

STUDENT EDUCATION NUMBER



GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa Secondary Leaving 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	17
STRAND 2: QUANTITATIVE CHEMISTRY	4	22	17
STRAND 3: INORGANIC CHEMISTRY	7	43	10
STRAND 4: ORGANIC CHEMISTRY	9	18	22
STRAND 5: PHYSICAL CHEMISTRY	12	50	10
STRAND 6: OXIDATION AND REDUCTION	14	29	24
TOTAL		180	100

Check that this booklet contains pages 2-17 in the correct order and that none of these pages is blank.

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

1. ${}_{17}^{35}\text{Cl}$ and ${}_{17}^{37}\text{Cl}$ describe atoms of two chlorine isotopes.

Which of the following statements is false with regards to these two isotopes?

Circle the best answer.

- A. The number of electrons in neutral atoms of each is the same.
- B. The number of protons in the nucleus of each is the same.
- C. The chemical properties of each are the same.
- D. The number of neutrons in the nucleus of each is the same.

SL 1

2. Describe a chemical test which would show magnesium is a metal.

SL 2

3. The melting point of carbon dioxide is -57°C . The melting point of diamond is about 3500°C . In terms of the bonding and structure of these substances, account for the high melting point of diamond compared to the low melting point of carbon dioxide.

SL 4

4. The water **molecule is polar**. With the aid of a suitable diagram give an explanation which could account for this.

SL 3

5. Predict the shape of the ammonia molecule.

SL 1

6. Explain briefly why the second ionization energy (4560 kJ/mol) of sodium is greater than its first ionization energy (494 kJ/mol).

SL 2

7. Define the term *electronegativity*.

SL 1

8. Which element below has a larger atomic radius?

Sodium **or** Sulphur

SL 1

9. Define the term *molecular mass*.

SL 1

10. Circle the element that has the largest ionization energy.

Lithium

Magnesium

Neon

Chlorine

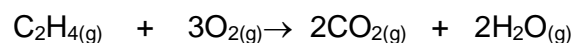
SL 1

STRAND 2:

QUANTITATIVE CHEMISTRY

Weighting 17

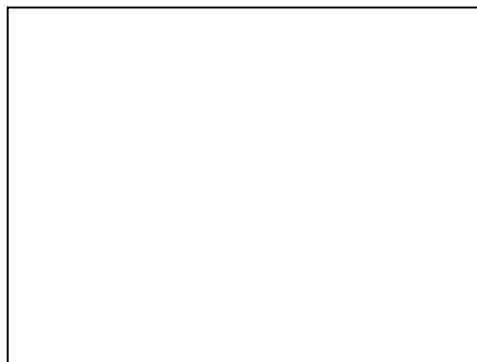
The equation for the combustion of ethane, C₂H₄ is:



11. Calculate the number of moles of oxygen gas are required for complete combustion of two moles of ethene.

SL 3

12. Draw a clear diagram of a round bottom flask.



SL 1

13. Define the term *endpoint*.

SL 1

14. Which one of the following would contain the greatest number of molecules?
Circle the best answer.

[Atomic masses: C=12, O=16, S=32, N=14, H=1, Cl=35.5]

- A. 10g of CO₂
- B. 10g of SO₂
- C. 10g of NO₂
- D. 10g of H₂O

SL 1

15. An unsaturated hydrocarbon known to be either ethene or ethyne reacts with excess bromine gas to give a substance containing 85.0% bromine and 12.8% carbon by mass, the remainder being hydrogen.

Is the unsaturated hydrocarbon ethene or ethyne? Justify your answer.

[M (H) = 1 g/mol (C) = 12 g/mol (Br) = 80 g/mol]

SL 4

16. A student wished to check a manufacturer's claim that the vinegar produced by her firm contains 60g of ethanoic acid per litre of vinegar.

If the manufacturer's claim is correct, what is the concentration of the ethanoic acid (CH_3COOH) in the vinegar in mol/L?

$$M(\text{C}) = 12 \text{ g/mol}, M(\text{H}) = 1 \text{ g/mol}, M(\text{O}) = 16 \text{ g/mol}$$

SL 2

17. Define the term *molecular formula*.

SL 1

The directions for an experiment involving titration of acids and bases contain this statement:

“Rinse the burette with clean water and then with the solution of hydrochloric acid before filling it with the hydrochloric acid solution.”

The sodium hydroxide solution is to be pipetted into a conical flask for the titration.

18. Write down the statements you might expect to find for the rinsing of a **pipette**.

SL 2

19. A 2.65g of anhydrous sodium carbonate was dissolved in water and made up to 500mL in a standard (graduated) flask. A 20mL portions of this required 18.5mL of a solution of hydrochloric acid when titrated using methyl orange indicator.

Calculate the concentration of the standard sodium carbonate solution in mol/L.

$$M(\text{Na}) = 23 \text{ g/mol}, \quad M(\text{C}) = 12 \text{ g/mol}, \quad M(\text{O}) = 16 \text{ g/mol}$$

SL 2

STRAND 3:

INORGANIC CHEMISTRY

Weighting 10

20. Complete the table below by filling in the missing information.

Name	Formula	State/Colour	Solubility in water
Ammonia	NH ₃	Colourless	48
Copper II hydroxide	Cu(OH) ₂		Insoluble

SL 1

21. Two of the spaces have been filled with descriptions of what would be observed when the solutions are mixed. List similar statements for the spaces (i) to (iv) to describe the reactions which occur.

Reacting solutions	Cu ²⁺ _(aq)	Zn ²⁺ _(aq)	Mg ²⁺ _(aq)
Sodium hydroxide	Pale blue precipitate of copper hydroxide	(i)	(ii)
Ammonia	(iii)	White precipitate of zinc hydroxide which redissolves in excess ammonia	(iv)

SL 4

22. Write down the formula of the chlorides of the elements of the second short period of the periodic table (sodium to sulphur).

--

SL 2

23. A colourless solution formed a white precipitate when barium chloride solution was added. The solution was filtered and when dilute hydrochloric acid was added to the residue no reaction took place. Briefly explain what ions are contained in the colourless solution.

SL 3

24. Compounds A, B, C and D are isomeric alcohols of molecular formula C_3H_8O of which A has the lowest boiling point. Only A, C and D react with warm acidified dichromate giving a blue/green solution. With Lucas reagent it reacts rapidly C whereas C reacts after about 15 minutes (A and D do not react).

Name and classify alcohols A to D.

SL 4

Define the following terms:

25. *Hydrolysis*

SL 1

26. *Condensation reactions*

SL 1

27. Aqueous silver nitrate (a few mL) is placed in a clean test tube and 1 drop of NaOH is added. The precipitate that forms is dissolved by adding just enough dilute ammonia.

Explain what is observed when this reagent is warmed with a few drops of each of the following:

(i) *butan-1-ol* (ii) *butanal* (iii) *butanone*

SL 4

28. Write the equation for the reaction between ethyl ethanoate and sodium hydroxide.

SL 3

29. Draw the open structure of glucose.

SL 3

30. List any properties of PVC that makes it useful as spouting.

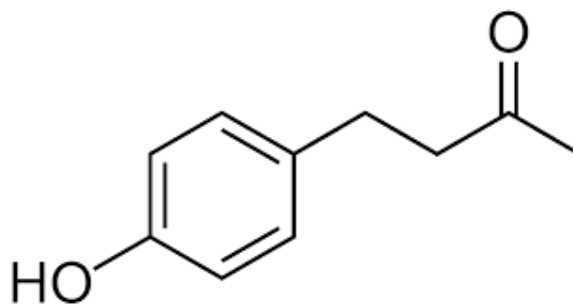
SL 2

31. Describe properties of tests you could use to distinguish $\text{CH}_3\text{CH}_2\text{OH}$ from C_3H_8 .

SL 2

32. The chemical compound commonly referred to as 'raspberry ketone' is the primary compound responsible for the aroma of raspberries.

Circle the **ketone** functional group.



SL 1

35. Write the chemical equation for the reaction below, given the equilibrium constant (K_c):

$$K_c = \frac{[CO_{(g)}][H_{2(g)}]^3}{[CH_{4(g)}][H_2O_{(g)}]}$$

SL 2

36. Explain why equilibrium occurs only in closed systems.

SL 3

37. Describe the relationship between chemical reactions and changes in enthalpy.

SL 2

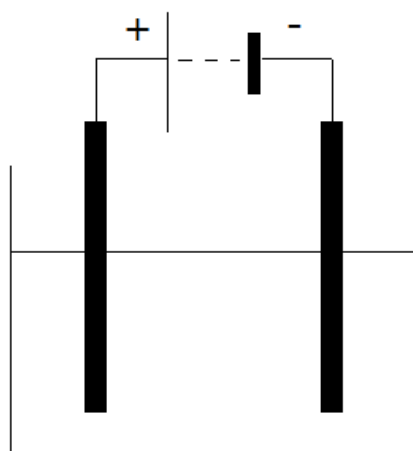
38. Below is a schematic diagram of an electrolytic cell. **On the diagram**, label the following:

(i) source of electric current

(ii) anode

(iii) cathode

(iv) direction of electron (mark this direction with arrows)



SL 4

39. Define the term *oxidizing agents*.

SL 1

40. State the oxidation number of manganese in:



SL 1

Write the formulae of the reactant that is oxidized, the reactant that is reduced and the spectator ion/s in each of the following:

41. Zinc is dissolved in hydrochloric acid to produce hydrogen gas and zinc ions.

Reactant oxidized: _____

Reactant reduced: _____

Spectator ion/s: _____

SL 3

42. Chlorine water is added to ferrous sulfate solution to produce ferric ions and chloride ions.

Reactant oxidized: _____

Reactant reduced: _____

Spectator ion/s: _____

SL 3

43. Ferrous sulfate is reacted with an acidified potassium permanganate solution to produce ferric ions and manganate ions.

Reactant oxidized: _____

Reactant reduced: _____

Spectator ion/s: _____

SL 3

44. Define the term electrolysis.

SL 1

45. Sulfur dioxide is oxidized to sulfate ions.

Write a balanced equation for the reaction of potassium permanganate solution with sulfur dioxide (a pungent smelling gas formed by burning sulfur).

SL 4

46. On adding five drops of chlorine water to 3mL of potassium iodide solution in a stoppered test tube, a chemical reaction takes place and the solution turns brown.

- (i) Give a balanced ion-electron half equation for the **oxidation** and **reduction**.
- (ii) Combine your answers in (i) to give a fully balanced redox equation.

SL 4

STUDENT EDUCATION NUMBER									

CHEMISTRY

2018

For scorers use only

STRANDS	SCORE	Weighting
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: Oxidation and Reduction		24
TOTAL		100