NCEAce teaching edition | Includes original NCEAce exercises

2

91164

911640

NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

# Level 2 Chemistry, 2017

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

2.00 p.m. Thursday 16 November 2017
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 room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 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

© New Zealand Qualifications Authority, 2017. All rights reserved.
No part of this publication may be reproduced by any means without the prior permission of the New Zealand Qualifications Authority.

## QUESTION ONE

ASSESSOR'S USE ONLY

(a) When solid calcium chloride, $CaCl_2(s)$, reacts with water, the temperature increases.

Circle the term that best describes this reaction.

**endothermic** **exothermic**

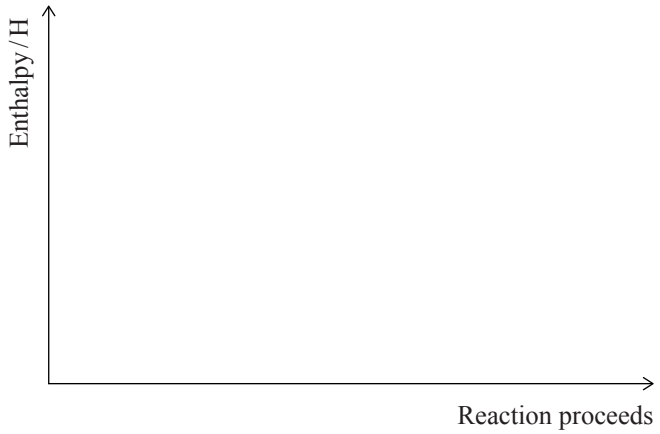
Give a reason for your choice.

(b) When a person sweats, water is lost from the body by evaporation. This is an endothermic process. This evaporation speeds up when a person exercises.

(i) Explain why the evaporation of water in sweat from the body is endothermic, and why exercise increases this evaporation.

(ii) Draw a labelled enthalpy diagram for the evaporation of water, $H_2O(\ell)$.

$H_2O(\ell) \rightarrow H_2O(g)$ $\Delta_r H° = 40.7$ kJ mol$^{-1}$



ASSESSOR'S USE ONLY

(iii) Sodium chloride, NaCl, is another compound that is excreted from the body in sweat.

Use your knowledge of structure and bonding to explain the dissolving process of sodium chloride, NaCl, in water.

Support your answer with a labelled diagram.

Space for diagram

A 50.0 g ice sample is at its melting point. A separate 50.0 g liquid water sample is at its boiling point. The molar enthalpies of fusion and vaporisation are 6.01 and 40.7 kJ $mol^{-1}$. Use $M(H_2O) = 18.0$ g $mol^{-1}$. Calculate the heat absorbed by each change of state and explain which requires more.

Show your working and reasoning.

## QUESTION TWO

ASSESSOR'S USE ONLY

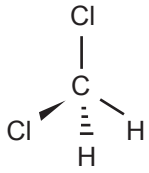
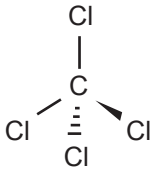
(a) (i) Draw the Lewis structure (electron dot diagram) for the following molecules, and name their shapes.

| **Molecule** | HOCl | $COCl_2$ | $NF_3$ |
|---|---|---|---|
| **Lewis structure** | | | |
| **Name of shape** | | | |
| **Approximate bond angle around the central atom** | 109.5° | 120° | 109.5° |

(ii) Justify the shapes and bond angles of HOCl and $COCl_2$.

ASSESSOR'S USE ONLY

(b) Three-dimensional diagrams for two molecules are shown below.

| **Molecule** |  |  |
|---|---|---|
| **Name** | Dichloromethane | Tetrachloromethane |
| **Polarity of molecule** | | |

(i) In the boxes above, identify the polarity of each molecule, by writing either **polar** or **non-polar.**

(ii) Justify your choices.

In a theoretical bond-energy calculation, a carbon dioxide molecule has two C=O bonds with average bond enthalpy 805 kJ $mol^{-1}$. Find the energy change for separating 0.250 mol of gaseous $CO_2$ into gaseous atoms. Calculate the energy change when the same atoms form the same amount of $CO_2$ again. Explain the signs.

Show your working and reasoning.

## QUESTION THREE

ASSESSOR'S USE ONLY

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

| Solid | Type of solid | Type of particle | Attractive forces between particles |
|---|---|---|---|
| **Al**(*s*) (aluminium) | | | |
| **$MgCl_2$**(*s*) (magnesium chloride) | | | |
| **$S_8$**(*s*) (sulfur) | | | |

(b) Circle the substance which has the lowest melting point.

Al(*s*) $MgCl_2$(*s*) $S_8$(*s*)

Justify your choice, referring to the attractive forces between the particles of ALL three substances.

ASSESSOR'S USE ONLY

**Question Three continues on the following page.**

ASSESSOR'S USE ONLY

(c) Circle the substance which is malleable.

$Al(s)$ $MgCl_2(s)$ $S_8(s)$

Justify your choice by referring to the structure and bonding of your chosen substance.
You may include a diagram or diagrams in your answer.

Space for diagram

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

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

QUESTION NUMBER

ASSESSOR'S USE ONLY

91164