STUDENT EDUCATION NUMBER									

GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa Secondary Leaving Certificate

CHEMISTRY

2019

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.

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.

STRAND 1: ATOMIC STRUCTURE AND BONDING Weighting 17

1. Which ONE of the following lists do ALL five particles represent the same electron configuration? *Circle the best answer.*

A. H^+, He, Li^+, Be^{2+}, B^{3+}
B. O, F, Ne, Na, Mg
C. S^{2-}, Cl^-, Ar, K^+, Ca^{2+}
D. Li^+, Na^+, K^+, Rb^+, Cs^+

SL 1

Consider the following table:

Substance	Melting point, ^0C
Carbon dioxide	-57
Silicon dioxide	1700

2. With reference to the structures of these compounds, explain the melting point of silicon dioxide compared with that of carbon dioxide.

_____

_____

_____

_____

SL 3

3. Ionic compounds are usually _____.

A. Solids with low melting points
B. Solids with fairly high melting points
C. Liquids with low boiling points
D. Liquids with fairly high boiling points

SL 1

4. Draw the Lewis dot diagram structure for Nitrogen trichloride.

SL 1

5. With reference to the crystal structure of solid sodium chloride and the structure of molten sodium chloride, explain why the solid sodium chloride is a non-conductor but the molten sodium chloride is a good electrical conductor.

SL 4

6. Predict the shape of the carbon dioxide molecule.

SL 1

7. Describe how calcium metal reacts with water. Name the products formed.

SL 2

8. Define the term *isotope*.

SL 1

9. An atom has 14 neutrons in the nucleus and its electron configuration is 2,8,3. The mass number of the atom is:

A. 13

B. 14

C. 17

D. 27

SL 1

10. If you had a good supply of a solid, explain how you would test it in a school laboratory to see if it contained ions.

_____

_____

_____

_____

_____

SL 2

STRAND 2: QUANTITATIVE CHEMISTRY Weighting 17

11. Calculate the number of moles of oxygen that are required for the complete combustion of two moles of methane.

SL 2

Read the following to answer Number 12 to 15.

During the preparation of a standard solution of sodium carbonate (Na_2CO_3), a student obtains the following results:

Mass of beaker = 128.45 g
Mass of beaker and anhydrous sodium carbonate = 131.10 g

The student dissolved this sodium carbonate in enough water to make exactly 100 mL of standard solution.

12. What piece of apparatus would the student have used to measure the 20 mL of standard solution into a conical flask for the titration?

_____

SL 1

13. What piece of apparatus would the student use to measure the acid necessary to neutralize the standard solution?

_____

SL 1

14. Briefly explain how the student would have known when the two solutions were neutralized?

_____

_____

_____

_____

SL 2

15. Write an equation for the reaction which occurred between hydrochloric acid and sodium carbonate.

SL 2

16. Discuss the preparation and use of standard solutions in real life situations.

SL 4

_____

_____

_____

_____

_____

_____

_____

_____

_____

17. Which of the following substances contains the greatest number of molecules?

A. 10 g ethane
B. 10 g chloromethane
C. 10 g methane
D. 10 g bromomethane

M(H) = 1 g/mol M(C) = 12 g/mol M(Br) = 78 g/mol M(Cl) = 35.5 g/mol

SL 3

Read the following to answer Number 18 and 19.

A student prepares a standard solution by dissolving 5.3 g anhydrous sodium carbonate in enough water to make up 200 mL of solution. The student then titrates the solution with a hydrochloric acid solution, using methyl orange indicator and finds that 20 mL of the standard solution requires 25 mL of the acid to reach the endpoint.

Calculate the concentration of the hydrochloric acid in:

18. mol/L

SL 1

19. g/L

SL 1

20. Use the electron structure to explain why sodium forms a chloride salt whereas neon will not.

SL 4

_____

_____

_____

_____

_____

From the KEY LIST select the element referred to in Number 21 below.

KEY LIST

A. Iron B. Calcium C. Sodium D. Zinc

21. The element which forms a soluble carbonate.

SL 1

_____

22. Some silver nitrate is added to a solution containing chloride ions. Later, dilute ammonia is added to the reaction mixture. Briefly explain what observations would be made.

SL 3

_____

_____

_____

_____

_____

23. Write the ionic equation for the precipitation of copper (II) hydroxide.

SL 2

24. Describe properties or test you could use to distinguish C_2H_4 and C_2H_2.

SL 2

Define the following terms for Number 25 and 26.

25. Isomer

SL 1

26. Refluxing

SL 1

27.

Acidified potassium dichromate will oxidise enthanal to ethanoic acid. For acidified potassium dichromate, give the name and formula of oxidizing species.

SL 2

For Number 28 and 29, give the most important observations that would be made in each of the following test tube reactions:

28. Propanol is warmed with methanoic acid in the presence of sulfuric acid.

SL 3

_____

_____

_____

_____

_____

29. Propanol is warmed with dilute acidified potassium dichromate.

SL 3

_____

_____

_____

_____

_____

30. Discuss why aldehydes have higher melting and boiling points than alkanes of similar molecular mass.

SL 4

_____

_____

_____

_____

_____

_____

_____

31. Esters are sweet smelling volatile organic compounds containing oxygen but no hydroxyl groups. Many perfumes contain naturally occurring esters dissolved in ethanol (b.p 78.6°C).

Discuss why ethanol is a more suitable solvent than water for perfumes.

SL 4

_____

_____

_____

_____

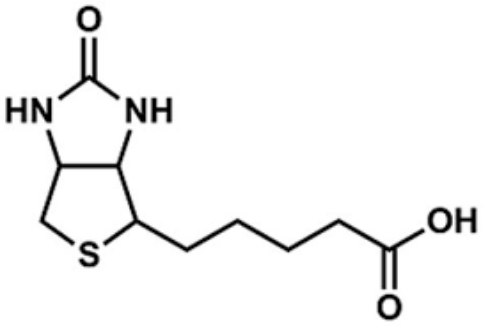
_____

_____

32. **Biotin** is a vitamin. It is found in small amounts in many foods such as eggs, milk, or bananas. **Biotin** is commonly used for hair loss, brittle nails, nerve damage and many other conditions.

Circle the **carboxylic acid** functional group.

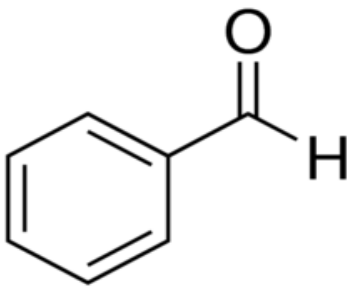
SL 1



33. **Benzaldehye** is a colourless liquid with a characteristic almond-like odour. It is widely used by the chemical industry in the preparation of various perfumes, flavourings and pharmaceuticals.

Circle the **aldehyde** functional group.

SL 1



The equation for the burning of carbon is:

$$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} \qquad \triangle H = -400 \text{ kJ/mol}$$

34. Calculate the enthalpy change, $\triangle H$ when 6 g of carbon burns.

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

SL 2

Ethanol is being developed as an alternative fuel to petrol. It burns according to the equation:

$$C_2H_5OH_{(l)} + 3O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{(g)}$$

35. Use the following information to find $\triangle H$, the enthalpy of reaction for ethanol burning.

$$2C_{(s)} + \tfrac{1}{2}O_{2(g)} + 3H_{2(g)} \rightarrow C_2H_5OH_{(l)} \qquad \triangle H = -235 \text{ kJ/mol}$$
$$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} \qquad \triangle H = -393 \text{ kJ/mol}$$
$$H_{2(g)} + \tfrac{1}{2}O_{2(g)} \rightarrow H_2O_{(g)} \qquad \triangle H = -242 \text{ kJ/mol}$$

SL 3

36. Write the **equilibrium (K_c) constant** for the reaction.

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

SL 2

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

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

How would the equilibrium amount (number of moles) of carbon monoxide alter if the temperature was increased while the pressure remained constant? Give a reason.

SL 3

Give the oxidation numbers of the named elements in the ions below:

38. Chromium in $Cr_2O_7^{2-}$ = _____

SL 1

39. Phosphorus in H_3PO_4 = _____

SL 1

40. Nitrogen in NO_2^- = _____

SL 1

41. Write the ion-electron half equation for the reduction of acidified permanganate ions.

SL 3

Determine the fully balanced equations for the following reactions:

42. Acidified dichromate ions oxidizing iron (II) ions.

SL 4

43. Iron and an aqueous solution of copper (II) sulphate.

SL 4

44. Acidified potassium permanganate oxidizing copper (II) ions.

SL 4

45. Place the following compounds of manganese in order of increasing of oxidation number for manganese:

$KMnO_4$ **$MnSO_4$** **MnO_2**

_____

SL 3

46. Write the ion-electron half-equation for the oxidation of zinc metal.

SL 3

STUDENT EDUCATION NUMBER									

CHEMISTRY

2019

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: Principles of Physical Chemistry		10
STRAND 6: Oxidation and Reduction		24
TOTAL		**100**