

MARKER CODE

STUDENT EDUCATION NUMBER



Sāmoa School Certificate
CHEMISTRY
2015
QUESTION and ANSWER BOOKLET

Time allowed: 3 Hours and 10 Minutes

INSTRUCTIONS:

1. You have 10 minutes to read **before** you start writing.
2. Write your **Student Education Number (SEN)** in the space provided on the top right hand corner of this page.
3. Answer **ALL QUESTIONS**. Write your answers in the spaces provided in this booklet.
4. If you need more space for answers, 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	Page Number	Time (Minutes)	Weighting
STRAND 1: Atomic Structure and Bonding	2	18	10
STRAND 2: Quantitative Chemistry	4	22	12
STRAND 3: Organic Chemistry	6	43	24
STRAND 4: Oxidation and Reduction	10	18	10
STRAND 5: Inorganic Chemistry	12	50	28
STRAND 6: Principles of Physical Chemistry	20	29	16
TOTAL		180	100

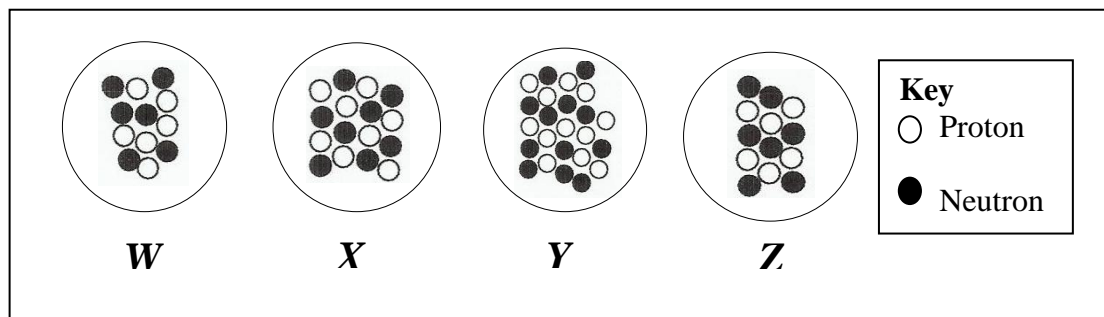
Check that this booklet contains pages 2-25 in the correct order and that none of these pages is blank.

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

STRAND 1: ATOMIC STRUCTURE AND BONDING

WEIGHTING 10

The diagrams below show the nuclei of four different Atoms, *W*, *X*, *Y* and *Z*. Use this information to answer Number 1-5.



1. Write the electron arrangement of an ion of Atom *Y*.

Skill Level 1	
1	
0	
NR	

2. Draw the structure of an ion of Atom *Y*.

Skill Level 1	
1	
0	
NR	

3. Which TWO atoms are isotopes of the same element?

Skill Level 2	
2	
1	
0	
NR	

4. Atoms **W** and **X** form a molecular compound. Determine the formula of the molecular compound and draw its possible Lewis diagram.

Skill Level 3	
3	
2	
1	
0	
NR	

5. Explain why solid compound **YX does not** dissolve in water.

Skill Level 3	
3	
2	
1	
0	
NR	

Define the following terms

6. Mole

Skill Level 1	
1	
0	
NR	

7. Relative atomic mass

Skill Level 1	
1	
0	
NR	

8. Molar mass

Skill Level 1	
1	
0	
NR	

9. You are provided with a 250 mL volumetric flask. What mass of sodium carbonate, Na_2CO_3 has to be weighed out to produce a solution of concentration $2.5 \times 10^{-3} \text{ mol L}^{-1}$?

Skill Level 2	
2	
1	
0	
NR	

10. Calculate the correct formula for hydrated copper sulfate ($\text{CuSO}_4 \cdot x\text{H}_2\text{O}$) if 5.0 g of hydrated salt was heated and produced 3.19 g of anhydrous salt.

Skill Level 3	
3	
2	
1	
0	
NR	

11. Show that a compound sample with composition of 40% C, 6.7% H and 53.3% O with a molar mass of 60g mol^{-1} has the empirical formula CH_2O and molecular formula $\text{C}_2\text{H}_4\text{O}_2$.

Skill Level 4	
4	
3	
2	
1	
0	
NR	

Choose the correct words from the list in the box to complete the passage. Write your choice in the spaces provided below the passage (12-15).

Saturated, homologous, unsaturated, functional groups, isomers, alcohol

Families of organic compounds which have the same general formula and **12** are called **13** series with the same chemical properties. Hydrocarbons, such as alkanes are organic molecules. In alkanes, the atoms are linked by single covalent bonds. We therefore say that alkanes are **14** as opposed to alkenes and alkynes. Hydrocarbons that have the same number of carbon and hydrogen atoms but the carbon atoms are joined to each other in different ways are often called **15**.

12. _____

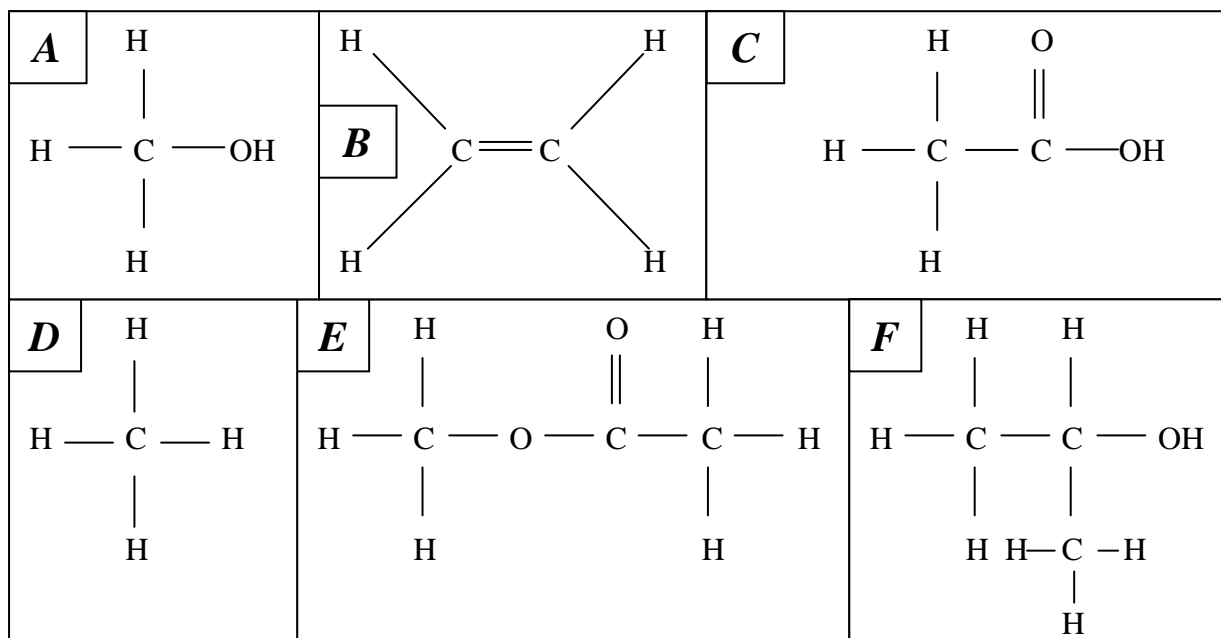
13. _____

14. _____

15. _____

Skill Level 1				
	12	13	14	15
1				
0				
NR				

Study the following structural formulae and then answer Number 16-21.



Match the structures above to its correct property below. Write the **LETTER** of the correct structure in the boxes on the right hand side.

16. The structure of Propan-2-ol is _____.

17. Structure **A** + structure **C** → structure _____.

18. Name of the functional group found in structure **F**.

19. Name one use of structure **A**.

20. An unsaturated hydrocarbon.

21. A sweet smelling liquid.

(For Maker's use only)

Skill Level 1						
	16	17	18	19	20	21
1						
0						
NR						

Ethanol is the alcohol that is produced by the fermentation of sugar in the absence of oxygen. It is the alcohol in beer, wines and spirits.

22. Write the balanced chemical equation for this process

Skill Level 2	
2	
1	
0	
NR	

23. Describe the result if acidified potassium permanganate (KMnO_4/H^+) is added into the beaker containing ethanol.

Skill Level 2	
2	
1	
0	
NR	

Explain the processes below

24. Polymerisation of ethene monomer

Skill Level 3	
3	
2	
1	
0	
NR	

25. Hydration of ethene

Skill Level 3	
3	
2	
1	
0	
NR	

26. Discuss the significance of refluxing during esterification process and describe an application in real life.

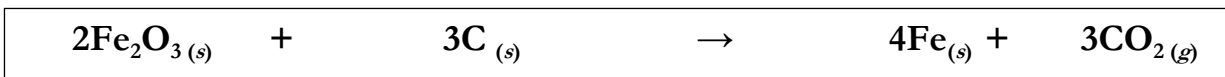
Skill Level 4	
4	
3	
2	
1	
0	
NR	

STRAND 4:

OXIDATION AND REDUCTION

WEIGHTING 10

The reaction between iron (III) oxide and solid carbon in a blast furnace process is shown in the equation below. Use this information to answer Number 27-30.



27. Which substance is the oxidising agent?

Skill Level 1	
1	
0	
NR	

28. Which substance is the reducing agent?

Skill Level 1	
1	
0	
NR	

29. Give a reason for your answer in question 28 above.

Skill Level 2	
2	
1	
0	
NR	

30. Calculate the oxidation number of Fe in Fe_2O_3 .

Skill Level 3	
3	
2	
1	
0	
NR	

Aqueous chlorine, Cl_2 (aq), can react with a solution containing iodide ions, I^- (aq). Write balanced half-equations for the oxidation and reduction reactions that occur.

27. Balanced oxidation half equation

Skill Level 1	
1	
0	
NR	

28. Balanced reduction half equation

Skill Level 1	
1	
0	
NR	

29. Write the overall equation

Skill Level 1	
1	
0	
NR	

STRAND 5:

INORGANIC CHEMISTRY

WEIGHTING 28

30. A zinc alloy is commonly used to make boat fittings, door knobs and taps. What is the name of this alloy?

- A. Bronze
B. Solder
C. Brass
D. Steel

Skill Level 1	
1	
0	
NR	

31. A white precipitate will be formed when sodium carbonate is mixed with one of the followings.

- A. HNO_3
B. $\text{Ca}(\text{NO}_3)_2$
C. NaHCO_3
D. K_2SO_4

Skill Level 1	
1	
0	
NR	

Complete the table by filling in the missing Word or Definition. Write your answers in the spaces below the table.

Word	Definition
36	Absorb water from air
Filtration	37
38	Formation of a solid from mixing two solutions together.
efflorescence	39

36. _____

37. _____

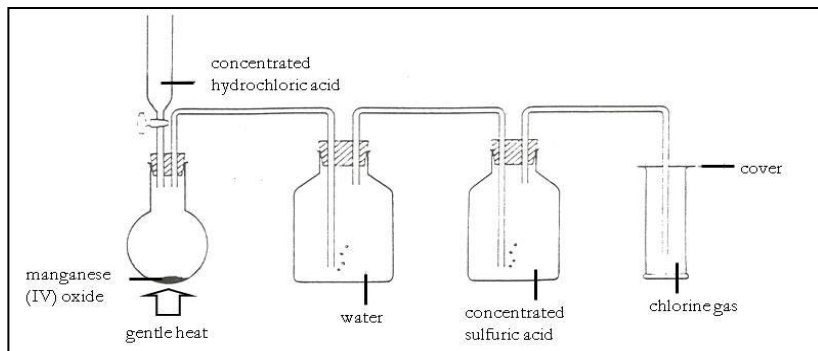
38. _____

39. _____

(For marker's use only)

Skill Level 1				
	36	37	38	39
1				
0				
NR				

Chlorine gas can be prepared in the laboratory as shown in the diagram below. Use this to answer Number 40 and 41.



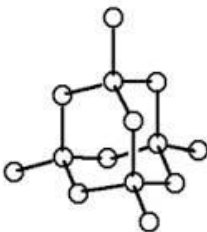
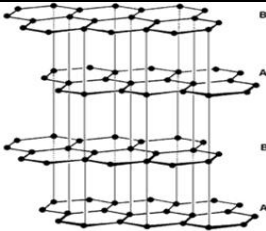

40. Name ONE property of chlorine gas.

Skill Level 1	
1	
0	
NR	

41. State ONE very common use of chlorine gas in Samoa today.

Skill Level 1	
1	
0	
NR	

The element carbon exists in three common forms known as allotropes. Some of the properties of these allotropes are outlined in the table below. Use the information in the table to answer Number 42-44.

PROPERTY	ALLOTROPE		
	A	B	C
Structure			
Melting point	> 3550°C	3367°C (sublimation)	400 – 500°C (sublimes)

42. Describe the characteristics of Allotrope **B** that makes it a good conductor.

Skill Level 2	
2	
1	
0	
NR	

43. Describe the main cause of the difference in the melting points of the Allotropes **A** and **B**.

Skill Level 2	
2	
1	
0	
NR	

44. What **state** would each of the three Allotropes **A**, **B** and **C** be at room temperature?

Skill Level 2	
2	
1	
0	
NR	

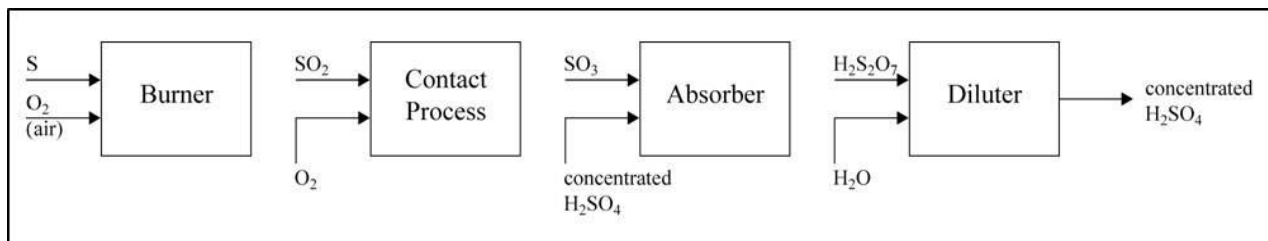
Tavita was conducting an experiment to determine the ions that cause hardness in water. He dissolved a selection of salts in distilled water and then shook an equal amount of each solution with a 5mL soap solution. The table below shows the height of lather formed in each solution.

Solution used	Height of lather (mm)
Sodium sulfate	19
Magnesium sulfate	3
Potassium chloride	21
Calcium chloride	1
Sodium nitrate	20
Magnesium nitrate	2
Calcium nitrate	1

45. Use the results of Tavita's experiment to determine the ions which cause hardness of water and explain how this happens.

Skill Level 3	
3	
2	
1	
0	
NR	

The diagram below shows a flow chart for the commercial production of sulfuric acid.



47. Refer to the diagram above to discuss how sulfuric acid is formed in this process.

Skill Level 4	
4	
3	
2	
1	
0	
NR	

Salt *P* and Salt *Q* were dissolved separately in 100 mL beakers of water. The temperatures of the water were recorded before and after dissolving each salt. The results are shown below.

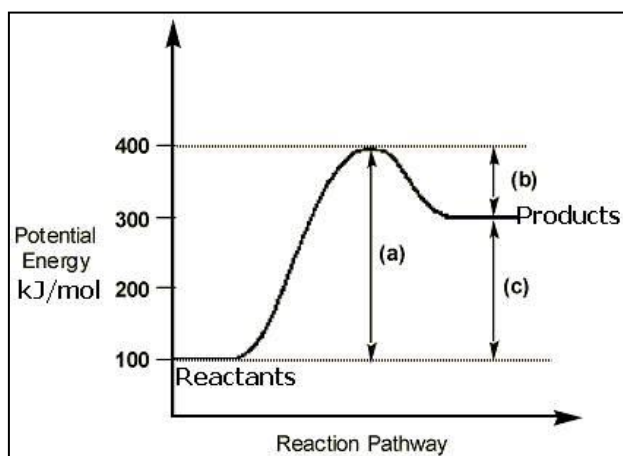
Salt	Initial Temperature °C	Final Temperature °C
<i>P</i>	25.1	30.2
<i>Q</i>	25.1	20.0

49. Which of the following is correct about the dissolving of Salt *P* and Salt *Q*? (Circle the letter of your answer)

	<i>P</i>	<i>Q</i>
A	Endothermic	Exothermic
B	Exothermic	Endothermic
C	Endothermic	Endothermic
D	Exothermic	Exothermic

Skill Level 1	
1	
0	
NR	

Study the enthalpy diagram for an endothermic reaction then answer question 50 and 51.



50. State the meaning of the term **endothermic**.

Skill Level 1	
1	
0	
NR	

51. Describe the features of the above reaction which makes it endothermic.

Skill Level 2	
2	
1	
0	
NR	

52. A few drops of universal indicator are added to ethanoic acid solution and then sodium hydroxide solution is added. Describe your observation.

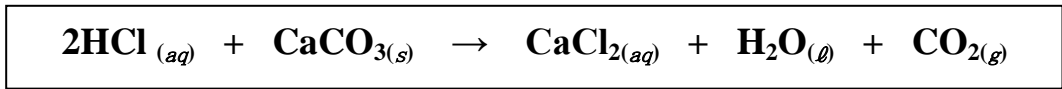
Skill Level 2	
2	
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NR	

The strength of acids and bases depend on their ability to dissociate in aqueous solution. How do you explain that HCl is a strong acid while ethanoic acid is considered a weak acid?

53. HCl:

Skill Level 3	
3	
2	
1	
0	
NR	

In an experiment, a sample of large marble chips (CaCO_3) is added to 200 mL of dilute hydrochloric acid in an open conical flask. The reaction that occurs is shown below.



As the carbon dioxide gas escapes from the flask, the total mass of the flask and contents decreases.

The loss in mass is recorded at 5-minute intervals until the reaction has stopped.

The experiment is repeated, using the same mass, but different sized, marble chips.

The results are shown in the table below.

Time (minutes)	Mass loss of flask and contents/g		
	Large marble chips	Medium marble chips	Small marble chips
0	0.00	0.00	0.00
5	3.29	3.73	3.98
10	3.88	4.00	4.00
15	4.00	4.00	4.00

55. Write a conclusion to the above experiment indicating the factor that affects the rate of the reaction between HCl and CaCO_3 .

Skill Level 4	
4	
3	
2	
1	
0	
NR	

Student Education Number									

CHEMISTRY

2015

(For Markers only)

STRANDS	Weighting	Marker	Check Marker	Final Weighting
STRAND 1: Atomic Structure and Bonding	10			
STRAND 2: Quantitative Chemistry	12			
STRAND 3: Organic Chemistry	24			
STRAND 4: Oxidation and Reduction	10			
STRAND 5: Inorganic Chemistry	28			
STRAND 6: Principles of Physical Chemistry	16			
TOTAL	100			