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# Samoa Secondary Leaving Certificate

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# CHEMISTRY

# 2022

## 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
<b>STRAND 1</b>	ATOMIC STRUCTURE AND BONDING	2-4	31	17
<b>STRAND 2</b>	QUANTITATIVE CHEMISTRY	5-7	31	17
<b>STRAND 3</b>	INORGANIC CHEMISTRY	8-9	18	10
<b>STRAND 4</b>	ORGANIC CHEMISTRY	10-13	40	22
<b>STRAND 5</b>	PRINCIPLES OF PHYSICAL CHEMISTRY	14-15	18	10
<b>STRAND 6</b>	OXIDATION AND REDUCTION	16-19	42	24
<b>TOTAL</b>			<b>180</b>	<b>100</b>

Check that this booklet contains pages 2-20 in the correct order and that none of these pages are blank.

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

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

1. Which of the following has the lowest ionization energy?

- A. chlorine
- B. sulfur
- C. sodium
- D. silicon

SL 1

2. The shape of an isolated  $\text{NH}_3$  molecule is likely to be:

- A. linear
- B. bent shape
- C. trigonal
- D. tetrahedral

SL 1

3. Electronegativity is defined as the:

- A. energy required to remove an electron from an atom.
- B. shielding effect in an atom.
- C. electron affinity in an atom.
- D. measure of how strongly electrons are attracted to the nucleus of an atom.

SL 1

4. Explain why the tetrachloromethane ( $\text{CCl}_4$ ) molecule is non-polar, yet it has polar bonds.

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SL 2

5. Describe the trends of the ionic radius, across Period 2 of the Periodic Table.

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SL 2

6. Explain in terms of structure and bonding why copper is a good conductor of electricity.

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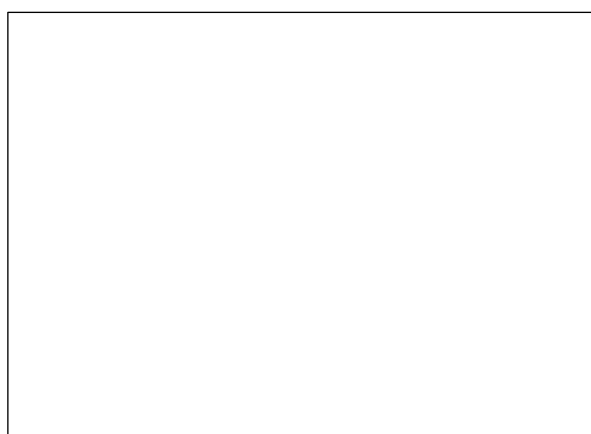
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SL 3

7. Draw the shape of the methane molecule.



SL 3

8. Discuss a chemical test that would show magnesium is a metal.

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SL 4

For Questions 9 to 10, choose and write the LETTER of the correct answer in the box provided.

9. The number of moles of  $C_2H_6$  which contains 30 g of hydrogen is:

$$M(C) = 12 \text{ g/mol}$$

$$M(H) = 1 \text{ g/mol}$$

- A. 1
- B. 3
- C. 5
- D. 6

SL 1

10. The equivalence point is the point:

- A. at which an indicator changes colour during a titration.
- B. at which no reaction takes place.
- C. at which a chemical reaction takes place.
- D. at which an acid or base is neutralized by added base or acid.

SL 1

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

SL 1

12. Describe the colour change for the methyl orange indicator when an endpoint of a titration is reached.

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SL 2

13. A student was provided with 14.3 g of sodium carbonate, 250 mL volumetric flask, funnels, pipettes, a wash bottle, and a supply of distilled water. Using all these, describe the steps that the student would take to prepare a standard solution of sodium carbonate.

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SL 2

14. A student wishes to prepare 250 mL of a 0.20 mol/L solution of the hydrated oxalic acid  $(\text{COOH})_2 \cdot 2\text{H}_2\text{O}$ . Calculate the mass of oxalic acid the student would need to weigh.

$$M((\text{COOH})_2 \cdot 2\text{H}_2\text{O}) = 126 \text{ g/mol}$$

SL 3

15. Calcium hydroxide dissolves in water to form a saturated solution (limewater). To determine the concentration of limewater, in mol/L, four separate 10 mL portions (aliquots) of the solution were titrated with 0.125 mol/L standardized hydrochloric acid using bromophenol blue as the indicator. The four titre values were 28.0 mL, 23.9 mL, 24.1 mL and 24.0 mL.

Calculate the concentration of the limewater solution.

<b>SL 3</b>

16. Discuss the preparation and uses of titrations in industries in real-life situations.

<b>SL 4</b>

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

17. The trend in the bond type of the chlorides in Period 3 of the Periodic Table is from:

- A. ionic to ionic.
- B. covalent to covalent.
- C. ionic to covalent.
- D. ionic to metallic.

SL 1

18. The chemical formula for sodium oxide is:

- A.  $S_2O$
- B.  $NaO$
- C.  $Na_2O$
- D.  $NaO_2$

SL 1

19. Describe one observation and name the complex ion formed when excess dilute ammonia is added to the solution of  $AgCl_{(s)}$ .

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SL 2



20. Write a balanced equation for the reaction of hydrochloric acid (dilute) and copper carbonate.

<b>SL 3</b>

21. The elements lithium, sodium, and potassium are members of the same group on the periodic table.  
State three physical properties common to all three elements.

<b>SL 3</b>

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

22. Which of the following is an aldehyde?

- A.  $\text{CH}_3\text{-O-CH}_3$
- B.  $\text{HCOOH}$
- C.  $\text{CH}_3\text{CH=O}$
- D.  $\text{CH}_2=\text{CH}_2$

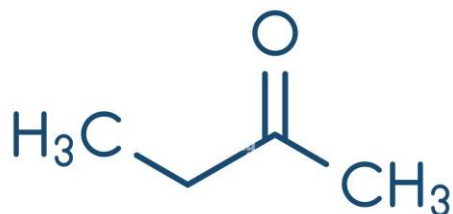
SL 1

23. The substitution reaction in which carboxylic acids reacts with alcohols to form esters is:

- A. Condensation.
- B. Saponification.
- C. Polymerization.
- D. Esterification.

SL 1

24. Name the following compound.



SL 2

Name of compound: \_\_\_\_\_

25. Draw the structure of a secondary alcohol and state its IUPAC name.

<b>IUPAC name:</b> _____
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<b>SL 2</b>

26. Choose ONE polymer other than PVC and explain its use in terms of its property.

_____ _____ _____ _____ _____ _____ _____
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<b>SL 2</b>

27. Draw the open structure of glucose.

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<b>SL 3</b>

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

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SL 3

29. For the oxidation of ethanol to ethanoic acid by acidified potassium dichromate, state the ion-electron half-equations for the oxidation reaction and discuss an important observation from the reaction.

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SL 4

30. Discuss why the solubility of alcohols in water decreases as the molar mass of the alcohol increases.

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SL 4

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

31. The photosynthesis process is an example of:

- A. An exothermic reaction.
- B. An endothermic reaction.
- C. A chemical reaction.
- D. None of the above.

SL 1

32. The equilibrium constant,  $K_c$  for the reaction,  
 $A + B \rightleftharpoons C + D$  is defined as:

- A.  $K_c = A + B + C + D$
- B.  $K_c = C + D + A + B$
- C.  $K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$
- D.  $K_c = \frac{[A]^a [B]^b}{[C]^c [D]^d}$

SL 1

33. Describe the role of a catalyst in a chemical reaction.

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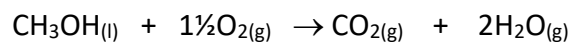
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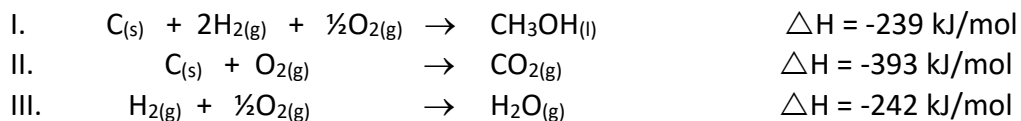
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SL 2

34. Methanol (CH<sub>3</sub>OH) has been suggested as an alternative for petrol. It burns according to the equation:



Use the following information to find,  $\Delta H$ , the enthalpy of reaction for methanol burning.



SL 3

35. Calculate the pH of a  $6.50 \times 10^{-3} \text{ mol/L}$  for the KOH solution.

SL 3

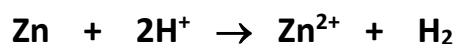
For Questions 36 and 37, choose and write the LETTER of the correct answer in the box provided.

36. The oxidation number of manganese in  $MnO_4^-$  is:

- A. 1
- B. 3
- C. 5
- D. 7

	SL 1

37. Which species is oxidised in the reaction below?



- A. Zn
- B.  $2H^+$
- C.  $Zn^{2+}$
- D.  $H_2$

	SL 1

38. List any TWO reducing agents.

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SL 2

39. Describe one observation you would see when a piece of copper metal is placed in concentrated nitric acid.

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SL 2



40. Explain an observation that would be made when an acidified dichromate ions is reduced.

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SL 2

41. Describe an acid and its use for acidifying oxidizing agents.

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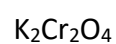
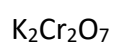
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SL 2

42. Place the following compounds of chromium in order of decreasing oxidation number for chromium.



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SL 3

43. When a pale green solution of ferrous sulfate is added to an orange solution of potassium dichromate (acidified with sulfuric acid), the orange colour disappears and a dull dark green solution results.

Write the balanced half equation for the oxidation reaction.

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SL 3

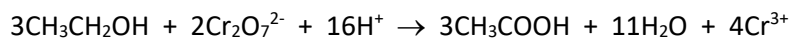
44. When a strip of iron metal is placed in copper sulfate solution, it is seen to dissolve. A brown precipitate of copper forms in the copper sulfate solution. If a strip of iron is placed in a solution of calcium chloride no reaction is observed.

Predict the two ion-electron equations for the half-reactions which occur.

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SL 4

45. The reaction below occurs in the 'breathalyser' when a drunken driver blows into the bag.



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

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<b>SL 4</b>

STUDENT EDUCATION NUMBER									

## CHEMISTRY

2022

*(For Scorers only)*

STRANDS		Weighting	Scores	Check Scorer	AED check
STRAND 1	ATOMIC STRUCTURE AND BONDING	17			
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<b>TOTAL</b>		<b>100</b>			