91164

911640

2

SUPERVISOR'S USE ONLY

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 2 Chemistry, 2012

91164 Demonstrate understanding of bonding, structure, properties and energy changes

9.30 am Tuesday 20 November 2012
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of bonding, structure, properties and energy changes.	Demonstrate in-depth understanding of bonding, structure, properties and energy changes.	Demonstrate comprehensive understanding of bonding, structure, properties and energy changes.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

A periodic table is provided on the Resource Sheet L2–CHEMR.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 in the correct order and that none of these pages is blank.

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

TOTAL

ASSESSOR'S USE ONLY

You are advised to spend 60 minutes answering the questions in this booklet.

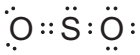
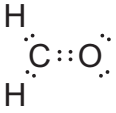
ASSESSOR'S USE ONLY

QUESTION ONE

(a) Draw the Lewis structure (electron dot diagram) for each of the following molecules.

Molecule	PCl_3	CO_2	H_2S
Lewis structure			

(b) The following table shows the Lewis structures and bond angles for the molecules SO_2 and H_2CO.

Molecule	SO_2	H_2CO
Lewis structure		
Approximate bond angle around the central atom	120°	120°

Explain why these molecules have different shapes, but have the same approximate bond angle.

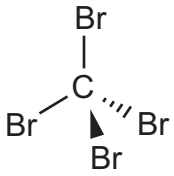
In your answer you should include:

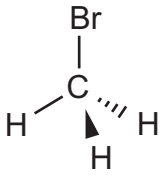
- the shapes of SO_2 and H_2CO
- factors which determine the shape of each molecule
- an explanation of why the approximate bond angle is the same by referring to the arrangement of electrons for each molecule.

ASSESSOR'S USE ONLY

ASSESSOR'S USE ONLY

(c) The 3-dimensional diagrams of two molecules are shown below.





Circle the word that describes the **polarity** of each of the molecules **CBr_4** and **CH_3Br**.

CBr_4	**Polar**	**Non-polar**
CH_3Br	**Polar**	**Non-polar**

For each molecule, justify your choice.

This page has been deliberately left blank.

The examination continues on the following page.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Complete the table below by stating the type of particle and the bonding (attractive forces) between the particles for each of the substances.

Substance	Type of particle	Attractive forces between particles
Ammonia, NH_3		
Zinc, Zn		
Silicon dioxide, SiO_2		

(b) Silicon dioxide has a melting point of 1770°C.

Explain why silicon dioxide has a high melting point by referring to the particles and the forces between the particles in the solid.

(c) Contrast both the electrical conductivity, and solubility in water, for both zinc, Zn, and zinc chloride, $ZnCl_2$, using your knowledge of structure and bonding.

ASSESSOR'S USE ONLY

QUESTION THREE

ASSESSOR'S USE ONLY

(a) Some Bunsen burners use methane gas, CH_4, as a fuel. The reaction for the combustion of methane in a Bunsen burner is shown in **Equation One** below.

Equation One: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ $\quad\quad$ $\Delta_r H = -889$ kJ mol^{-1}

When this reaction occurs, bonds are broken and bonds are formed.

State which bonds are broken and which bonds are formed during the reaction.

Bonds broken: _____

Bonds formed: _____

(b) Calculate the energy released when 128 g of methane is burnt.

M (CH_4) = 16.0 g mol^{-1}.

(c) The equation for water boiling at 100°C is shown below in **Equation Two**.

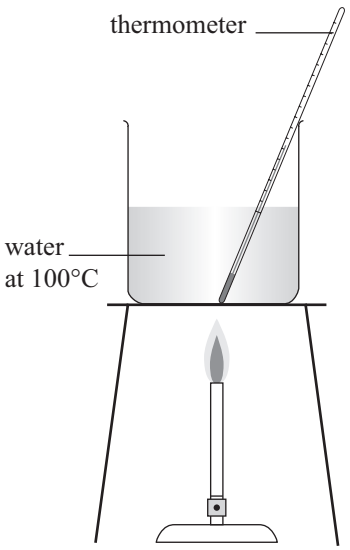
Equation Two: $H_2O(\ell) \rightarrow H_2O(g)$ $\quad\quad$ $\Delta_r H = 40.7$ kJ mol^{-1}

Explain why this equation is endothermic.

You should relate the energy changes that are occurring to the specific bonds being broken or formed.

ASSESSOR'S USE ONLY

(d) A student heats 72.0 g of water to 100°C using a Bunsen burner.



The student then boils the water.

Calculate the mass of methane gas, CH_4, that would need to be combusted in a Bunsen burner to boil the 72.0 g of water.

M (H_2O) = 18.0 g mol^{-1}.

In your answer you will need to:

- use **Equation Two** to determine the amount of energy required to boil the water
- use **Equation One** to determine the mass of methane needed to produce the required amount of energy
- assume that no energy is lost to the surrounding environment.

There is more space for your answer to Question Three (d) on the following page.

ASSESSOR'S USE ONLY

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

ASSESSOR'S USE ONLY

91164