STUDENT EDUCATION NUMBER									

GOVERNMENT OF SAMOA
MINISTRY OF EDUCATION, SPORTS AND CULTURE

Samoa Secondary Leaving Certificate

CHEMISTRY

2017

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 and on **all** extra papers used.
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. Number your answers clearly and attach the extra sheets at the appropriate places in this booklet.

NB: A Periodic Table is inserted as a separate sheet.

CHECK that this booklet contains pages 2-19 in the right order.
HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION

STRAND 1: ATOMIC STRUCTURE AND BONDING Weighting 17

1.1 Lithium has two naturally occurring isotopes $^{6}_{3}\mathbf{Li}$ **and** $^{7}_{3}\mathbf{Li}$.

Using symbols in the form used for the lithium isotope above, write the **common isotope** of carbon.

SL1

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1.2 Describe a test of a physical property which could show a solid to be a metal.

SL2

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

SL4

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1.4 *Silicon dioxide, SiO_2 is a high melting point solid* because of the strong three dimensional network of covalent bonds.

Choose **ONE** solid. Make a similar statement relating an important physical property to the associated structural feature.

(a) Iodine (b) Sulphur (c) Graphite (d) Copper

SL3

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1.5 Predict the shape of the carbon dioxide molecule.

SL1

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1.6 Describe the general trend in atomic radii across a row of the periodic table.

SL2

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1.7 Define the term *relative atomic mass* (A_r).

SL1

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1.8 Which is more electronegative? Carbon **or** Fluorine

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SL1

1.9 Define the term *ionic bonding*

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SL1

1.10 **Circle** the element that has the largest ionization energy:

Hydrogen Potassium Helium Silicon

SL1

STRAND 2:	QUANTITATIVE CHEMISTRY	Weighting 17

2.1 Calculate the concentration of the solution before and after dilution when a 0.02 mol sodium chloride in 5 mL of solution is diluted to 500 mL by adding 495 mL of water.

SL3

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2.2 Draw a clear diagram of a volumetric flask.

SL1

2.3 A substance **X** reacts with oxygen as shown by the equation:

$$4\mathbf{X} + O_2 \rightarrow 2X_2O$$

How many moles of oxygen molecules react with one mole of X?

_____

SL1

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

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

She dissolved this sodium carbonate in enough water to make exactly 100 mL of standard solution. Ten minutes later, she titrated this standard solution against a solution of hydrochloric acid and found that 20 mL of the sodium carbonate solution was exactly neutralized by 5 mL of the acid.

Discuss how she would have known when the two solutions were neutralized.

SL4

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2.5 A student wishes to prepare 250 mL of a 0.20 $molL^{-1}$ solution of oxalic acid $(COOH)_2.2H_2O$.

Calculate the mass of oxalic acid the student would need to weigh.

$$M\ ((COOH)_2.2H_2O) = 126\ g/mol$$

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SL2

2.6 State the formula for **calculating the concentration** of a solution.

_____

SL1

2.7 The following laboratory manual instructions were given for an experiment involving a titration:

"Pipette 20 mL of the standard solution into a titration flask. Add 2-3 drops of methyl orange indicator. Titrate from a burette until the end-point is reached."

Describe the colour change of the methyl orange when reaching the end-point.

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SL2

2.8 A 7.02 mg sample of a hydrocarbon ***X*** gave 21.99 mg of carbon dioxide and 8.95 mg of water on combustion.

Calculate the percentage composition of the elements in the hydrocarbon.

_____

SL2

2.9 Define the term *aliquot*.

_____

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SL1

STRAND 3: INORGANIC CHEMISTRY Weighting 10

3.1 Fill in the missing information:

OXIDE	State at 20°C	BONDING
SiO_2	solid	

SL1

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

Discuss any observations and state ONE product from the reaction.

SL4

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3.3 List **TWO** factors that influence the solubility of salts.

SL2

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3.4 Write the balanced equation for the reaction of $\mathbf{MgCl_{2(s)}}$ with water

SL3

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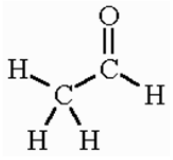
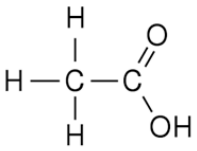
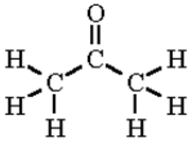
Consider the following steps in the oxidation of alcohols **A** and **B**:

Alcohol (A) —*oxidation*→  —*oxidation*→ 

Alcohol (B) —*oxidation*→ 

4.1 Draw the structures of **A** & **B**.
Discuss the difference in structures which leads to the different oxidation products obtained from each.
Identify the oxidizing agents used to oxidize **A** and **B**.

STRUCTURE A	**STRUCTURE B**

SL4

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4.2 Define the following terms:

(i) *Saponification*

SL1

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(ii) *Triglycerides*

SL1

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4.3 A few drops of Benedict solution are heated with glucose solution in a water bath.

Report what you would observe and identify the TWO coloured species in this reaction.

SL4

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4.4 Write the equation for the reaction between propanoic acid and ethanol to form an ester.

SL3

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4.5 Polythene is an addition polymer made from ethene.

Using structural formula, write the equation for the formation of polyethene.

SL3

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4.6 Describe properties of tests you could use to distinguish **CH_3COOH** from **CH_3OH**.

SL2

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4.7 List **TWO** common properties of esters.

SL2

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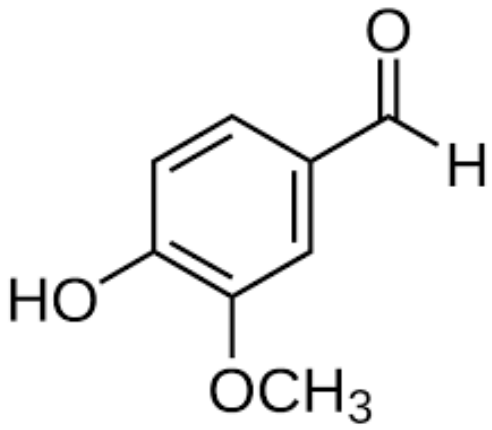
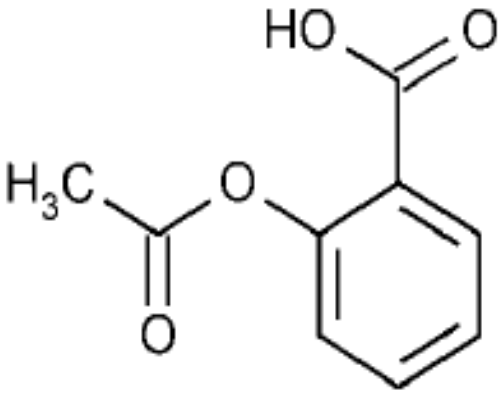
4.8 **Circle** the **aldehyde** functional group.

SL1



4.9 **Circle** the **ester** functional group.

SL1



STRAND 5:	PHYSICAL CHEMISTRY	Weighting 10

5.1 Methanol **(CH_3OH)** has been suggested as an alternative for petrol. It burns according to the equation:

$$CH_3OH_{(l)} + 1½O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(g)}$$

Use the following information to find △H, the enthalpy of reaction for methanol burning:

$C_{(s)} + 2H_{2(g)} + ½O_{2(g)} \rightarrow CH_3OH_{(l)}$ $\quad \triangle H = -239\ kJmol^{-1}$

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\quad \triangle H = -393\ kJmol^{-1}$

$H_{2(g)} + ½O_{2(g)} \rightarrow H_2O_{(g)}$ $\quad \triangle H = -242\ kJmol^{-1}$

SL3

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5.2 Write the equilibrium constant (K_c) for the reaction below:

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

SL2

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5.3 A **10 mL of 0.001 $molL^{-1}$** sodium hydroxide solution is diluted with pure water to a total volume of 100 mL.

Calculate the pH of the resulting solution.

SL3

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5.4 When **0.1 molL^{-1}** aqueous solutions of hydrochloric acid and ethanoic acid are tested, the ethanoic acid is found to have a lower hydrogen ion concentration than the hydrochloric acid.

Explain why.

SL2

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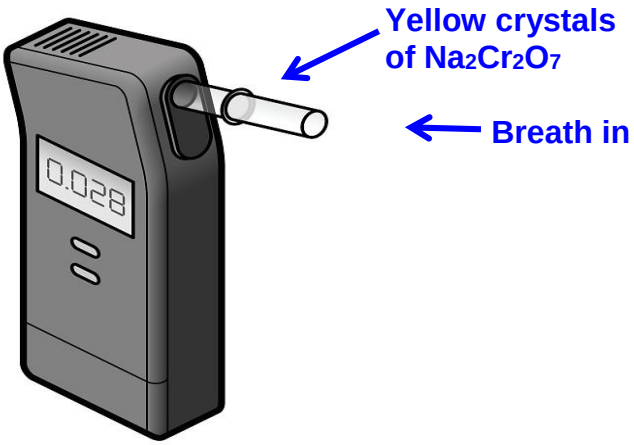
STRAND 6: OXIDATION AND REDUCTION Weighting 24

The first type of breathalyzer, still in use today, was a disposal device consisting of a plastic tube packed with yellow crystals of **$Na_2Cr_2O_7$** as shown in the diagram below.



6.1 Explain the breathalyzer test in terms of **oxidation** and **reduction**.

SL4

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6.2 State the **oxidation number** of chromium in:

$Cr_2O_7^{2-}$ = _____

SL1

6.3 List **TWO** common reducing agents.

SL1

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6.4 Write the overall redox equation for the oxidation of iron (II) ions to iron (III) ions by the permanganate ion in acid solution. The permanganate ion reacts to form the manganese (II) ion.

SL3

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6.5 Explain reduction reactions in terms of transfer of oxygen.

SL3

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6.6 Discuss any ionic reactions that occur at the cathode and the anode when a solution of copper sulphate is electrolyses between copper electrodes.

SL4

Write the equations for the reaction at each electrode.
State **ONE** important industrial use of this process.

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6.7 Write half-cell equations for the redox reactions between an acidified aqueous solution of potassium dichromate and an aqueous potassium iodide solution.

For both reactions clearly indicate where oxidation and reduction have occurred.

SL4

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6.8 Arrange the following compounds in **order** of **increasing** oxidation number for the carbon atom.

CO **CO_2** **CH_4** **CH_3OH**

_____

SL3

6.9 Define the term *reduction*.

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SL1

For scorers use only

CURRICULUM 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**