



MINISTRY OF EDUCATION AND CULTURE

STUDENT EDUCATION NUMBER

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# Samoa Secondary Leaving Certificate

# CHEMISTRY

# 2025

## 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 to the appropriate places in this booklet.

**NB:** The Periodic Table is attached on page 21 of the exam paper.

| STRANDS         |                                  | Pages | Time (min) | Weighting  |
|-----------------|----------------------------------|-------|------------|------------|
| <b>STRAND 1</b> | ATOMIC STRUCTURE AND BONDING     | 2-3   | 27         | 15         |
| <b>STRAND 2</b> | QUANTITATIVE CHEMISTRY           | 4-6   | 31         | 17         |
| <b>STRAND 3</b> | ORGANIC CHEMISTRY                | 7-10  | 34         | 19         |
| <b>STRAND 4</b> | INORGANIC CHEMISTRY              | 11-12 | 18         | 10         |
| <b>STRAND 5</b> | PRINCIPLES OF PHYSICAL CHEMISTRY | 13-14 | 18         | 10         |
| <b>STRAND 6</b> | OXIDATION AND REDUCTION          | 15-18 | 36         | 20         |
| <b>STRAND 7</b> | ENVIRONMENTAL CHEMISTRY          | 19-20 | 16         | 9          |
| <b>TOTAL</b>    |                                  |       | <b>180</b> | <b>100</b> |

Check that this booklet contains pages 2-22 in the correct order and that none of these pages are blank.

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

1. State the general rule for the mass of an isotope.

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SL 1

2. Describe the electronegativity trends across the period.

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SL 2

3. Describe **ONE** property of discrete molecular substances (e.g. H<sub>2</sub>O, CO<sub>2</sub>, N<sub>2</sub>)

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SL 2

4. Explain how the structure and bonding of copper (Cu) metal contribute to its physical properties (*e.g. conductivity, malleability and ductility*).

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SL 3



7. It is important to know the concentration of a solution because it directly impacts the behavior and properties of the solution.

State the formula for calculating the concentration of a solution.

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| SL 1 |
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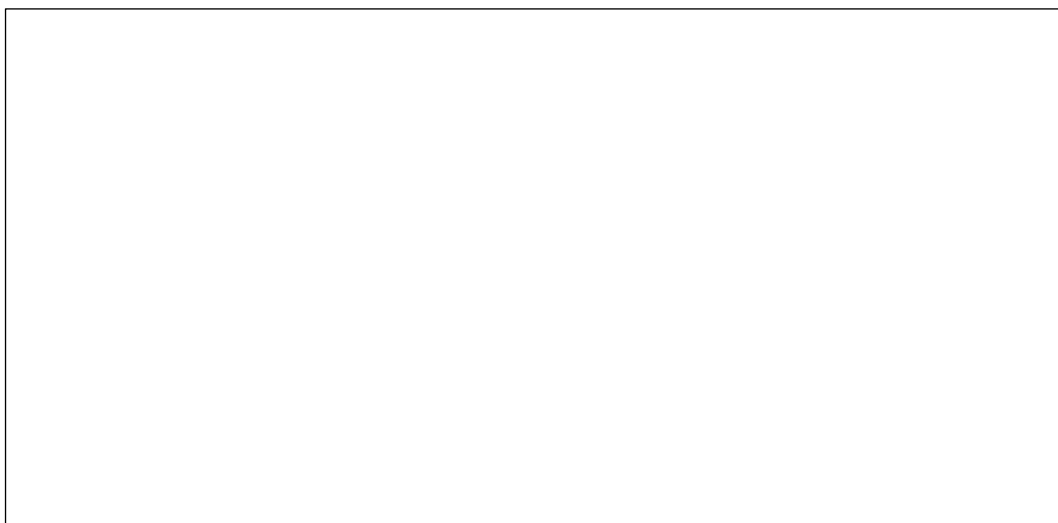
- 8 The equivalence point signifies the end of the reaction between the trial and the substance being titrated.

Define the term equivalence point.

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| SL 1 |
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9. Draw a diagram of the conical flask (also known as an Erlenmeyer flask).



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| SL 1 |
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10. Describe the colour change of methyl orange at the endpoint of a titration between a strong acid and a weak base.

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| SL 2 |
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11. Convert  $3.01 \times 10^{23}$  molecules of water ( $\text{H}_2\text{O}$ ) into moles. (Show your working).

Given: Avogadro's number =  $6.022 \times 10^{23}$  molecules/mole

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| SL 2 |
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12. You are synthesizing aspirin (acetylsalicylic acid). Based on stoichiometric calculations, the theoretical yield is 5.00 grams. After purification, you obtain 4.20 grams.

Calculate the percentage yield of aspirin for this reaction (Show your working).

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| SL 3 |
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13. Your chemistry teacher has assigned you the task of preparing a 500.0 mL solution of 0.200 M potassium chloride (KCl) for a laboratory experiment.

Given that the molar mass of KCl is 74.55 g/mol, calculate the mass of KCl required to make this solution.

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| SL 3 |
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14. A 7.02 mg sample of hydrocarbon **X** gave 21.99 mg of carbon dioxide and 8.95 mg of water on combustion.

Calculate the empirical formula of the hydrocarbon **X**.

**M(C) = 12 g/mol**

**M(H) = 1 g/mol**

**M(O) = 16 g/mol**

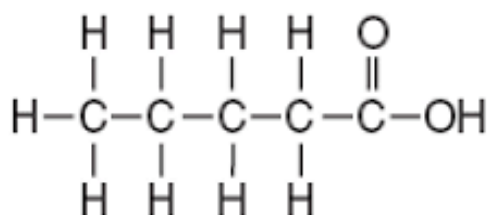
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| SL 4 |
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15. Name **ONE** class of unsaturated hydrocarbon.

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SL 1

16. Name the following compound using IUPAC nomenclature.



SL 1

Name: \_\_\_\_\_

17. A student compares two types of plastic used in making water pipes. One of them is polyethylene. Polyethylene pipes are bendable and resist breaking even when pressure is applied.

List **TWO** physical properties of polyethylene that make it suitable for water pipes.

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SL 2

- 18 Draw the structural formula of the secondary alcohol: propan-2-ol in the space provided.

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| SL 2 |
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19. List **TWO** properties of esters.

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| SL 2 |
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20. Write a balanced chemical equation for the formation of ethyl ethanoate. Include the formula of all reactants and products.

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| SL 3 |
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23. Write the chemical formula for **aluminum oxide**.

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| SL 1 |
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24. Write the **chemical formula** for the chloride compound formed by any one element from sodium (Na) to phosphorus (P) in Period 3 of the periodic table.

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| SL 1 |
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25. List **TWO** essential pieces of apparatus used in a water of crystallization experiment.

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| SL 2 |
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26. Explain the chemical reaction that occurs in the ion test for the Carbonate ion ( $\text{CO}_3^{2-}$ ). Support your answer by writing balanced equations.

Carbonate ion ( $\text{CO}_3^{2-}$ )

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| SL 3 |
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27. A case study looks at a coal-burning plant and its effects on nearby lakes and soils. The data shows that air emissions of Sulphur dioxide ( $\text{SO}_2$ ) and Nitrogen dioxide ( $\text{NO}_2$ ) are prevalent and fish deaths in the lakes are often seen on its shores.



Source : [www.nytimes.com](http://www.nytimes.com)

Explain how acidic oxides from the power plant cause changes in the rainwater to harm our ecosystem.

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| SL 3 |
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28. Write the conjugate base of  $\text{CH}_3\text{NH}_3^+$

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SL 1

29. During a chemistry practical, students mix hydrochloric acid and sodium hydroxide in a beaker. They noticed that the temperature of the solution increased.

Define the term *enthalpy* in the context of this reaction.

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\_\_\_\_\_

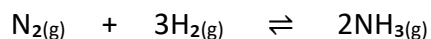
SL 1

30. List **TWO** factors that affect the rate of reactions.

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\_\_\_\_\_

SL 2

31. The Haber process is represented by the equilibrium reaction:



At 450°C, the equilibrium concentrations are:

$$[\text{H}_2] = 2.17 \text{ mol/L}, \quad [\text{N}_2] = 0.725 \text{ mol/L}, \quad [\text{NH}_3] = 0.256 \text{ mol/L}.$$

Calculate the value of  $K_c$  for the reaction (Show your working).

SL 3

32. Calculate the hydrogen ion  $[H^+]$  concentration for a solution with **pH 6.80**. Show all necessary steps.

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| SL 3 |
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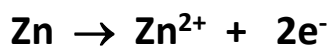
For Question 33, choose and write the LETTER of the correct answer in the box provided.

33. The oxidation number of chromium (Cr) in  $\text{CrO}_4^{2-}$  is :

- A. -6
- B. -3
- C. +3
- D. +6

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| SL 1 |
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34. In the following half-ion equation, circle the species that is oxidized.



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| SL 1 |
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35. Describe the observation when sulfur dioxide is bubbled through acidified  $\text{KMnO}_4$ .

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| SL 2 |
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36. List **TWO** common reducing agents used in laboratory or industrial processes.

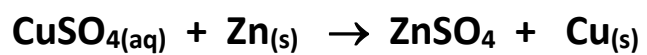
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| SL 2 |
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39. During an oxidation-reduction reaction, two half-reactions occur – one involving oxidation and the other involving reduction.

Given the following redox reaction:



Predict and write the two ion-electron equations for oxidation and reduction half-reactions involved in this reaction.

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| SL 4 |
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41. Name **ONE** type of renewable energy used in Samoa.

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| SL 1 |
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42. Define the term *greenhouse effect*.

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| SL 1 |
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43. Describe how renewable energy sources affect the environment.

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| SL 2 |
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***The stratosphere is the second major layer of Earth's atmosphere, located above the troposphere and below the mesosphere.***

44. The stratosphere is the second layer of the Earth's atmosphere.

Describe the function of the stratosphere.

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| SL 2 |
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## Periodic Table of the Elements

|  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  |   |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |
|--|--|--|--|---|--|--|--|--|--|--|--|--|--|--|--|---|--|---|--|---|--|--|--|---|--|--|--|---|--|--|--|---|--|--|--|---|--|--|--|--|--|--|--|--|--|--|--|---|--|--|--|---|--|--|--|---|--|--|--|---|--|--|--|---|--|--|--|--|--|--|--|
| 1  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  | 2 |  | 18  |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |
| 1<br><b>H</b><br>Hydrogen<br>1.008       |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  |   |  | 2<br><b>He</b><br>Helium<br>4.003         |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |
| 3<br><b>Li</b><br>Lithium<br>6.941       |  |  |  | 4<br><b>Be</b><br>Beryllium<br>9.012    |  |  |  |  |  |  |  | 5<br><b>B</b><br>Boron<br>10.811           |  |  |  | 6<br><b>C</b><br>Carbon<br>12.011         |  |   |  | 7<br><b>N</b><br>Nitrogen<br>14.007       |  |  |  | 8<br><b>O</b><br>Oxygen<br>15.999         |  |  |  | 9<br><b>F</b><br>Fluorine<br>18.998     |  |  |  | 10<br><b>Ne</b><br>Neon<br>20.180         |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |
| 11<br><b>Na</b><br>Sodium<br>22.990      |  |  |  | 12<br><b>Mg</b><br>Magnesium<br>24.305  |  |  |  | 3  |  |  |  | 4  |  |  |  | 5   |  |   |  | 6   |  |  |  | 7   |  |  |  | 8                                       |  |  |  | 9   |  |  |  | 10  |  |  |  | 11                                       |  |  |  | 12                                       |  |  |  | 13<br><b>Al</b><br>Aluminum<br>26.982     |  |  |  | 14<br><b>Si</b><br>Silicon<br>28.086      |  |  |  | 15<br><b>P</b><br>Phosphorus<br>30.974      |  |  |  | 16<br><b>S</b><br>Sulfur<br>32.066        |  |  |  | 17<br><b>Cl</b><br>Chlorine<br>35.453       |  |  |  | 18<br><b>Ar</b><br>Argon<br>39.948         |  |  |  |
| 19<br><b>K</b><br>Potassium<br>39.098    |  |  |  | 20<br><b>Ca</b><br>Calcium<br>40.078    |  |  |  | 21<br><b>Sc</b><br>Scandium<br>44.956        |  |  |  | 22<br><b>Ti</b><br>Titanium<br>47.88       |  |  |  | 23<br><b>V</b><br>Vanadium<br>50.942      |  |   |  | 24<br><b>Cr</b><br>Chromium<br>51.996     |  |  |  | 25<br><b>Mn</b><br>Manganese<br>54.938    |  |  |  | 26<br><b>Fe</b><br>Iron<br>55.933       |  |  |  | 27<br><b>Co</b><br>Cobalt<br>58.933       |  |  |  | 28<br><b>Ni</b><br>Nickel<br>58.693         |  |  |  | 29<br><b>Cu</b><br>Copper<br>63.546      |  |  |  | 30<br><b>Zn</b><br>Zinc<br>65.39         |  |  |  | 31<br><b>Ga</b><br>Gallium<br>69.723      |  |  |  | 32<br><b>Ge</b><br>Germanium<br>72.61     |  |  |  | 33<br><b>As</b><br>Arsenic<br>74.922        |  |  |  | 34<br><b>Se</b><br>Selenium<br>78.09      |  |  |  | 35<br><b>Br</b><br>Bromine<br>79.904        |  |  |  | 36<br><b>Kr</b><br>Krypton<br>84.80        |  |  |  |
| 37<br><b>Rb</b><br>Rubidium<br>84.468    |  |  |  | 38<br><b>Sr</b><br>Strontium<br>87.62   |  |  |  | 39<br><b>Y</b><br>Yttrium<br>88.906          |  |  |  | 40<br><b>Zr</b><br>Zirconium<br>91.224     |  |  |  | 41<br><b>Nb</b><br>Niobium<br>92.906      |  |   |  | 42<br><b>Mo</b><br>Molybdenum<br>95.94    |  |  |  | 43<br><b>Tc</b><br>Technetium<br>98.907   |  |  |  | 44<br><b>Ru</b><br>Ruthenium<br>101.07  |  |  |  | 45<br><b>Rh</b><br>Rhodium<br>102.906     |  |  |  | 46<br><b>Pd</b><br>Palladium<br>106.42      |  |  |  | 47<br><b>Ag</b><br>Silver<br>107.868     |  |  |  | 48<br><b>Cd</b><br>Cadmium<br>112.411    |  |  |  | 49<br><b>In</b><br>Indium<br>114.818      |  |  |  | 50<br><b>Sn</b><br>Tin<br>118.71          |  |  |  | 51<br><b>Sb</b><br>Antimony<br>121.760      |  |  |  | 52<br><b>Te</b><br>Tellurium<br>127.6     |  |  |  | 53<br><b>I</b><br>Iodine<br>126.904         |  |  |  | 54<br><b>Xe</b><br>Xenon<br>131.29         |  |  |  |
| 55<br><b>Cs</b><br>Cesium<br>132.905     |  |  |  | 56<br><b>Ba</b><br>Barium<br>137.327    |  |  |  | 57-71<br>Lanthanides                         |  |  |  | 72<br><b>Hf</b><br>Hafnium<br>178.49       |  |  |  | 73<br><b>Ta</b><br>Tantalum<br>180.948    |  |   |  | 74<br><b>W</b><br>Tungsten<br>183.85      |  |  |  | 75<br><b>Re</b><br>Rhenium<br>186.207     |  |  |  | 76<br><b>Os</b><br>Osmium<br>190.23     |  |  |  | 77<br><b>Ir</b><br>Iridium<br>192.22      |  |  |  | 78<br><b>Pt</b><br>Platinum<br>195.08       |  |  |  | 79<br><b>Au</b><br>Gold<br>196.967       |  |  |  | 80<br><b>Hg</b><br>Mercury<br>200.59     |  |  |  | 81<br><b>Tl</b><br>Thallium<br>204.383    |  |  |  | 82<br><b>Pb</b><br>Lead<br>207.2          |  |  |  | 83<br><b>Bi</b><br>Bismuth<br>208.980       |  |  |  | 84<br><b>Po</b><br>Polonium<br>[208, 982] |  |  |  | 85<br><b>At</b><br>Astatine<br>209, 987     |  |  |  | 86<br><b>Rn</b><br>Radon<br>222, 0.18      |  |  |  |
| 87<br><b>Fr</b><br>Francium<br>223, 0.00 |  |  |  | 88<br><b>Ra</b><br>Radium<br>226, 0.25  |  |  |  | 89-103<br>Actinides                          |  |  |  | 104<br><b>Rf</b><br>Rutherfordium<br>[261] |  |  |  | 105<br><b>Db</b><br>Dubnium<br>[262]      |  |   |  | 106<br><b>Sg</b><br>Seaborgium<br>[266]   |  |  |  | 107<br><b>Bh</b><br>Bohrium<br>[264]      |  |  |  | 108<br><b>Hs</b><br>Hassium<br>[269]    |  |  |  | 109<br><b>Mt</b><br>Meitnerium<br>[268]   |  |  |  | 110<br><b>Ds</b><br>Darmstadtium<br>[269]   |  |  |  | 111<br><b>Rg</b><br>Roentgenium<br>[272] |  |  |  | 112<br><b>Cn</b><br>Copernicium<br>[277] |  |  |  | 113<br><b>Uut</b><br>Ununtrium<br>unknown |  |  |  | 114<br><b>F1</b><br>Flerovium<br>[289]    |  |  |  | 115<br><b>Uup</b><br>Ununpentium<br>unknown |  |  |  | 116<br><b>Lv</b><br>Livermorium<br>[298]  |  |  |  | 117<br><b>Uus</b><br>Ununseptium<br>unknown |  |  |  | 118<br><b>Uuo</b><br>Ununoctium<br>unknown |  |  |  |
| 57<br><b>La</b><br>Lanthanum<br>138.906  |  |  |  | 58<br><b>Ce</b><br>Cerium<br>140.115    |  |  |  | 59<br><b>Pr</b><br>Praseodymium<br>140.908   |  |  |  | 60<br><b>Nd</b><br>Neodymium<br>144.24     |  |  |  | 61<br><b>Pm</b><br>Promethium<br>144.913  |  |   |  | 62<br><b>Sm</b><br>Samarium<br>150.36     |  |  |  | 63<br><b>Eu</b><br>Europium<br>151.966    |  |  |  | 64<br><b>Gd</b><br>Gadolinium<br>157.25 |  |  |  | 65<br><b>Tb</b><br>Terbium<br>158.925     |  |  |  | 66<br><b>Dy</b><br>Dysprosium<br>162.50     |  |  |  | 67<br><b>Ho</b><br>Holmium<br>164.930    |  |  |  | 68<br><b>Er</b><br>Erbium<br>167.26      |  |  |  | 69<br><b>Tm</b><br>Thulium<br>168.934     |  |  |  | 70<br><b>Yb</b><br>Ytterbium<br>173.04    |  |  |  | 71<br><b>Lu</b><br>Lutetium<br>174.967      |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |
| 89<br><b>Ac</b><br>Actinium<br>227, 0.28 |  |  |  | 90<br><b>Th</b><br>Thorium<br>232, 0.28 |  |  |  | 91<br><b>Pa</b><br>Protactinium<br>231, 0.36 |  |  |  | 92<br><b>U</b><br>Uranium<br>238, 0.29     |  |  |  | 93<br><b>Np</b><br>Neptunium<br>237, 0.48 |  |   |  | 94<br><b>Pu</b><br>Plutonium<br>244, 0.64 |  |  |  | 95<br><b>Am</b><br>Americium<br>243, 0.61 |  |  |  | 96<br><b>Cm</b><br>Curium<br>247, 0.70  |  |  |  | 97<br><b>Bk</b><br>Berkelium<br>247, 0.70 |  |  |  | 98<br><b>Cf</b><br>Californium<br>251, 0.80 |  |  |  | 99<br><b>Es</b><br>Einsteinium<br>[254]  |  |  |  | 100<br><b>Fm</b><br>Fermium<br>257, 0.95 |  |  |  | 101<br><b>Md</b><br>Mendelevium<br>258, 1 |  |  |  | 102<br><b>No</b><br>Nobelium<br>259, 1.01 |  |  |  | 103<br><b>Lr</b><br>Lawrencium<br>[262]     |  |  |  |   |  |  |  |   |  |  |  |  |  |  |  |

| STUDENT EDUCATION NUMBER |  |  |  |  |  |  |  |  |  |
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## SSLC CHEMISTRY

2025

*(For Scorers only)*

| STRANDS         |                                  | Weighting  | Scores | Check Scorer | AED check |
|-----------------|----------------------------------|------------|--------|--------------|-----------|
| <b>STRAND 1</b> | ATOMIC STRUCTURE AND BONDING     | 15         |        |              |           |
| <b>STRAND 2</b> | QUANTITATIVE CHEMISTRY           | 17         |        |              |           |
| <b>STRAND 3</b> | ORGANIC CHEMISTRY                | 19         |        |              |           |
| <b>STRAND 4</b> | INORGANIC CHEMISTRY              | 10         |        |              |           |
| <b>STRAND 5</b> | PRINCIPLES OF PHYSICAL CHEMISTRY | 10         |        |              |           |
| <b>STRAND 6</b> | OXIDATION AND REDUCTION          | 20         |        |              |           |
| <b>STRAND 7</b> | ENVIRONMENTAL CHEMISTRY          | 9          |        |              |           |
| <b>TOTAL</b>    |                                  | <b>100</b> |        |              |           |