MARKER CODE				

Student Enrolment Number (SEN)									

TONGA FORM SIX CERTIFICATE

2017

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. ALL SECTIONS ARE COMPULSORY in this examination booklet.
3. Additional sheets of paper can be obtained from your supervisor if necessary. Write your **Student Enrolment Number (SEN)** on each addition sheet, number the questions clearly and insert them in the appropriate part of this booklet.
4. You are expected to apply the principles and knowledge learned from the Chemistry curriculum taught throughout this academic year.
5. This examination consists of **FIVE** QUESTIONS.

QUESTIONS		Pages	Total Weight
1	Atomic Structure, Bonding and Shapes of Molecules	2-5	18
2	Quantitative Chemistry	6-7	13
3	Organic and Inorganic Chemistry	8-10	19
4	Principles and Physical Chemistry	11-13	15
5	Oxidation and Reduction	14-15	10
		35	75

6. Check that this booklet contains pages 2-15 in the correct order and that none of the pages is blank.

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

ATTEMPT ALL QUESTIONS IN THIS EXAM PAPER.

Write the answer to each question in the correct spaces provided.

QUESTION 1: ATOMIC STRUCTURE, BONDING & SHAPES OF MOLECULES

a. Write the electron configuration of ***potassium ion (K^+)*** using s, p, d, f notation.

Skill level 1	
1	
0	
NR	

b. Name the atom having **FIVE** (5) valence electrons in the third energy level.

Skill level 1	
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0	
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c. Which of these three ions is produced by an atom from ***group 1***. Ions **X^-, Y^{2+}** and **Z^+.**

Skill level 1	
1	
0	
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d. In your own words, define the term ***electronegativity***.

Skill level 1	
1	
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e. Explain the trend of the ***Atomic Radii*** across the period (from left to right) and down the group.

Skill level 3	
3	
2	
1	
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f. Lina, a Form 6 Chemistry student was given and told to analyse two solutions having the same molar masses as follows.

Solution A: Diethyl ether, Mr = 74 g/mol ($CH_3 – CH_2 – O – CH_2 – CH_3$)
Solution B: Butan – 1 – ol, Mr = 74 g/mol ($CH_3 – CH_2 – CH_2 – CH_2 – OH$)

i. Describe the type of intermolecular forces in each of the given solutions.

Skill level 2	
2	
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ii. Compare the type of intermolecular forces in the two solutions and say which has the higher boiling point.

Skill level 3	
3	
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g. Describe the ***physical property*** that makes copper a suitable element for electrical wires.

Skill level 2	
2	
1	
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h. Nitric acid (**HNO_3**) a colourless liquid is one of the strongest mineral acids. It is used in the production of ammonium nitrate for fertilizers, making plastics, and in the manufacture of dyes.

i. Draw the ***Lewis structure*** of Nitric acid (**HNO_3**).

Skill level 1	
1	
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ii. Deduce the ***final shape*** of Nitric acid (**HNO_3**) using electron pair repulsion theory.

Skill level 3	
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QUESTION 2: QUANTITATIVE CHEMISTRY

a. Vinyl ether, also known as Vinethene (pharmaceutical trade name) is a clear, nearly colorless, volatile liquid which was briefly used as an inhalation anesthetic. I is composed of 68.54% carbon (C), 8.63% hydrogen (H), and 22.83% oxygen (O) by mass.

Calculate its ***empirical formula***.

Skill level 2	
2	
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0	
NR	

b. Distinguish between ***empirical formula and molecular formula*** giving ***suitable examples***.

Skill level 3	
3	
2	
1	
0	
NR	

c. The reaction of zinc with sulfuric acid is shown below but one of the product is unknown and is written as ***X.***

$$Zn_{(s)} + H_2SO_{4\,(aq)} \longrightarrow H_{2\,(g)} + \boldsymbol{X}$$

i. Complete the above reaction equation by writing the correct ***chemical formula*** of the unknown product ***X.***

Skill level 1	
1	
0	
NR	

ii. In an experiment, 250 g of zinc (Zn) is reacted with access sulfuric acid (H_2SO_4) solution. Predict the ***amount (in grams) of hydrogen gas (H_2) produced*** using stoichiometric analysis. *(Assuming 1:1 mole ratio between zinc and hydrogen gas)*

Skill level 4	
4	
3	
2	
1	
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NR	

d. A titration reveals that 11.6 mL of 3.0 M standard solution of hydrochloric acid (HCl) is required to neutralise the sodium hydroxide in 25.00 mL of NaOH solution.

i. Define the term ***standard solution***.

Skill level 1	
1	
0	
NR	

ii. Calculate the ***concentration*** of NaOH solution.

Skill level 2	
2	
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QUESTION 3: ORGANIC AND INORGANIC CHEMISTRY

a. Draw the structures of cis-2-butene and trans-2-butene

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Skill level 2	
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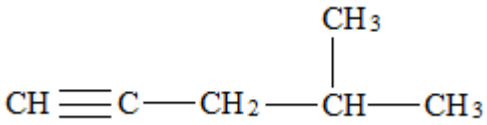
b. Use the IUPAC nomenclature system to name the following structure.



IUPAC name: _____

Skill level 2	
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Write an equation for the ***substitution reaction of ethane with chlorine***.

Skill level 3	
3	
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0	
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c. Write an equation for the ***addition reaction of 1-propene with water***.

Skill level 3	
3	
2	
1	
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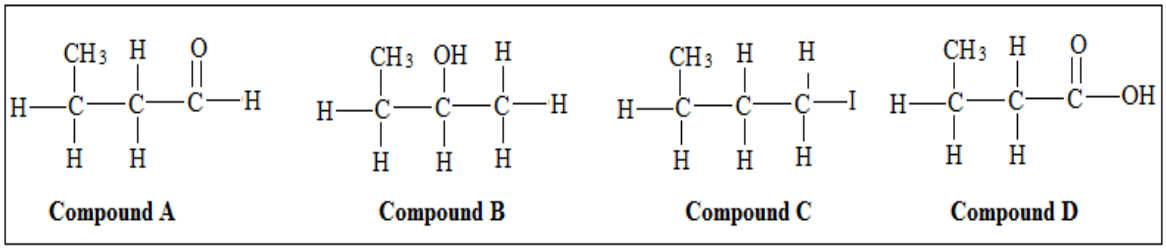
NR	

d. Given below are structures of different organic compounds.



i. Name ***compound C***

IUPAC name: _____

Skill level 1	
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ii. Which of the above compounds is an ***aldehyde***?

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Skill level 1	
1	
0	
NR	

iii. Name the ***major group of organic compound*** where compound D belongs to.

_____

Skill level 1	
1	
0	
NR	

iv. ***Draw and name*** the product formed from the oxidation of compound B using IUPAC naming system.

Skill level 2	
2	
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IUPAC name: _____

e. State the ***unique physical property*** of all esters.

Skill level 1	
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f. Explain the ***ratio of the atoms in the oxide*** as it relates to the position of the element in the periodic table.

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Skill level 3	
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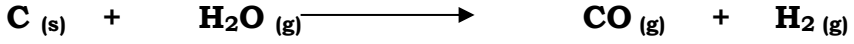
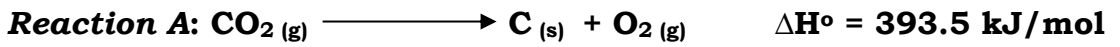
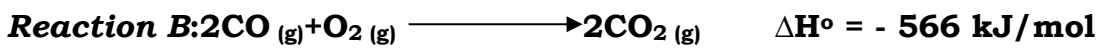
QUESTION 4: PRINCIPLES OF PHYSICAL CHEMISTRY

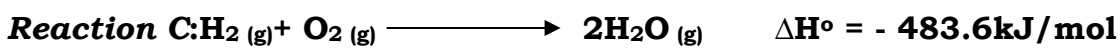
a. When steam is passed over hot charcoal at 1000 ^{o}C, carbon monoxide and hydrogen gas are produced. The equation for the ***net reaction*** is as follows.



i. Evaluate the ***enthalpy change value*** of the above reaction using the following data.







Skill level 4	
4	
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ii. State whether the net reaction is ***endothermic or exothermic***.

Skill level 1	
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iii. Construct an energy profile diagram for ***Reaction A***. In the diagram, label the activation energy as ***EA*** and energy change as ΔH.

Skill level 2	
2	
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b. Explain ***the role of a catalyst*** in a chemical reaction.

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Skill level 3	
3	
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c. Consider the following ***equilibrium*** reaction

$$N_2O_{(g)} + NO_{2(g)} \longleftrightarrow 3\ NO_{(g)} \qquad \Delta H^o = +155.7\ kJ$$

i. Define the term ***dynamic equilibrium***.

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Skill level 1	
1	
0	
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ii. Using Le Chatlier's principle, ***predict the direction*** in which the reaction will be shifted and ***explain how the concentration*** of ***nitrogen dioxide $NO_{2\,(g)}$*** will be affected if the volume of the container is increased at constant temperature.

Skill level 4	
4	
3	
2	
1	
0	
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QUESTION 5: OXIDATION AND REDUCTION

a. Define the term ***oxidation reaction in terms of electron transfer***.

Skill level 1	
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NR	

b. Explain ***oxidation and reduction reactions*** in terms of changes in oxidation states (numbers).

Skill level 3	
3	
2	
1	
0	
NR	

c. Consider the following unbalanced redox reaction.

$$Ni + NO_3^- \longrightarrow Ni^{2+} + NO$$

i. Identify the ***reductant*** in the above redox reaction.

Skill level 1	
1	
0	
NR	

ii. Define the term ***oxidant.***

Skill level 1	
1	
0	
NR	

iii. ***Balance*** the above redox reaction showing all workings clearly.

Skill level 3	
3	
2	
1	
0	
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d. Name **ONE** (1) ***common oxidizing agent*** found in the laboratory.

Skill level 1	
1	
0	
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