopic (absorbs moisture from air)
- $AlCl_3$ sublimes easily at relatively low temperatures
- NaCl forms a stable crystalline lattice but is less effective in moisture retention

Task

As a chemistry student advising the engineering team:

(a). Analyse the trend in melting points of the three chlorides.

(b). Using the data and chemical principles, evaluate the suitability of each chloride for road stabilisation in Karamoja.

(c). The engineers propose using aluminium chloride. Critically assess this proposal and justify whether it should be adopted or rejected.

(d). Propose the most suitable chloride or combination of chlorides for the project.

END

"Science is not just about knowing—it is about understanding, questioning, and applying knowledge to solve real-world problems."
By Tr. Benmil