GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

STUDENT EDUCATION NUMBER									

Samoa Secondary Leaving Certificate

CHEMISTRY

2021

QUESTION and ANSWER BOOKLET

Time allowed: 3 Hours & 10 minutes

INSTRUCTIONS

1. You have 10 minutes to read **before** you start the exam.
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, 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: The Periodic Table is inserted as a separate sheet.

STRANDS		Pages	Time (min)	Weighting
STRAND 1	ATOMIC STRUCTURE AND BONDING	2	31	17
STRAND 2	QUANTITATIVE CHEMISTRY	5	31	17
STRAND 3	INORGANIC CHEMISTRY	8	18	10
STRAND 4	ORGANIC CHEMISTRY	10	40	22
STRAND 5	PRINCIPLES OF PHYSICAL CHEMISTRY	14	18	10
STRAND 6	OXIDATION AND REDUCTION	16	42	24
TOTAL			**180**	**100**

Check that this booklet contains pages 2-19 in the correct order and that none of these pages are blank.

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

STRAND 1: **ATOMIC STRUCTURE AND BONDING** **WEIGHTING 17**

For Questions 1 to 3, choose and write the LETTER of the correct answer in the box provided.

1. The Octet Rule refers to the tendency of atoms to have how many electrons in the valence shells?

   A. Two
   B. Four
   C. Six
   D. Eight

	SL 1

(Use your knowledge of the Periodic Table to answer Questions 2 and Question 3.)

2. Which of the following group in the periodic table would have elements with the largest atoms radius?

   A. Group 1.
   B. Group 2.
   C. Group 14.
   D. Group 17.

	SL 1

3. Which of the following group in the periodic table would have elements with the highest possible first ionization energy?

   A. Group 1.
   B. Group 2.
   C. Group 14.
   D. Group 17.

	SL 1

4. Describe how a polar bond is formed between Si and Cl atoms.

_____
_____
_____
_____
_____
_____
_____
_____

SL 2

5. State the symbol for a hydrated potassium ion.

_____

SL 2

6. Draw and name the shape of NH_3.

SL 3

7. Explain in terms of structure and bonding why both diamond and graphite have very high melting points and yet graphite is a soft, greasy solid while diamond is very hard.

_____
_____
_____
_____
_____

SL 3

8. If you have a good supply of a solid, discuss how you would test it in your school laboratory to see if it contains ions.

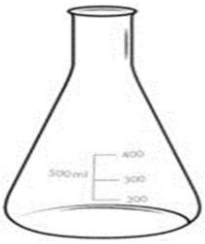
SL 4

STRAND 2: **QUANTITATIVE CHEMISTRY** **WEIGHTING 17**

For Questions 9 to 11, choose and write the LETTER of the correct answer in the box provided.

9. This glassware is called a:

A. burette.
B. beaker.
C. conical flask.
D. test tube.



	SL 1

10. A solution containing precisely a known concentration of an element is called a:

A. weak solution.
B. standard solution.
C. non-standard solution.
D. concentrated solution.

	SL 1

11. The formula for calculating the concentration of a solution is:

A. $c = \frac{d}{v}$
B. $c = \frac{n}{v}$
C. $c = \frac{v}{m}$
D. $c = \frac{v}{n}$

	SL 1

12. The reaction of methane and oxygen is given below:

$$CH_{4(g)} + 2O_{2(g)} \rightarrow 2H_2O_{(g)} + CO_{2(g)}$$

Calculate the number of moles of water vapour formed when 32 g of methane burns.

M(C) = 12 g/mol M(H) = 1 g/mol M(O) = 16 g/mol

SL 2

13. Describe the methodology for carrying out an acid-base titration.

SL 2

14. A 0.02 mol sodium chloride in 5 mL solution is diluted to 500 mL by adding 495 mL of water. Calculate the concentrations of the following solution, before and dilution.

SL 3

15. Calculate the mass of water that will react completely with 4.0 g of pure calcium metal according to the equation below:

$$Ca_{(s)} + 2H_2O_{(l)} \rightarrow Ca(OH)_{2(s)} + H_{2(g)}$$

SL 3

16. Discuss how the uses of standard solutions and titrations have impacted an industry in real life situations. Use examples.

SL 4

STRAND 3: INORGANIC CHEMISTRY WEIGHTING 10

For Questions 17 and 18, choose and write the LETTER of the correct answer in the box provided.

17. Which of the following elements has the most acidic oxide?

A. Sodium
B. Aluminium
C. Chlorine
D. Argon

	SL 1

18. Which of the following is the chemical formula for silicon chloride?

A. $SiCl_2$
B. $SiCl_3$
C. $SiCl_4$
D. $SiCl_5$

	SL 1

19. Describe an observation when a solution of silver nitrate is added to a solution of potassium chloride.

_____
_____
_____
_____
_____
_____
_____

SL 2

20. Explain why ice is less dense than water.

SL 3

21. Some silver nitrate is added to a solution containing chloride ions. Later, dilute ammonia is added to the reaction mixture.

Explain an observation that would be made.

SL 3

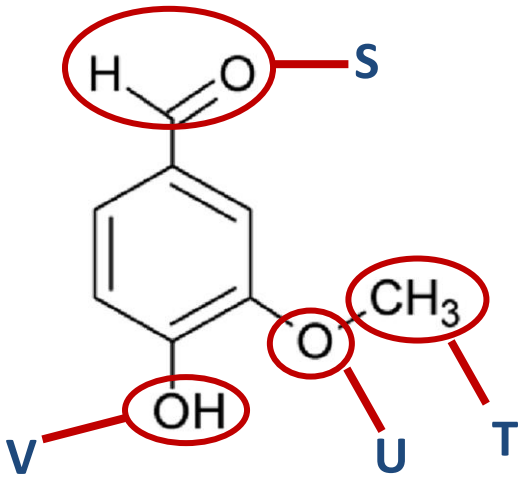
For Questions 22 and 23, choose and write the LETTER of the correct answer in the box provided.

22. Polymers that are formed by single linking of monomer units are called:

A. addition polymers.
B. substitution polymers.
C. condensation polymers.
D. natural polymers.

	SL 1

23. The **aldehydes** functional group is shown by the letter:



A. **S**
B. **T**
C. **U**
D. **V**

	SL 1

24. Write the equation for the reaction between methanoic acid and methanol in the presence of sulfuric acid.

SL 2

25. Describe a chemical test that you could use to determine the presence of aldehydes.

_____
_____
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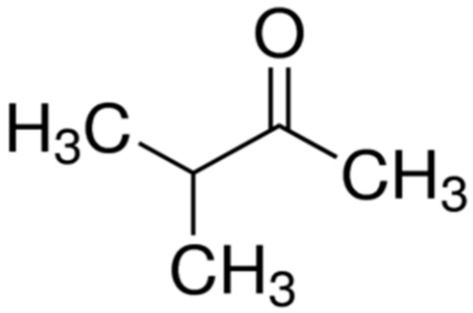
SL 2

26. State the IUPAC name for the following compound.



_____

SL 2

27. Draw the cyclic structure of glucose.

SL 3

28. Explain, using names and structural formula of reactants and products, the production of polyvinyl chloride (PVC) from ethene.

SL 3

29. Discuss how primary, secondary and tertiary alcohols differ in their reactions with $Cr_2O_7^{2-}/H^+$

SL 4

30. Discuss, using examples, why ethanol is a more suitable solvent than water.

SL 4

For Questions 31 and 32, choose and write the LETTER of the correct answer in the box provided.

31. The law that states that the total enthalpy change for the reaction is the sum of all changes, regardless of multiple stages of a reaction, is known as:

A. Boyle's law.
B. Newton's law.
C. Hess's law.
D. Archimedes law.

	SL 1

32. The conjugate base of $CH_3NH_3^+$ is:

A. CH_3NH_3
B. $CH_3NH_2^+$
C. CH_3NH_2
D. NH_3

	SL 1

33. Write the equilibrium constant (K_c) for the reaction below:

$$2NH_{3(g)} \rightleftharpoons N_{2(g)} + 3H_{2(g)}$$

SL 2

34. A certain brand of root beer has a hydronium concentration equal to 1.9×10^{-5}M. Calculate the pH and pOH of this root beer.

SL 3

35. A step in the conversion of natural gas to synthesized gas involves the partial oxidation of methane with steam to form carbon monoxide and hydrogen. The equilibrium can be represented by the equation:

$$CH_{4(g)} + H_2O_{(g)} \rightleftharpoons CO_{(g)} + 3H_{2(g)} \qquad \triangle H = +206 \text{ kJ/mol}$$

Explain how the equilibrium amount (number of moles) of carbon monoxide alter if the temperature was increased while the pressure remained constant.

SL 3

For Questions 36 and 37, choose and write the LETTER of the correct answer in the box provided.

36. What is the oxidation number of silicon in $MgSiO_3$?

A. +1
B. +2
C. +4
D. -2

	SL 1

37. Which species is reduced in the reaction below?

$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$$

A. $8H^+$
B. MnO_4^-
C. Mn
D. Mn^{2+}

	SL 1

38. List any TWO oxidising agents.

_____

SL 2

39. Describe one observation you would see when a shiny nail (iron) is placed in a copper sulphate solution.

_____
_____
_____
_____
_____

SL 2

40. If a concentrated solution of sodium chloride (called brine) is electrolysed, chloride ions are oxidized at the anode in preference to water.

Write the half equation for the anode reaction.

_____

SL 2

41. List any TWO reducing agents.

_____

SL 2

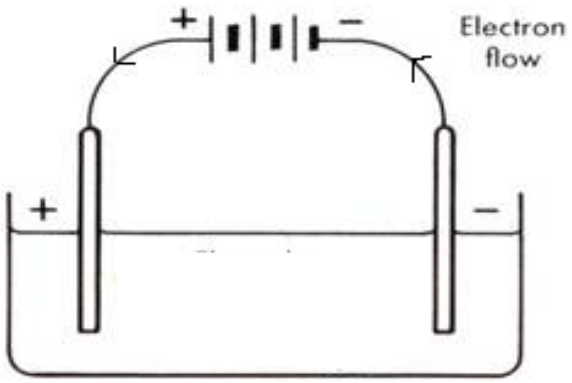
42. Write a balanced half equation showing hydrogen peroxide, H_2O_2 acting as an oxidant.

SL 3

43. Write a balanced half equation showing nitrate ions in acid solution forming nitrogen dioxide.

SL 3

44. The diagram below shows equipment set up for the electrolysis of molten sodium chloride.



Label the cathode and anode ends in the diagram above then predict the two ion-electron equations for the half-reactions involved during the electrolysis.

SL 4

45. In a laboratory experiment, a reaction is represented by the equation:

$$4Zn + NO_3^- + 6H_2O + 7OH^- \rightarrow 4[Zn(OH)_4]^{2-} + NH_3$$

Discuss the result of this reaction in terms of electron transfer.

SL 4

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(For Scorers only)

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