

STUDENT EDUCATION NUMBER


 GOVERNMENT OF SAMOA
 MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa School Certificate

CHEMISTRY

2018

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.

NB: Periodic Table is inserted as a separate sheet.

STRANDS	Page	Time (min)	Weighting
STRAND 1: ATOMIC STRUCTURE AND BONDING	2	18	10
STRAND 2: QUANTITATIVE CHEMISTRY	3	22	12
STRAND 3: ORGANIC CHEMISTRY	5	43	24
STRAND 4: OXIDATION AND REDUCTION	8	18	10
STRAND 5: INORGANIC CHEMISTRY	10	50	28
STRAND 6: PRINCIPLES OF PHYSICAL CHEMISTRY	14	29	16
TOTAL		180	100

Check that this booklet contains pages 2-16 in the correct order and that none of these pages is blank.

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

The Lewis structures for the two molecules are shown in the table below.

Molecule	Ammonia	Methane
	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{N}-\text{H} \\ \cdot\cdot \end{array}$	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$
Molar mass	17.04g/mol	16.00g/mol

1. Describe the difference in terms of polarity of the two molecules above.

SL 2

Sodium chloride (NaCl) melts at 801°C while Chlorine gas (Cl₂), melts at -155.6 °C.

2. Describe why NaCl has a higher melting point than Cl₂.

SL 3

3. Describe ONE reason why chlorine molecules have non polar covalent bonds.

SL 3

4. Define *covalent bond*.

SL 1

5. Define *ionic bond*.

SL 1

STRAND 2:

QUANTITATIVE CHEMISTRY

Weighting 12

Define the terms:

6. *Mass number* of an atom.

SL 1

7. *Relative atomic mass* of an atom.

SL 1

8. *Molar mass* of a compound.

SL 1

Sodium chlorate (V), NaClO₃ contains 21.6% by mass of sodium, 33.3% by mass of chlorine and 45.1% by mass of oxygen.

[Given M(Na) = 23g/mol; M(Cl) = 35.5g/mol; M(O) = 16g/mol].

9. Use the above data to show that the empirical formula of **sodium chlorate (V)** is **NaClO₃**.

SL 4

10. **Sodium chlorate (V)** may be prepared by passing chlorine into hot aqueous sodium hydroxide. Balance the equation below.



SL 3

11. You are provided with a 250 mL volumetric flask. What mass of sodium carbonate (Na₂CO₃) has to be weighed out to produce a solution of concentration 2.5 x 10⁻³ mol/L?

[Given M(Na) = 23g/mol; M(C) = 12g/mol; M(O) = 16g/mol]

SL 2

Butane and candle wax are both saturated hydrocarbons and belong to the family of compounds called alkanes.

12. Define the term saturated hydrocarbons.

Saturated Hydrocarbons: _____

SL 1

13. Draw the structural formula for butane.

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SL 1

14. Write the balanced chemical equation for the complete combustion of butane.

SL 2

15. Draw ONE isomer for the structure drawn in Number 14 above.

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SL 1

16. List ONE physical property of the isomer of butane drawn in Number 15.

_____	SL 2

Select the correct formula from the table that matches the descriptions below.

CH₃OH, CH₄, C₂H₄, CH₃COOCH₃, C₃H₈, CH₃(CH₂)₅CH₃, (CH₃)₂CHOH, CH₃COOH
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17. An unsaturated compound _____

SL 1

18. Propane molecule _____

SL 1

19. Secondary alcohol _____

SL 1

20. A compound containing a carbonyl group _____

SL 1

Refluxing of compound CH₃COOH and CH₃OH produces an ester with a formula of CH₃COOCH₃.

21. Explain this process and how sodium carbonate: Na₂CO₃, is necessary in the production of an ester.

_____	SL 3

Explain the processes below.

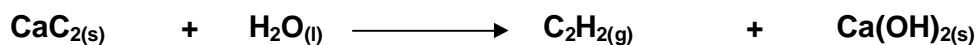
22. Polymerisation of ethane monomer.

SL 3

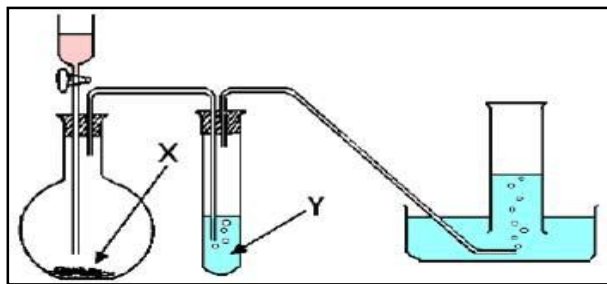
23. Hydration of ethyne.

SL 3

In a science laboratory, students were asked to prepare ethyne gas, C_2H_2 as shown in the chemical equation below.



The apparatus are set up as in the diagram below.



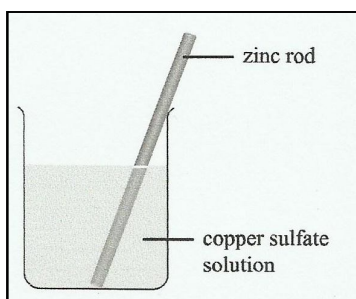
24. Write a brief report on this laboratory experiment including your results and identification of the gas.

SL 4

STRAND 4: OXIDATION AND REDUCTION REACTIONS

Weighting 10

A zinc rod was placed in a solution of copper sulfate and it was left for one week.



25. Identify the reducing agent in this reaction.

SL 1

26. Give a reason for your answer in Number 25 above.

SL 2

27. Write half equation for the reduction reaction.

SL 1

28. Write half equation for the oxidation reaction.

SL 1

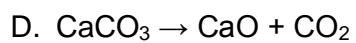
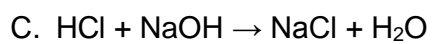
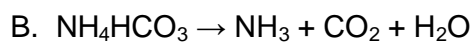
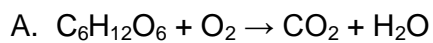
29. Calculate the oxidation state of sulfur ion in copper sulfate solution.

SL 3

30. Define *reduction*.

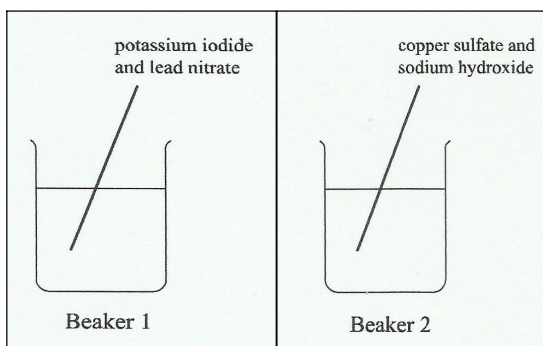
SL 1

31. Which of the following involves oxidation reaction? (Circle the correct answer).



SL 1

Various solutions were mixed in two separate beakers and students were allowed to make observations.



32. Identify the colour of the precipitate that may have formed in Beaker 1.

SL 1

33. Name the precipitate formed in Beaker 1.

SL 2

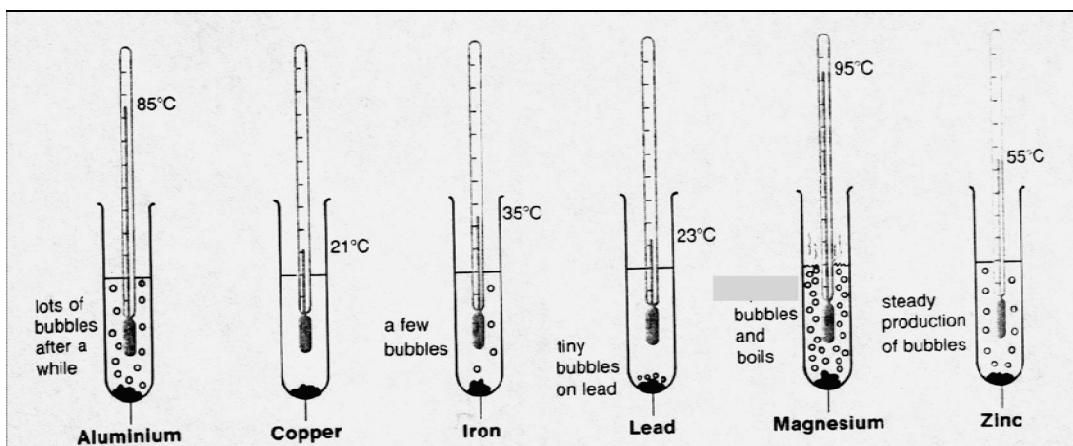
34. Discuss a test for the presence of copper ions in Beaker 2.

SL 4

35. A test tube containing fresh copper sulfate solution was presented to the students to investigate for the presence of sulfate ions. Explain how you would carry out this investigation.

SL 4

Six common metals were added to dilute hydrochloric acid that was initially at room temperature, 20°C. Use the diagram below to answer Number 38 to 39.



36. List the activity series of the six metals in the above experiment, from the most to the least reactive.

SL 2

37. From this experiment, describe the chemical properties of metals.

SL 2

38. Explain how seas water affects the use of soap.

SL 3

39. Discuss the significance of sensitive plant in the nitrogen cycle.



Sensitive Plant

SL 3

Define the terms:

40. *chlorination*: _____

SL 1

41. *hygroscopy*: _____

SL 1

42. Name ONE use of sulfur, (S₈).

SL 1

43. Name ONE use of chlorine gas, Cl₂.

SL 1

44. Name a property of hydrochloric acid, HCl.

SL 1

45. Name a property of the chlorides.

SL 1

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

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

SL 1

47. Which of the following is endothermic?

- A. Putting magnesium metal in HCl.
- B. Burning firewood
- C. Ice melting
- D. Dissolving NaOH in water

SL 1

48. Define exothermic.

SL 1

The table shows the **pH** of two acidic solutions, ethanoic acid, CH₃COOH, and hydrochloric acid, HCl, which both have a concentration of 0.1 mol/L.

Solutions	CH ₃ COOH(aq)	HCl(aq)
pH	2.4	1

49. Explain the chemical reactions of the two acids with a 2 cm strip of cleaned magnesium ribbon, Mg_(s).

SL 4

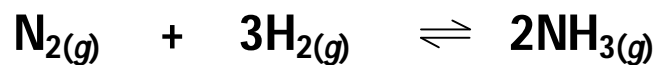
50. Describe an observation if few drops of universal indicator were added into ethanoic acid.

SL 2

51. Explain the difference between the two acids.

SL 3

Use the equation below to answer questions (i) and (ii) below.



52. Describe equilibrium with reference to the equation above.

SL 2

53. If nitrogen gas, N_2 is removed from the system, explain what happens to the reaction and the factor affecting the rate of the reaction.

SL 3

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CHEMISTRY

2018

For scorers use only

STRANDS	SCORE	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