TONGA GOVERNMENT
MINISTRY OF EDUCATION AND TRAINING

TONGA FORM SIX CERTIFICATE
2014
CHEMISTRY

QUESTION AND ANSWER BOOKLET

Time allowed: 3 Hours

INSTRUCTIONS

1. Write your Student Personal Identification Number (SPIN) on the top right hand corner of this page and on the last page of this booklet. Write the Marker Code in the box at the top left hand corner of this page.

2. This Examination Paper consists of TWO sections. Answer ALL QUESTIONS.

   SECTION A : MULTIPLE CHOICE   40 MARKS
   SECTION B : SHORT ANSWERS   160 MARKS
   TOTAL   200 MARKS

3. Write the answer to the Multiple Choice Questions in the answer sheet at the back of this Booklet.

4. In SECTION B, write the answers to the questions in the spaces provided.

5. Check that this booklet contains pages 2-35 in the correct order and that none of these pages are blank.

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

TOTAL MARKS

200
SECTION A: MULTIPLE CHOICE (40 MARKS)

Answer **ALL** the questions in this section. Write the LETTERS of the best answers in the boxes at the back flap on this booklet. **Questions 1-16** are worth 1 mark each, Questions **17-25** worth 2 marks and Questions **26-27** are worth 3 marks.

**QUESTION 1:**
The valence electrons of elements like Chlorine and bromine are the same as group ________.
A. 1  
B. 5  
C. 1  
D. 7

**QUESTION 2:**
Gain of electrons is defined as ________________.
A. Oxidation  
B. Reduction  
C. Redox  
D. Oxired

**QUESTION 3:**
Common reducing agents include each of the following except ____________.
A. Carbon  
B. Carbon Monoxide  
C. Iron  
D. Oxygen

**QUESTION 4:**
The pH value of water is ______.
A. 14  
B. 12  
C. 0  
D. 7
**QUESTION 5:**
In an acid base reaction, the base is the substance that ____________.

A. donates the hydrogen or proton
B. accepts the hydrogen or proton
C. causes the reaction to occur
D. speeds up the reaction

**QUESTION 6:**
There are organic compounds which have a distinctive fruity smell and are present in the essential oils of plants. These organic compounds are most likely __________.

A. Alkenes
B. Oils
C. Esters
D. Carbohydrates

**QUESTION 7:**

![Figure 1: Reaction co-ordinate diagram.](image)

The reaction co-ordinate diagram in **Figure 1** represents a/an

A. exothermic reaction.
B. endothermic reaction.
C. sketch of a very high mountain.
D. reaction in which a catalyst was used.
QUESTION 8:

Heat that is evolved or absorbed when a reaction takes place under constant pressure is referred to as _____________.

A. standard enthalpy
B. enthalpy change
C. just enthalpy
D. lost or gained energy

QUESTION 9:

The complex compound Y is used in the determination of the Equilibrium constant of reactions due to its characteristic colour, deep red colour, which absorbs light at a certain wavelength. The complex compound Y is:

A. [FeCNS]^{2+}
B. [Cu(NH3)4]^{2+}
C. [Al(OH)4]^{-}
D. [Zn(OH)4]^{2-}

QUESTION 10:

A physical system which does not allow certain transfer of energy or matter in or out of it is said to be _____________.

A. Open
B. Wide
C. Distant
D. Closed

QUESTION 11:

Which ONE of the following statements correctly defines a standard solution?

A. Solution whose concentration is accurately known.
B. Solution with an accurately known number of moles.
C. This solution has the ordinary properties of solutions.
D. Solution with an unknown or undetermined concentration.
QUESTION 12:
Consider the reaction: $\text{Zn (s) + HCl (l)} \rightarrow \text{ZnCl}_2 + \text{H}_2$

The missing symbols on the product side which identifies the state of the product at room temperature respectively are:

A. l and aq
B. aq and g
C. s and g
D. aq and s

QUESTION 13:
What type of reaction is the following?

$\text{Cu}^{2+} + \text{Ag} \rightarrow \text{Cu} + \text{Ag}^+$

A. oxidation
B. reduction
C. redox
D. addition

QUESTION 14:
The concentration of a Calcium Chloride solution made up of 5 g of Calcium Chloride and 400 ml of water in gL$^{-1}$ is ____________.

A. 12.5
B. 10.5
C. 0.166
D. 0.013

QUESTION 15:
The substance in a reaction that causes other substances in the reaction to be oxidized is known as the ____________.

A. Reductant
B. Oxidant
C. Catalyst
D. Spectator
Use Figure 2 to answer QUESTIONS 16 and 17.

![Figure 2]

**QUESTION 16:**
The compound of Figure 2 is a _________________.
A. Primary alcohol
B. Secondary alcohol
C. Tertiary alcohol
D. structure of an Alkane

**QUESTION 17:**
Which ONE of the following is the IUPAC name of the compound in Figure 2.
A. Propanone
B. Propan – 1 – ol
C. Propan – 2 – ol
D. Propan – 3 – ol

**QUESTION 18:**
Which of the following are empirical formulae?

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>C₂H₆</td>
<td>CuSO₄</td>
<td>N₂O₄</td>
<td>Na₂SO₄</td>
</tr>
</tbody>
</table>

A. I and II
B. III and IV
C. II and III
D. II and IV
QUESTION 19

When ethanol and SOCl₂ in the presence of pyridine undergoes a substitution reaction, the product would be _______________.

A. Chloro ethane  
B. Di-chloro ethane  
C. the Ethanal  
D. Ethyl Sulfonate

Use **Figure 3** and the information below it to answer **QUESTIONS 20 and 21**.

**Figure 3**

Substance A has 20 protons and the same electrons as **Figure 3** in the 1\textsuperscript{st} and 2\textsuperscript{nd} shell. In the 3\textsuperscript{rd} shell it has only 8 electrons.

QUESTION 20

Substance A’s spdf electron configuration is__________.

A. 1s²2s²2p⁶3s²3p⁴4s²  
B. 1 s s²p²6s²3p⁴4s²  
C. 1s²2p⁶3s²3p⁶4s²  
D. 1s²2s²2p⁶3s²3p⁶

QUESTION 21

Substance A is the ______________________.

A. ion Magnesium  
B. ion Calcium  
C. element Neon  
D. element Calcium
**QUESTION 22**

**Table 1: UNIVERSAL INDICATOR COLOUR GUIDE**

<table>
<thead>
<tr>
<th>Strong Acid</th>
<th>Weak Acid</th>
<th>Neutral</th>
<th>Weak Base</th>
<th>Strong Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Red.........</td>
<td>..........................</td>
<td>Red Orange Yellow Yellowish Green</td>
<td>Green Blue</td>
<td>Purple</td>
</tr>
</tbody>
</table>

The Universal Indicator is used to determine the strength of an acid or base. Use the **UNIVERSAL INDICATOR COLOUR GUIDE** in **Table 1** to determine the appropriate colour that will show up when \( H_2SO_4 \) is mixed with the Universal Indicator.

A. Yellow
B. Orange
C. Purple
D. Red

**QUESTION 23:**

The percentage composition of Oxygen in \( Al_2(SO_4)_3 \) is _________.

A. 56
B. 65
C. 48
D. 19

Use the following equation to answer **Questions 24 and 25**.

\[
Cr_2O_7^{2-} + 14 H_3O^+ + 6 e^- \rightarrow 2 Cr^{3+} + 21 H_2O
\]

**QUESTION 24:**

The colour change of \( Cr_2O_7^{2-} \) to \( Cr^{3+} \) in the reaction is from ____________________.

A. red to orange
B. orange to green
C. orange to yellow
D. green to brown
QUESTION 25:

Which ONE of the following statement is correct about the equation?

A. The ion Cr$_2$O$_7^{2-}$ is reduced to the ion Cr$^{3+}$.
B. The ion Cr$_2$O$_7^{2-}$ is oxidized to the ion Cr$^{3+}$.
C. This reaction is in a very basic environment.
D. This reaction is an oxidation reaction.

QUESTION 26:

Calculate the standard enthalpy of combustion of phenol, C$_6$H$_5$OH, at 298.15 K in KJ mol$^{-1}$ given that, at this temperature, the standard enthalpy of formation of phenol is -165.0 kJ mol$^{-1}$, of liquid water, H$_2$O is -285.8 kJ mol$^{-1}$ and gaseous carbon dioxide, CO$_2$, is -393.51 kJ mol$^{-1}$.

A. -2202.9
B. -1872.9
C. -514.3
D. -844.3

QUESTION 27:

What is the sum of all coefficients when the following equation was balanced with the lowest whole number possible?

\[ \text{H}_5\text{IO}_6 + \text{Cr} \rightarrow \text{IO}_3^- + \text{Cr}^{3+} \]

A. 10
B. 16
C. 22
D. 25
SECTION A: SHORT ANSWERS (160 MARKS)

Answer **ALL** the questions in this **SECTION**. Write your answers in the space provided.

QUESTION 28: ATOMIC STRUCTURE & BONDING AND QUANTITATIVE CHEMISTRY (20 MARKS)

PART A: Atomic Structure and Bonding (11 Marks)

1.a) Define the following terms:

i) Electronegativity  
______________________________________________________________________  
______________________________________________________________________  
(1 mark)

ii) First Ionisation Energy  
______________________________________________________________________  
______________________________________________________________________  
(1 mark)

*Figure 4: Ionization energies of the first 20 elements.*

![Ionization energies of the first 20 elements](image)
a) State the trend of the first ionization energy of the second period of the periodic table.

____________________________________________________________________________
(1 mark)

b) Explain the general trend of the first ionization energy of the second period of the periodic table.

____________________________________________________________________________
____________________________________________________________________________
(2 marks)

c) Explain why Ar has higher ionization energy than K.

____________________________________________________________________________
____________________________________________________________________________
(2 marks)

d) Consider the elements Mg and Cl.

i) Which element would have the bigger electronegativity?

____________________________________________________________________________
(1 mark)

ii) Explain why this element has the bigger electronegativity.

____________________________________________________________________________
____________________________________________________________________________
(2 marks)

iii) State the type of bond that exists between the atoms of Mg and Cl in the compound MgCl$_2$.

____________________________________________________________________________
(1 mark)
A 1.0 g sample of a compound X contains only Carbon, Hydrogen and Oxygen. It was burned in excess Oxygen. The products were 2.52g of Carbon Dioxide and 0.0443g of Water.

a) Determine the mass of carbon and hydrogen and Oxygen in X, using the combustion and precipitation data reaction.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(3 marks)

b) Determine empirical formula of X.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(3 marks)

c) The molar mass was determined to be 394 g mol\(^{-1}\). Deduce the molecular formula of X.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(3 marks)
Table 2

<table>
<thead>
<tr>
<th></th>
<th>Sodium</th>
<th>Sulfur</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxide bond type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride bond type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride conductivity in liquid</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) For each of the two elements of period 3, fill Table 2 with their oxide and chloride bonding type, except Sulfur’s chloride and chloride liquid conductivity in the appropriate boxes.

   (4 marks)

b) Relate the conductivity or non-conductivity of the chloride of Sodium to its structure.

   __________________________________________________________________________
   __________________________________________________________________________

   (1 mark)

c) Aluminium is another element in period 3. The oxide of aluminium is Amphoteric or it can both react as an acid and a base.

Write balanced chemical equations which describes how the oxide of Aluminium acts as an:

i) Acid : ________________________________________________________________

   (2 marks)

ii) Base : ________________________________________________________________

   (2 marks)
PART B: Organic Chemistry

Figure 5:

a) What kind of organic compound is shown in Figure 5?

____________________________________________________________________________
(1 mark)

b) How many alkyl substituents are attached to the longest chain?

____________________________________________________________________________
(1 mark)

c) What is the IUPAC name of the compound in Figure 5?

____________________________________________________________________________
(2 marks)

d) The following is a reaction of a plant oil producing a component of margarine.

\[ \text{linoleic} \]
\[ \text{linoleic} \]
\[ \text{oleic} \]
\[ \text{H}_2, \text{Ni} \]
\[ \text{stearic} \]
\[ \text{oleic} \]
\[ \text{oleic} \]
i) Name the type of reaction that takes place here.  

________________________________           (1 mark)

ii) By looking at the general structure of the plant oil, what group of organic compound would oil be classified as?  

_______________________________________________________________________  (2 marks)

iii) Compare the degree of saturation of the plant oil and the margarine component and explain why.  

_______________________________________________________________________  

_______________________________________________________________________  

_______________________________________________________________________  (2 marks)

iv) Contrast the melting points of the reactant and the product using their structures.  

_______________________________________________________________________  

_______________________________________________________________________  

_______________________________________________________________________  (2 marks)
PART A: Quantitative and Organic Chemistry      (14 Marks)

a) During an acid base titration the equipments in Figure 6 were used. Name the labelled equipments:

A: ___________________________           (1 mark)
B: ___________________________           (1 mark)
C: ___________________________           (1 mark)
D: ___________________________           (1 mark)
E: ___________________________           (1 mark)

b) A group of Form 6 students conducted an acid base titration in class where 0.01 molL\(^{-1}\) of Hydrochloric acid was titrated with 25 ml of Sodium Hydroxide. They used methyl orange as their indicator. The students obtained the following results:

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Initial Readings</th>
<th>Final Readings</th>
<th>Volume (ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rough</td>
<td>0</td>
<td>24.40</td>
<td>24.40</td>
</tr>
<tr>
<td>1</td>
<td>24.4</td>
<td>48.25</td>
<td>23.85</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>23.80</td>
<td>23.80</td>
</tr>
<tr>
<td>3</td>
<td>23.80</td>
<td>47.60</td>
<td>23.80</td>
</tr>
</tbody>
</table>

Average Titre
i) In Table 3, write the Average Titre volume. (2 marks)

ii) What colour change occurs at the end point of the titration? (1 mark)

iii) Write the balanced equation of the reaction that takes place during the titration. (2 marks)

iv) How many moles of Hydrochloric acid were used in the reaction? (1 mark)

v) How many moles of Sodium Hydroxide were in the reaction? (1 mark)

vi) Calculate the concentration of the Sodium Hydroxide in mol L\(^{-1}\). (2 marks)
PART B: Organic Chemistry (6 Marks)

Alcohol undergoes oxidation when excess oxidizing agent is heated under reflux with the alcohol.

CH₃CH₂OH → G → F → H

a) Write the chemical formula of the oxidizing agent F that is used with H⁺ in the oxidation of CH₃CH₂OH.

______________________________________________________________________

(1 mark)

d) Write the structural formulae of the compounds formed in the oxidation reaction.

G: ________________

H: ________________

(1 mark)

(1 mark)

c) Write the chemical equation for the oxidation of butan – 2 – ol. Use structural formulae for the organic compounds.

______________________________________________________________________

(3 marks)
QUESTION 31: PHYSICAL CHEMISTRY & ATOMIC STRUCTURE & BONDING

(20 MARKS)

PART A: Principles of Physical Chemistry

(13 Marks)

a) Aluminium reacts with dilute Hydrochloric acid to form Aluminium Chloride and Hydrogen.

i) Explain why the reaction of dilute hydrochloric acid with Aluminium foil is fairly slow compared to a reaction of the same mass of aluminium powder reacting vigorously with dilute hydrochloric acid.

______________________________________________________________________
______________________________________________________________________
(2 marks)

ii) Explain why a reaction of aluminium foil reacts faster with warm dilute Hydrochloric acid than a reaction of the same aluminium foil with cold dilute Hydrochloric acid?

______________________________________________________________________
______________________________________________________________________
(2 marks)

b) Explain the role of a catalyst in a chemical reaction.

____________________________________________________________________________
____________________________________________________________________________
(2 marks)

c) Ammonia is produced commercially in the Haber Process as in the following equation.

\[ \text{N}_2(g) + 3\text{H}_2(g) \rightleftharpoons 2\text{NH}_3(g) \quad \Delta H = -95 \text{ KJ mol}^{-1} \]

i) Is this reaction exothermic or endothermic?

____________________________________________________________________________
(1 mark)
ii) What kind of temperature is favoured in the production of ammonia? Explain why.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

(3 marks)

iii) Explain what happens to the concentration of ammonia should the volume of the reaction be decreased? Explain why.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

(3 marks)
PART B: Atomic Structure and Bonding (7 Marks)

a) Consider the compound Carbon Dioxide.

i) Draw the Lewis Structure of Carbon Dioxide.

______________________________________________________________________

(2 marks)

ii) State the shape and explain why Carbon Dioxide has this particular shape.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(3 marks)

iii) Determine whether the molecule of Carbon Dioxide is polar or non-polar.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(2 marks)
a) Edible oils and fats are refined by the Alkali Neutralization during its processing periods. Describe using the Stearic acid triglyceride structure in Figure 7 the Alkali Neutralization Process.

![Figure 7: Triglyceride](image)

b) Carbohydrate is an important compound as they make up the most of Earth’s biomass, ranging from tiny structural components of cells to the food we eat. C₆H₁₂O₆ is the same formula for two compounds of which one is glucose.

i) Name of the other compound with the same formula as glucose.
ii) Draw the two different straight structures of the compound, \( \text{C}_6\text{H}_{12}\text{O}_6 \).

1. 

__________________________

(2 marks)

2. 

__________________________

(2 marks)

iii) Explain what happens to the glucose when in the solution form.

______________________________________________________________________

(1 mark)

iv) Describe how a Benedict reagent indicates the presence of an open glucose structure.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

(2 marks)

v) Which part of the open glucose structure reacts with Benedict solution?

__________________________

(1 mark)
PART B: Oxidation and Reduction  

The Electrolysis of Copper Chloride is as in Figure 8.

a) For each arrow, correctly label the electrolysis diagram.

I: ________________________________  

J: ________________________________  

K: ________________________________  

b) Write the balanced half equations at the i) anode, ii) cathode then the iii) balanced total equation.

i) **Anode:** ________________________________  

ii) **Cathode:** ________________________________  

iii) **Total Equation:** ________________________________

(2 marks)

(c) The electrolysis of Copper Chloride is a redox reaction. Which electrode is the one where:

i) oxidation takes place?

______________________________  

(1 mark)

ii) reduction takes place?

______________________________  

(1 mark)
QUESTION 33: ATOMIC STRUCTURE & BONDING&ORGANIC CHEMISTRY
(20 MARKS)

PART A: Atomic Structure and Bonding
(9 Marks)

a) Metals are important in our everyday life so it is important to know how they can be used in our lives. Draw the structures of metallic bonding labeling the metallic ions.

____________________________________________________________________________

(2 marks)

b) Metals and their alloys are used in the making of aircrafts due to these properties: hardness, density, ductility, malleability, elasticity and so forth. Discuss why the malleability and ductility of metals are vital considerations during the makings of aircrafts.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(3 marks)

Figure 9: End of an electrical wire.

____________________________________________________________________________

(2 marks)

c) Identify the metal used and explain why it is used in the electrical wiring.

____________________________________________________________________________
Figure 10: Intermolecular and intramolecular forces in Water molecules.

Identify which is the stronger force intramolecular or intermolecular and explain why.

(2 marks)
PART B: Organic Chemistry

(11 Marks)

a) The following Flow diagram is how ethane is extracted from crude oil and its reactions.

Grude Oil → fractional distillation → 2 Carbons Alkane → steam cracking → L → M

i) Write the molecular formula of the 2 Carbons Alkane.

______________________________  (1 mark)

ii) Draw the structural formulae of all the compounds that are supposed to be formed in the labelled boxes:

L: ____________________________  (2 marks)
M: ____________________________  (2 marks)
N: ____________________________  (2 marks)

a) Write the balanced chemical reaction for the preparation of ethyne in the Laboratory.

______________________________  (2 marks)

b) Describe the unsaturation test for alkene using Baeyer’s reagent.

___________________________________________________________________________
___________________________________________________________________________  (2 marks)
Each student in the lab were given four test tubes where the following solutions Mg(NO₃)₂, Fe(NO₃)₂, NaCl and NaI were in each one. Describe the two precipitation tests that will identify each ion i) Mg²⁺ from Fe²⁺ and ii) Cl⁻ from I⁻

i) Precipitation test for Mg²⁺ and Fe²⁺


(2 marks)

ii) Precipitation test for Cl⁻ and I⁻


(2 marks)

iii) State ONE observation that students are expected to make in any one test.

<table>
<thead>
<tr>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precipitation test for Mg²⁺ and Fe²⁺</td>
</tr>
<tr>
<td>Precipitation test for Cl⁻ and I⁻</td>
</tr>
</tbody>
</table>

(1 mark)
iv) Write a balanced precipitation equation of any one of the four reactions that took place in the test tubes.

(2 marks)

b) Explain the similarities or the differences between Magnesium Sulfate and Barium Sulfate in terms of their water solubility.

(2 marks)

c) Write the ionic equation for the formation of the precipitate Calcium Carbonate.

(1 mark)

PART B: Quantitative Chemistry (10 Marks)

a) Define the following terms commonly used during the titration:

i) End point

(1 mark)

ii) Aliquot

(1 mark)

iii) Titre

(1 mark)
b) A 40ml solution of 0.02 mol/L sodium chloride solution was diluted by adding 20ml to the solution. What is the new concentration of the solution in mol/L?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(1 mark)

c) A hydrated Copper Sulfate compound which weighted 10g was dehydrated in an Experiment in the classroom and was found to contain 6.5g of anhydrous Copper Sulfate.

i) Describe how hydrated copper sulfate became anhydrous Copper Sulfate.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(2 marks)

ii) What is the % composition of the water of crystallisation.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(2 marks)

iii) How many water molecules that are in the hydrated copper sulfate compound?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(2 marks)
QUESTION 35: ORGANIC CHEMISTRY & PRINCIPLES OF PHYSICAL CHEMISTRY (20 MARKS)

PART A: Organic Chemistry (9 Marks)

a) The Carboxylic acid is a group of organic compounds that follow a general rule. The first Carboxylic acid is CH₃COOH.

i) What is the general rule of the Carboxylic acid group?

____________________________________________________________________

(1 mark)

ii) Draw the structural formula of the 4 Carbons carboxylic acid.

____________________________________________________________________

(2 marks)

iii) Write the balanced chemical equation of the reaction of CH₃COOH with sodium Hydroxide.

____________________________________________________________________

(2 marks)

iv) Write the balanced chemical equation of the reaction of the 4 Carbons carboxylic acid with propanol.

____________________________________________________________________

(2 marks)

v) Write the IUPAC name of the main product of the reaction in iv)?

____________________________________________________________________

(2 marks)
PART B: Principles of Physical Chemistry (11 Marks)

a) Define the following terms:
   i) Strong acid: ____________________________________________________________
   (1 mark)
   ii) Weak base: ____________________________________________________________
   (1 mark)
   iii) Activation energy: ____________________________________________________
   (1 mark)

a) Water can act both as an acid and as a base.

   i) State the term that refers to the acidic and basic reactions of water?
      ____________________________________________________________
      (1 mark)

   ii) Write two balanced equations of when water acts as an acid and as a base.

      1. Acid: ____________________________________________________________
      (2 marks)

      2. Base: ____________________________________________________________
      (2 marks)

b) What is the pH of a 0.0025M of HCl?

   ____________________________________________________________
   (2 marks)

c) What is the pOH of a solution with a hydroxide ion concentration of 4.58x10^-5? 

   ____________________________________________________________
   (1 mark)
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SECTION A: MULTIPLE CHOICE

Write the letter of your **Best** answer in the boxes below.

1. □ 15. □
2. □ 16. □
3. □ 17. □
4. □ 18. □
5. □ 19. □
6. □ 20. □
7. □ 21. □
8. □ 22. □
9. □ 23. □
10. □ 24. □
11. □ 25. □
13. □ 27. □
14. □

---

**S.A**

40

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**TONGA FORM SIX CERTIFICATE CHEMISTRY**

**2014**

**FOR MARKER’S USE ONLY**

<table>
<thead>
<tr>
<th>Sections</th>
<th>Marks</th>
<th>C/Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section A</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Section B</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Question 28</td>
<td>20</td>
<td></td>
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<tr>
<td>Question 29</td>
<td>20</td>
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<td>Question 30</td>
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<td>Question 31</td>
<td>20</td>
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<tr>
<td>Question 32</td>
<td>20</td>
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