MARKER CODE				

STUDENT ENROLMENT NUMBER (SEN)									

TONGA FORM SIX CERTIFICATE

2023

CHEMISTRY

QUESTION AND ANSWER BOOKLET

Time allowed: 3 Hours

INSTRUCTIONS:

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

SECTION	STRANDS	TOTAL SKILL LEVEL
ONE	ATOMIC STRUCTURE AND BONDING	14
TWO	SOLIDS AND RELATED PROPERTIES AND KINETIC CHEMISTRY	16
THREE	QUANTITATIVE, INORGANIC AND REDOX CHEMISTRY	17
FOUR	ORGANIC CHEMISTRY	23
	TOTAL	70

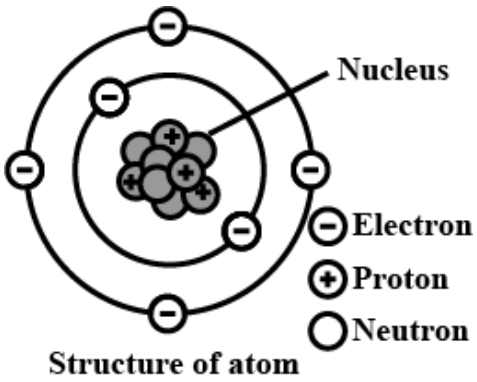
3. Answer ALL QUESTIONS. Write your answers in the spaces provided in this booklet.
4. Use a **BLUE** or **BLACK** ball point pen only for writing. Use a pencil for drawing if required.
5. If you need more space for answers, ask the supervisor for extra paper. Write your **Student Enrolment Number (SEN)** on each additional sheet, number the questions clearly and insert them in the appropriate places in this booklet.
6. There is a periodic table of the elements provided on page 15.
7. Check that this booklet contain pages 2-15 in the correct order and that page 14 has been deliberately left blank.

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

SECTION ONE: ATOMIC STRUCTURE AND BONDING

1. Study **Figure 1** below to answer the questions that follow.

Figure 1



Structure of atom

a. Define the following terms:

i. Proton

_____

_____

_____

Skill level 1	
1	
0	
NR	

ii. Electron

_____

_____

_____

Skill level 1	
1	
0	
NR	

b. Determine the **mass number** of the atom in **Figure 1**.

Skill level 1	
1	
0	
NR	

c. **Name** the atom in **Figure 1**.

_____

_____

Skill level 1	
1	
0	
NR	

d. Determine the **number of valence electrons** of the atom in **Figure 1**.

_____

_____

Skill level 1	
1	
0	
NR	

2. Describe **how** covalent bond forms using Lewis Structure in Oxygen, O_2.

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Skill level 2	
2	
1	
0	
NR	

3. a. **Draw the shape** of HOCl molecule.

Skill level 3	
3	
2	
1	
0	
NR	

b. **Name** the shape of HOCl.

_____

Skill level 1	
1	
0	
NR	

4. Explain **why** OF_2 and CO_2 have different bonding angles.

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Skill level 3	
3	
2	
1	
0	
NR	

SECTION TWO: SOLIDS AND RELATED PROPERTIES AND KINETIC CHEMISTRY

Skill level 1	
1	
0	
NR	

1. Name the **type of bonds** that holds ice water particles together.

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_____

Skill level 1	
1	
0	
NR	

2. Define the term '**hydration**'.

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3. Describe **how** Potassium Sulphate dissolves in water.

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Skill level 2	
2	
1	
0	
NR	

4. Explain the **difference** between the boiling point of Sodium Chloride and Ethanol.

Substance	**Boiling point (^{0}C)**
Sodium Chloride	1686
Ethanol	78.37

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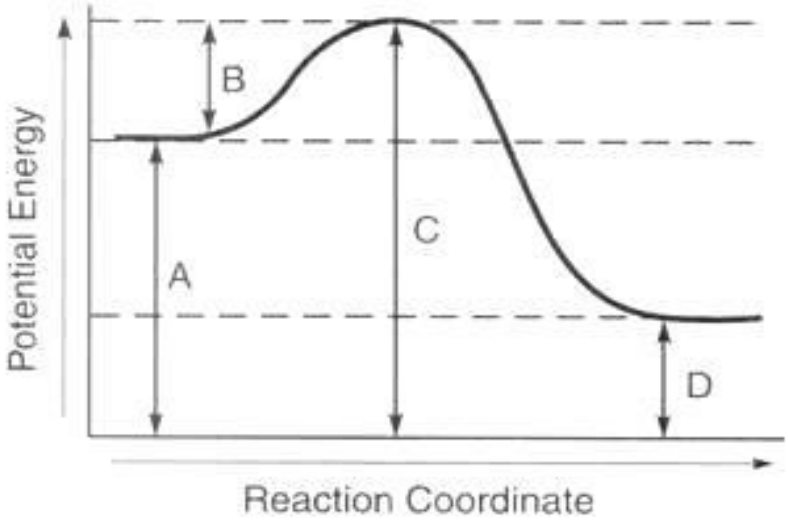
Skill level 3	
3	
2	
1	
0	
NR	

5. **Figure 2** shows an example of an energy diagram.

Figure 2



Use the letters from **Figure 2** to determine the following:

ENERGY DIAGRAM	LETTER FROM THE GRAPH-FIGURE 2
i. E_a	
ii. $\sum\Delta H$ reactant	
iii. $\sum\Delta H$ product	

Skill level 1	i.	ii.	iii.
1			
0			
NR			

6. Use **Le Chatelier's principle** to explain the qualitative effects of changing the **temperature** to produce more methanol.

$2H_2(g) + CO(g) \leftrightarrow CH_3OH(g)$ the forward direction is exothermic.

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Skill level 3	
3	
2	
1	
0	
NR	

7. Apply Hess Law to **calculate the energy change** for the chemical reaction:

$Zn\,(s) + S(s) \rightarrow ZnS(s) \quad \Delta^oH=$

By using the following information:

$Zn(s) + ½\,O_2(g) \rightarrow ZnO(s) \qquad \Delta^oH = -348$ kJ/mol

$ZnS(s) + 1½\,O_2(g) \rightarrow ZnO(s) + SO_2(g) \qquad \Delta^oH = -441$ kJ/mol

$S(s) + O_2(g) \rightarrow SO_2(g) \qquad \Delta^oH = -297$ kJ/mol

Skill level 3	
3	
2	
1	
0	
NR	

SECTION THREE: QUANTITATIVE, INORGANIC AND REDOX CHEMISTRY

1. Define **Avogadro's number**.

_____

_____

_____

Skill level 1	
1	
0	
NR	

2. 20mL of potassium hydroxide solution was neutralized by 24mL of 0.167mol/L solution of hydrochloric acid.

$KOH + HCl \rightarrow KCl + H_2O$

Calculate the **amount** of neutralized potassium hydroxide in the solution.

Skill level 2	
2	
1	
0	
NR	

3. **Name** the following complex ion:

a. $[Cu(NH_3)_4]^{+2}$

_____

_____

Skill level 1	
1	
0	
NR	

b. $[Zn(OH)_4]^{-2}$

_____

_____

Skill level 1	
1	
0	
NR	

4. Relate the **bonding** in the oxides of Sodium and Sulfur to their **position** in the periodic table.

Skill level 3	
3	
2	
1	
0	
NR	

5. Describe the **type of bonds** existing in Chlorides formed between chlorine and phosphorus.

Skill level 2	
2	
1	
0	
NR	

6. Explain oxidation and reduction reactions in terms of **oxidation number**.

Skill level 3	
3	
2	
1	
0	
NR	

7. Discuss the **occurrence** of oxidation and reduction in a breathalyzer test.

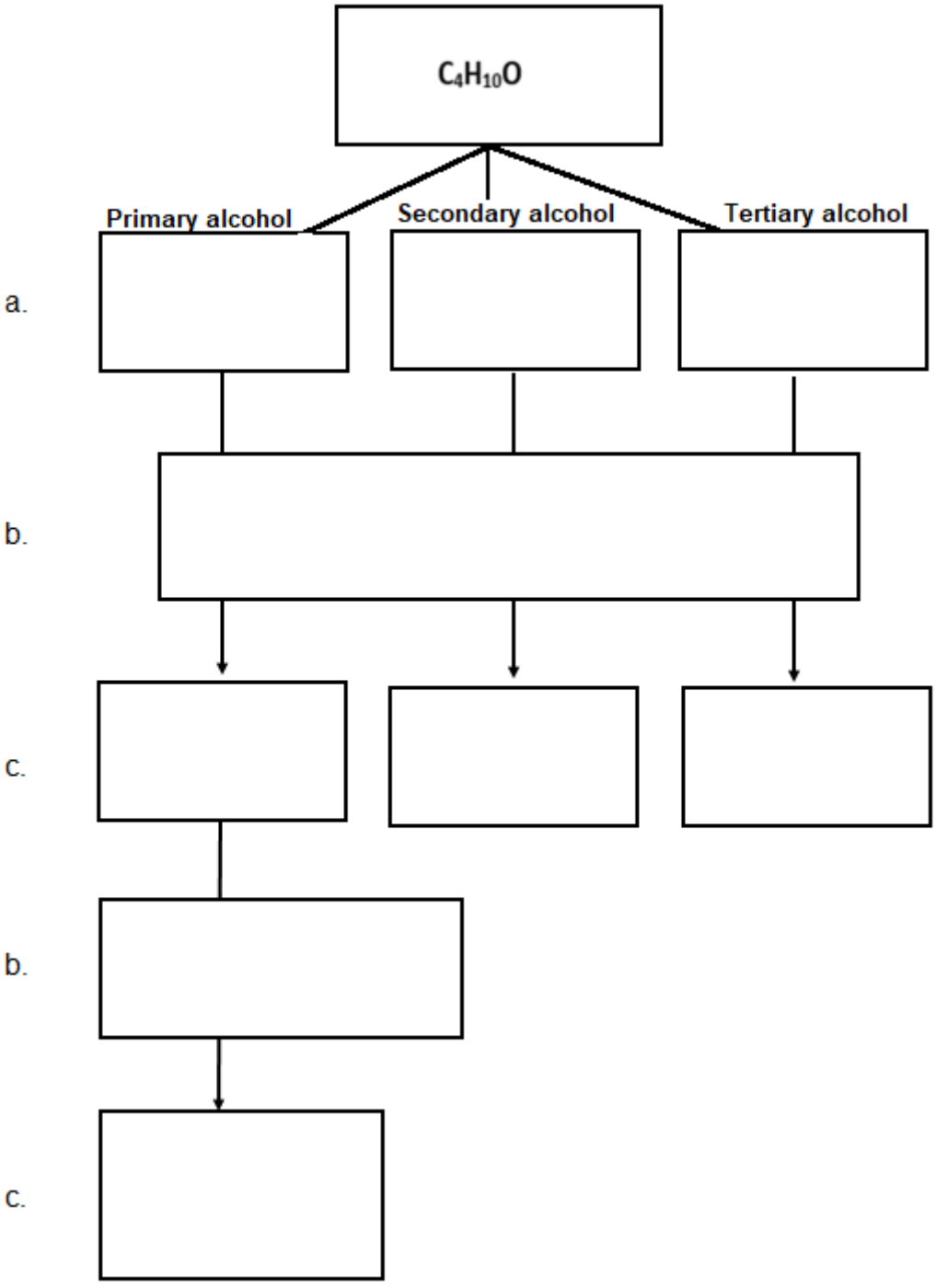
Skill level 4	
4	
3	
2	
1	
0	
NR	

SECTION FOUR: ORGANIC CHEMISTRY

1. $C_4H_{10}O$ - butanol can form three different types of alcohols. Discuss a test to differentiate between the products of the oxidation of the three different types of alcohols in butanol $C_4H_{10}O$

   Study the flowchart below for the oxidation of three different types of butanol then:

   a. **draw** the structural formula and **name** the alcohol
   b. **name the test reagent** used and
   c. **draw** structural formula for products and name



Skill level 4	
4	
3	
2	
1	
0	
NR	

2. Describe the **physical properties** of cis and trans isomers in but-2-ene.

Skill level 2	
2	
1	
0	
NR	

3. Write the **equation** for the reactions in the test to differentiate the ketone from an aldehyde.

Skill level 3	
3	
2	
1	
0	
NR	

4. Explain using **structural formula** the production of polythene and polyvinyl chloride.

Skill level 3	
3	
2	
1	
0	
NR	

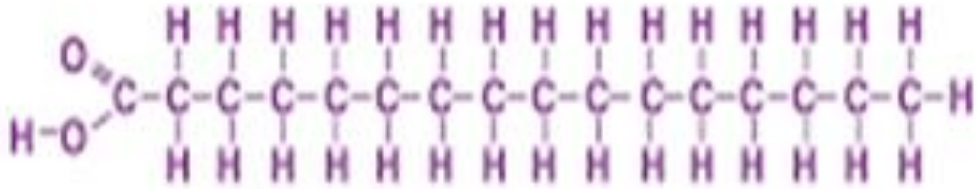
5. Explain the **differences in structures** of the two structural isomers of glucose: open and cyclic.

Skill level 3	
3	
2	
1	
0	
NR	

6. Describe the **conditions** in which stereoisomerism can occur in alkenes.

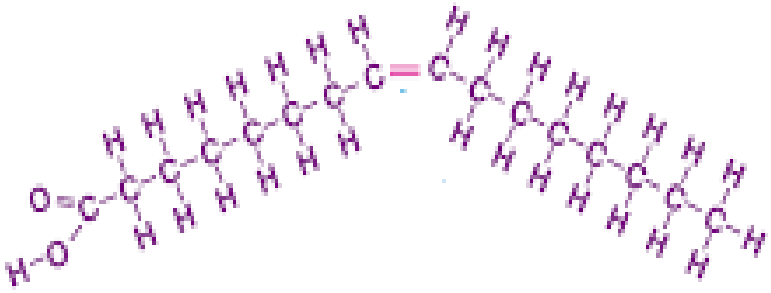
Skill level 2	
2	
1	
0	
NR	

7. Draw the **structure** of the triglycerides given the structure of the constituent fatty acids.



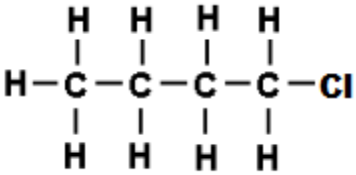
Skill level 2	
2	
1	
0	
NR	

8. Identify by **circling** the functional group of the carboxylic acid.



Skill level 1	
1	
0	
NR	

9. **Name** the structure shown below.



Skill level 1	
1	
0	
NR	

_____

10. Describe **Markovnikov's rule** in the reaction of 1-butene with hydrogen chloride.

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Skill level 2	
2	
1	
0	
NR	

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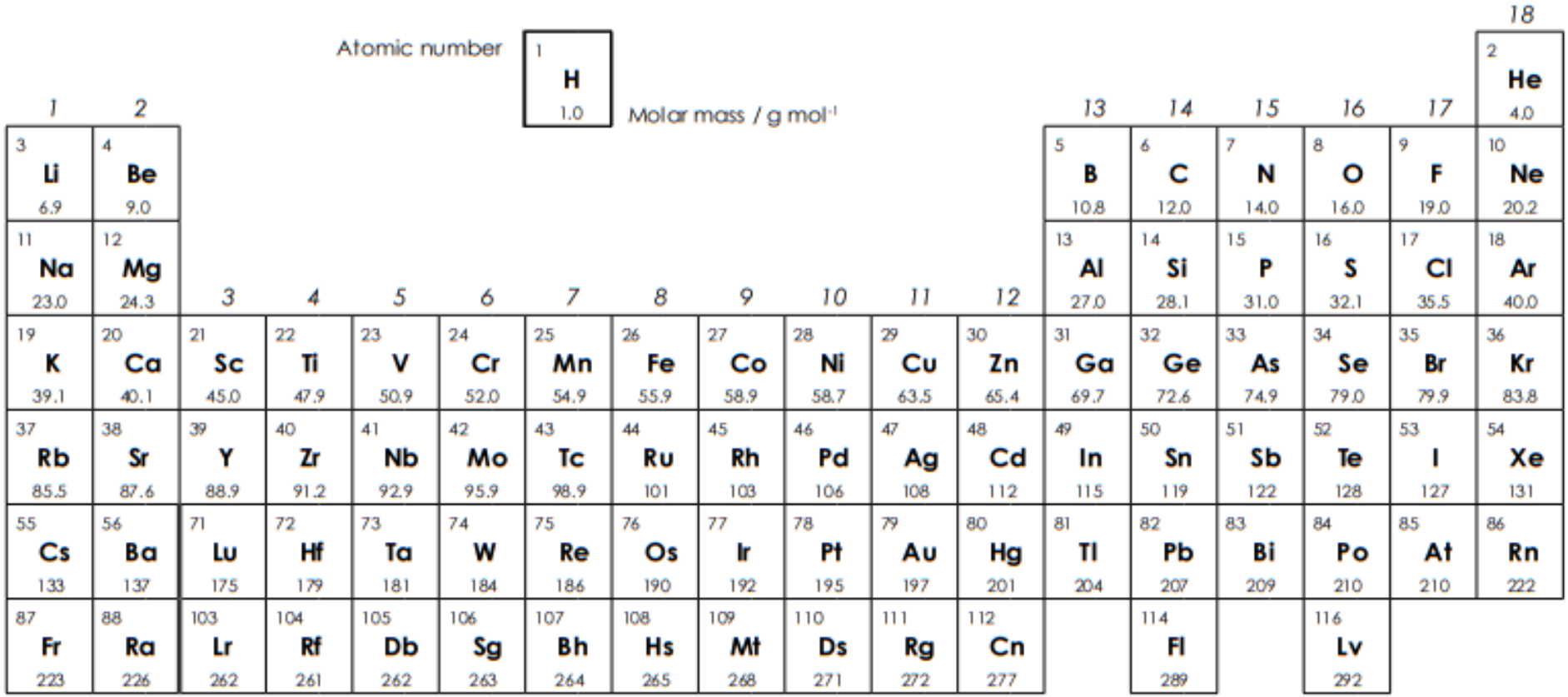
PERIODIC TABLE



Lanthanide Series	57 La 139	58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 147	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173
Actinide Series	89 Ac 227	90 Th 232	91 Pa 231	92 U 238	93 Np 237	94 Pu 239	95 Am 241	96 Cm 244	97 Bk 249	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259