

MARKER CODE				



STUDENT ENROLMENT NUMBER (SEN)									

TONGA NATIONAL FORM SEVEN CERTIFICATE

2024

CHEMISTRY

QUESTION AND ANSWER BOOKLET

Time allowed: 3 Hours

INSTRUCTIONS:

- Write your **Student Enrolment Number (SEN)** on the top right-hand corner of this page.
- This paper consists of **FIVE SECTIONS** and is out of 70 weighted scores.

SECTION	STRANDS	TOTAL SKILL LEVEL
ONE	ATOMIC STRUCTURE, BONDING, SOLIDS AND RELATED PROPERTIES	11
TWO	KINETIC AND NUCLEAR CHEMISTRY	8
THREE	INORGANIC CHEMISTRY	18
FOUR	QUANTITATIVE AND REDOX CHEMISTRY	20
FIVE	ORGANIC CHEMISTRY	13
TOTAL		70

- Answer ALL QUESTIONS. Write your answers in the spaces provided in this booklet.
- Use a **BLUE** or **BLACK** ball point pen only for writing. Use a pencil for drawing if required.
- If you need more space for answers, ask the supervisor for extra paper. Write your **Student Enrolment Number (SEN)** on each additional sheet, number the questions clearly and insert them in the appropriate places in this booklet.
- Note: There is a **periodic table** of the elements provided on **page 19**.
- Check that this booklet contain pages **2-19** in the correct order and that pages 16-18 have been deliberately left blank.

YOU MUST HAND IN THIS BOOKLET TO THE SUPERVISOR BEFORE YOU LEAVE THE EXAMINATION ROOM.

SECTION ONE: ATOMIC STRUCTURE, BONDING, SOLIDS AND RELATED PROPERTIES

1. Consider the compounds listed below:

HCN Cl₂ Br₂ CO

Identify **TWO (2) compounds** from the list above that are **isoelectronic**.

Compound 1: _____

Compound 2: _____

Skill level 1	
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2. Write the **ground state electron configuration** of the **Chromium atom** using the s, p, d, f notation.

Skill level 2	
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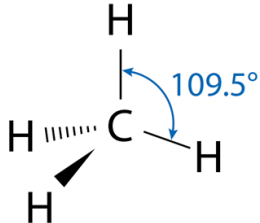
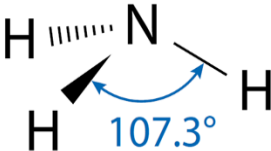
3. Select **ONE (1)** appropriate compound from the list below and use it to **describe hydrogen bond**.
Consider in your response to include a labelled diagram to clarify the description.

HCN HCl HF H₂S

Skill level 2	
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4. Use a 'dot and cross' diagram to **draw the Lewis structure** of **Hydrogen cyanide, HCN**.

Skill level 3	
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- | Observed Bond Angle (°) in Methane | Observed Bond Angle (°) in Ammonia |
|---|--|
|  |  |

[illegible]

Skill level 3	
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SECTION TWO: KINETIC AND NUCLEAR CHEMISTRY

1. Define the **standard heat of fusion**, $\Delta_{\text{fus}}H^\circ$.

Skill level 1	
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2. Draw **TWO (2)** labelled energy profiles with one for an **endothermic reaction** and the other for an **exothermic reaction**.

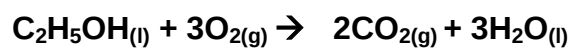
Endothermic Energy Profile	Exothermic Energy Profile

Skill level 2	
2	
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3. Write the **complete nuclear equation** for the **alpha emission** of Polonium-218.
(Word Equation is **not** acceptable)

Skill level 2	
2	
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4. The equation for the **combustion of ethanol** is:



Apply Hess's Law to **calculate** the **enthalpy change for the combustion** of ethanol above using the bond energies (in kJmol^{-1}) shown below:

$$E(\text{C}-\text{C}) = +347$$

$$E(\text{C}-\text{H}) = +410$$

$$E(\text{C}-\text{O}) = +336$$

$$E(\text{O}=\text{O}) = +496$$

$$E(\text{C}=\text{O}) = +805$$

$$E(\text{O}-\text{H}) = +465$$

Skill level 3	
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SECTION THREE: INORGANIC CHEMISTRY

1. Give the *chemical formula* of **ammonium sulphide**.

Skill level 1	
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2. State the **colour** of solid **manganese dioxide**.

Skill level 1	
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3. Describe, using appropriate **half-equation**, the **reaction** of the permanganate ion, MnO_4^{2-} in **acidic condition**.

Skill level 2	
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NR	

4. Describe the **basic nature** of copper oxide, CuO .

Skill level 2	
2	
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NR	

5. Describe how **chlorine** acts as an **oxidizing agent**.

Skill level 2	
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- Consider in your response the following:

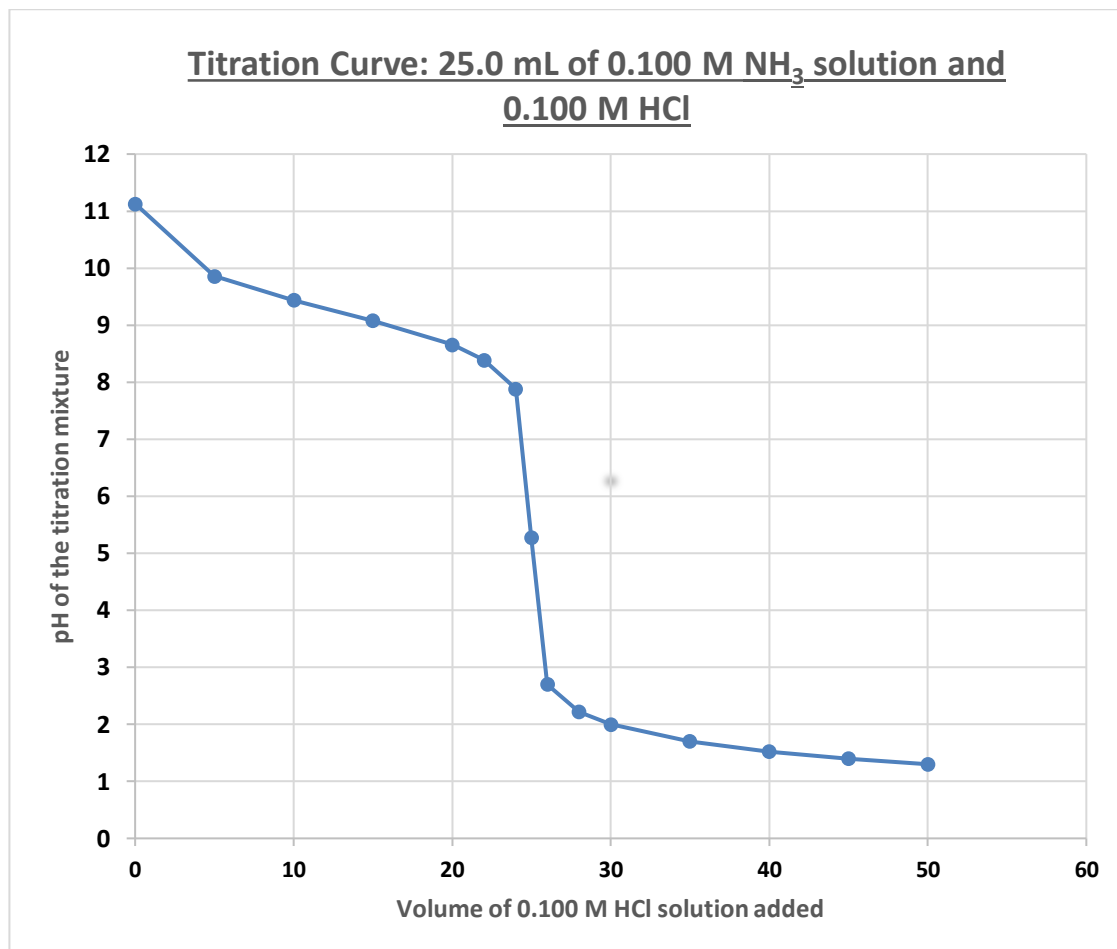
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Skill level 4	
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SECTION FOUR:

QUANTITATIVE AND REDOX CHEMISTRY

1. A 0.100 M HCl solution is added from a burette to 25.0 mL of a 0.100 M of NH_3 solution in a conical flask. The pH of the mixture in the conical flask is graphed in the Titration Curve below:



Use the Titration Curve above to answer questions a. to c. below.

- Identify the **conjugate acid-base pair** involving NH_3 .

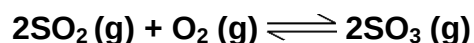
_____ - _____
 Conjugate acid - conjugate base

- Circle the **buffer region** in the titration curve, showing the **limits**.

Skill level 1	
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Skill level 2	
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3. Sulphuric acid is made by the Contact process where the **main** equilibrium reaction occurs between Sulphur dioxide gas, $\text{SO}_2(\text{g})$ and Oxygen gas, $\text{O}_2(\text{g})$ to **form** Sulphur trioxide gas, $\text{SO}_3(\text{g})$ as shown below:



- a. Write the **equilibrium constant expression**, K_c for this **main** equilibrium reaction in the Contact process.

Skill level 2	
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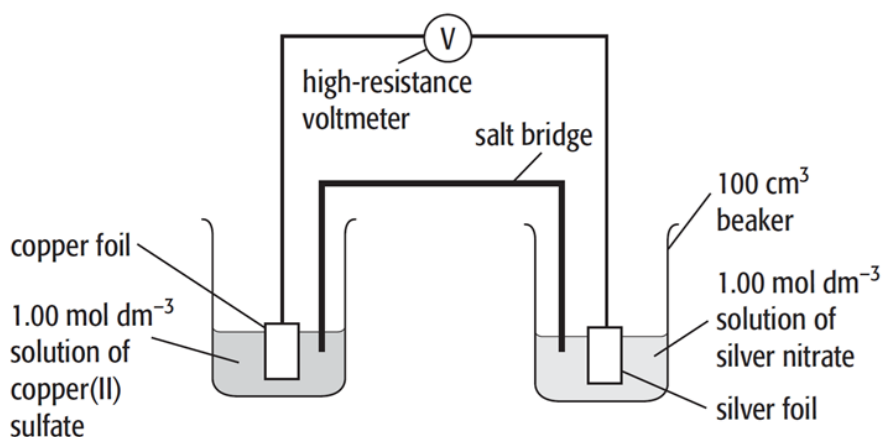
- b. Discuss the **effect on the equilibrium position** in the reaction above when there are **changes to the pressure in the system**.

Consider the following in your response:

- i. Definition of an equilibrium reaction,
- ii. Position of equilibrium before any changes in the pressure,
- iii. Change in equilibrium position when pressure in the system is increased and why there is change.
- iv. Change in equilibrium position when pressure in the system is decreased and why there is change.
- v. State what happens if the system has species in solid or liquid states.

Skill level 4	
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4. The labelled diagram below shows the electrochemical cell involving two different metals, Copper, Cu and Silver, Ag:



The standard electrode potentials for their half-cells are:

$$E^{\circ}_{\text{Ag}^+(\text{aq})/\text{Ag}(\text{s})} = +0.80 \text{ V}$$

$$E^{\circ}_{\text{Cu}^{2+}(\text{aq})/\text{Cu}(\text{s})} = +0.34 \text{ V}$$

- a. Describe **TWO (2)** possible **observations** made at the electrochemical cell in the diagram above.

Observation 1: _____

 Observation 2: _____

Skill level 2	
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- b. Use the given half-cell standard electrode potentials to **calculate** the potential of the electrochemical cell, E°_{cell} .

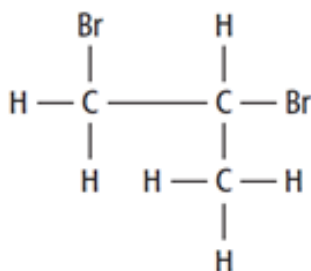
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SECTION FIVE:

ORGANIC CHEMISTRY

Organic Compounds

1. Use the IUPAC rule to write the **systemic name** of the organic compound below:



Skill level 1	
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2. a. Draw the **TWO (2) structural isomers** with the **same** molecular formula, C_3H_6O .

Structural Isomer 1

Structural Isomer 2

Skill level 2	
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- b. Describe a test to **distinguish** between the two structural isomers in a. above.

Skill level 2	
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3. Use *Markovnikoff's rule* to describe the **products formed** when HCl is added to propene.
Include in your response the structures of the products, and **major and minor products formed**.

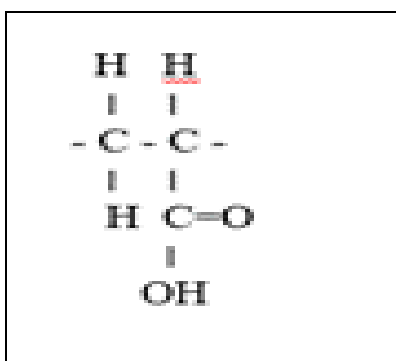
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4. **Differentiate** between **triglycerides** produced by **plants** and those produced by **animals**.

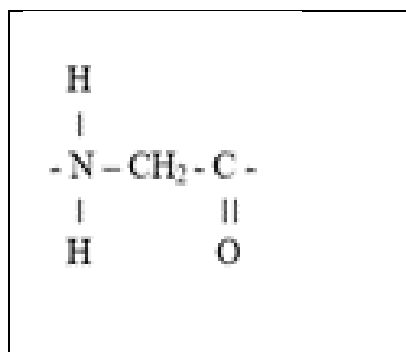
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5. Shown in the boxes below are the **repeating units** of two **polymers, A and B**.

Polymer A



Polymer B



Use the repeating units of Polymer A and Polymer B to **distinguish** between **addition and condensation polymerisation**.

Consider in your response the following:

- The possible monomer of Polymer A and the possible monomer of Polymer B.
- Differences between the structures of the two monomers,
- Differences in how the two monomers form their polymer. Resulting in the two different repeating units.

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PERIODIC TABLE

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		Molar mass / g mol ⁻¹																			
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