



MARKER CODE

STUDENT EDUCATION NUMBER



Samoa Secondary Leaving Certificate

CHEMISTRY

2015

QUESTION and ANSWER BOOKLET

Time Allowed: 3 Hours and 10 Minutes

INSTRUCTIONS

1. You have 10 minutes to read **before** the exam starts.
2. Write your **Student Education Number (SEN)** in the space provided on the top right hand corner of this page.
3. Write your answers in the spaces provided in this booklet.
4. If you need more space, ask the Supervisor for extra paper. Write your SEN on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

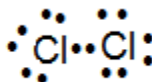
STRANDS	Pages	Time (Minutes)	Weighting
STRAND 1: Atomic Structure and Bonding	2	30	17
STRAND 2: Quantitative Chemistry	5	30	17
STRAND 3: Inorganic Chemistry	9	18	10
STRAND 4: Organic Chemistry	11	40	22
STRAND 5: Physical Chemistry	16	18	10
STRAND 6: Principles of Chemical Changes	19	44	24
TOTAL		180	100

Check that this booklet contains pages 2-24 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

STRAND 1:**Atomic Structure and Bonding****WEIGHTING 17**

1.1 The electron-dot diagram for a molecule of chlorine is:



Draw electron-dot diagrams for a hydrogen chloride molecule. Show all the electrons in the valence shells.

Skill level 2	
2	
1	
0	
NR	

1.2 State a property of water which indicates that the water molecule is polar.

Skill level 1	
1	
0	
NR	

1.3 Explain the melting point of diamond compared to the low melting point of carbon dioxide in terms of bonding and structure of these substances.

Skill level 3	
3	
2	
1	
0	
NR	

- 1.4 Describe the trend in ionisation energy shown within a group or family of elements as the atomic number increases.

Skill level 2	
2	
1	
0	
NR	

- 1.5 *The most common isotope of carbon is represented by the symbol ${}^{12}_6\text{C}$. Chlorine has two naturally-occurring isotopes which have respectively relative isotopic masses of 35 and 37.*

Use symbols in the form used for the carbon isotope above to represent the one isotope of chlorine.

Skill level 1	
1	
0	
NR	

- 1.6 Define the term *electronegativity*.

Skill level 1	
1	
0	
NR	

- 1.7 Which is more electronegative – Carbon or Sulphur?

Skill level 1	
1	
0	
NR	

1.8 Draw the shape of the tetrachloromethane molecule.

Skill level 1	
1	
0	
NR	

1.9 Define the term atomic radius.

Skill level 1	
1	
0	
NR	

2.0 Consider the following ionization energies (kJ/mol) for oxygen and nitrogen:

	1 st IE	2 nd IE
Oxygen (O ₈)	1,310	2,860
Nitrogen (N ₇)	1,400	3,390

Evaluate the difference in first ionisation energies between oxygen and nitrogen.

Skill level 4	
4	
3	
2	
1	
0	
NR	

STRAND 2:**Quantitative Chemistry****WEIGHTING 17**

- 2.1 Use symbols to denote states of substances in the following chemical equation:



Skill level 1	
1	
0	
NR	

- 2.2 Define the term standard solution.

Skill level 1	
1	
0	
NR	

- 2.3 *Calcium hydroxide dissolves in water to form a saturated solution (limewater). To determine the concentration of limewater in mol/L, three separate 10 mL portions (aliquots) of the solution were titrated with 0.125 mol/L standardized hydrochloric acid using bromophenol blue as the indicator. The three titre values were 28.0 mL, 24.1 mL and 24.0 mL.*

- (i) List any TWO pieces of apparatus needed for the titration procedure.

Skill level 2	
2	
1	
0	
NR	

- (ii) Use the average of the other three titre values to calculate the number of moles of hydrochloric acid that reacted.

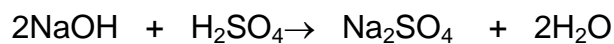
Skill level 2	
2	
1	
0	

NR	
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2.4 Define the term *end-point*.

Skill level 1	
1	
0	
NR	

2.5 The following equation represents the reaction between sodium hydroxide and sulphuric acid:



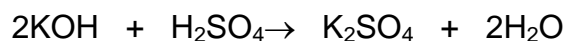
(i) If 20 mL of 0.2 mol/L sodium hydroxide solution is exactly neutralized by 20 mL of a sulphuric acid solution, calculate the concentration of the acid in mol/L.

Skill level 3	
3	
2	
1	
0	
NR	

(ii) Define the term *Molar mass*.

Skill level 1	
1	
0	
NR	

2.6 *The reaction between potassium hydroxide and sulphuric acid is represented by the equation:*



20 mL of a 0.3 mol/L potassium hydroxide solution is neutralized by 15 mL of sulphuric acid.

(i) How many moles of potassium hydroxide are required to react with 1 mole of sulphuric acid?

Skill level 1	
1	
0	
NR	

(ii) What is the formula for calculating the concentration of a solution?

Skill level 1	
1	
0	
NR	

(iii) Discuss the use of standard solutions and titrations in real life situations.

Skill level 4	
4	
3	
2	
1	
0	
NR	

STRAND 3: Inorganic Chemistry**WEIGHTING 10**

- 3.1 Write down the formula of the oxides of the first three elements of the second short period of the periodic table (sodium to chlorine).

Skill level 2	
2	
1	
0	
NR	

- 3.2 *The table below contains the chlorides of the elements in the third period from sodium to sulphur.*

NaCl	MgCl ₂	AlCl ₃	(i)	PCl ₃	SCl ₂
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- (i) Write the formula for the missing chloride.

Skill level 1	
1	
0	
NR	

- (ii) State the trend in bond type from left to right in the table above.

Skill level 1	
1	
0	
NR	

- 3.3 *When sodium oxide, Na₂O is added to water the solution turns litmus blue.*

Write the equation for the reaction of sodium oxide with water.

Skill level 3	
3	
2	
1	
0	
NR	

- 3.4 *Carbonate ions react with water to produce hydrogen carbonate, HCO₃⁻ ions.*

(i) Give a balanced ionic equation for this reaction.

Skill level 3	
3	
2	
1	
0	
NR	

STRAND 4:**Organic Chemistry****WEIGHTING 22**

- 4.1 Identify an important observation/s that would be made when *propanol* is warmed with *dilute acidified potassium dichromate*.

Skill level 1	
1	
0	
NR	

- 4.2 Write down the name and structure of any aldehyde with the molecular formula C_4H_8O .

Skill level 2	
2	
1	
0	
NR	

- 4.3 Identify any TWO properties of PVC that make it useful as a waterproof coat.

Skill level 2	
2	
1	
0	
NR	

4.4 Draw the functional group for the following:

(i) alcohol

Skill level 1	
1	
0	
NR	

(ii) carboxylic acid

Skill level 1	
1	
0	
NR	

(iii) aldehydes

Skill level 1	
1	
0	
NR	

(iv) ketones

Skill level 1	
1	
0	
NR	

4.5 Write an equation to show ethanoic acid reacting with sodium hydroxide.

Skill level 3	
3	
2	
1	
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4.6 Define the following terms.

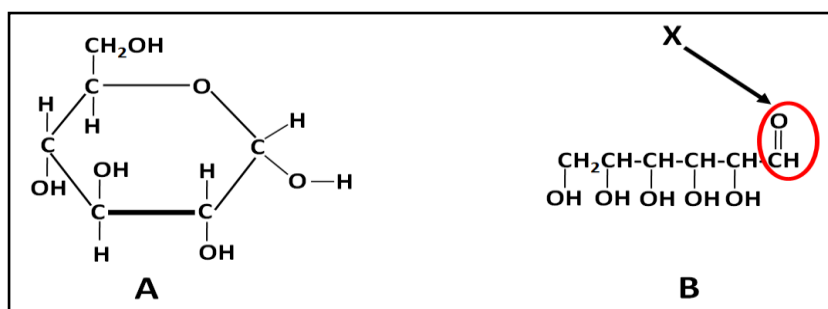
(i) Triglycerides

Skill level 1	
1	
0	
NR	

(ii) Esterification

Skill level 1	
1	
0	
NR	

4.7 Carbohydrates are naturally occurring organic compounds including glucose which is the building unit for cellulose and starch. Glucose exists in two forms; cyclic form and an open chain form as shown in the diagram below.



(i) Name the functional group marked X.

Skill level 1	
1	
0	
NR	

(ii) Discuss the purpose of the Fehling's test, the type of reaction that takes place, the explanations for the different colour changes and the final product that is formed.

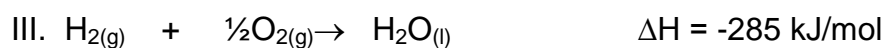
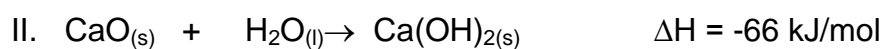
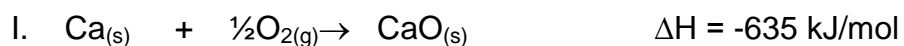
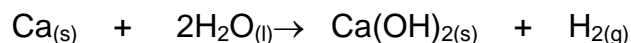
Skill level 4	
4	
3	
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NR	

4.8 Explain how soaps work to remove dirt and grease from surfaces.

Skill level 3	
3	
2	
1	
0	
NR	

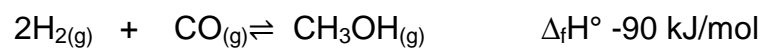
STRAND 5: Principles of Physical Chemistry WEIGHTING 10

5.1 Use the enthalpy changes of the three reactions, I, II and III below to calculate the enthalpy of the reaction:



Skill level 3	
3	
2	
1	
0	
NR	

5.2 For the equilibrium reaction:



Explain the effect on the equilibrium position when the pressure is increased.

Skill level 3	
3	
2	
1	
0	
NR	

5.3 Zinc powder reacts rapidly with 2 mol/L hydrochloric acid.

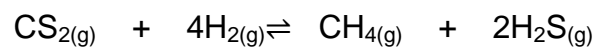
(i) List TWO ways of reducing the rate of the reaction.

Skill level 2	
2	
1	
0	
NR	

5.4 Give the formula for the conjugate base of CH_3NH_3^+

Skill level 1	
1	
0	
NR	

5.5 Write an expression for the equilibrium constant for the following reaction:



Skill level 1	
1	
0	
NR	

STRAND 6: Principles of Chemical Changes WEIGHTING 24

6.1 *Chlorine is a good oxidizing agent.*

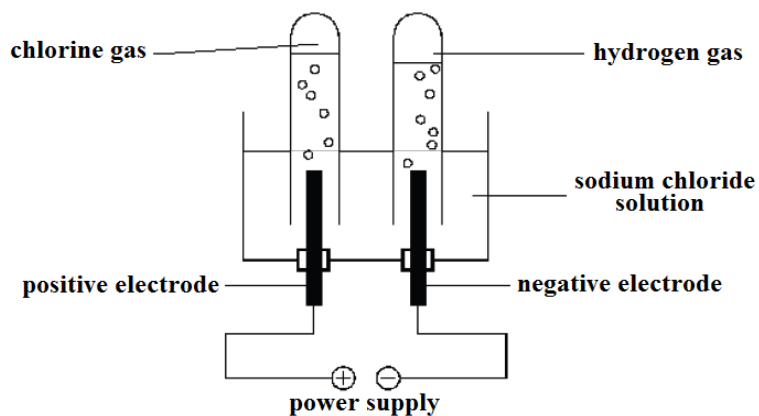
(i) Define the term *oxidizing agent*.

Skill level 1	
1	
0	
NR	

(ii) Give ONE example of chlorine acting as an oxidizing agent.

Skill level 1	
1	
0	
NR	

6.2 The diagram below shows electrolysis of sodium chloride solution.



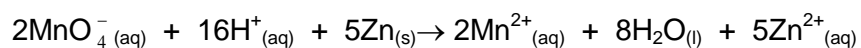
(i) Write the half equation for the process occurring at the anode.

Skill level 3	
3	
2	
1	
0	
NR	

(ii) Write the half equation for the process occurring at the cathode.

Skill level 3	
3	
2	
1	
0	
NR	

6.3 In the equation:



(i) Which species is oxidized?

Skill level 1	
1	
0	
NR	

(ii) Which species is reduced?

Skill level 1	
1	
0	
NR	

(iii) Which species is acting as an oxidizing agent?

Skill level 1	
1	
0	
NR	

6.4 *Sulphur dioxide gas is bubbled through acidified potassium permanganate solution.*

Describe ONE observation you would see. Name the product associated with the above reaction:

Skill level 2	
2	
1	
0	
NR	

6.5 List any TWO common oxidising agents.

Skill level 2	
2	
1	
0	
NR	

6.6 Define the term *electrolysis*.

Skill level 1	
1	
0	
NR	

6.7 Predict any ionic reactions that occur at the cathode and the anode when a solution of copper sulphate is electrolysed between copper electrode.

Write the equations for the reaction at each electrode.

Skill level 4	
4	
3	
2	
1	
0	
NR	

6.8 Predict the TWO ion-electron equations for the half reactions involved when copper metal is added to silver nitrate solution. State clearly which atoms or ions are oxidized and which are reduced.

Skill level 4	
4	
3	
2	
1	
0	
NR	

Student Education Number

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CHEMISTRY

2015

(For Markers only)

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STRAND 1: Atomic Structure and Bonding	17		
STRAND 2: Quantitative Chemistry	17		
STRAND 3: Inorganic Chemistry	10		
STRAND 4: Organic Chemistry	22		
STRAND 5: Physical Chemistry	10		
STRAND 6: Principles of Chemical Changes	24		
TOTAL	100		