

90780



NEW ZEALAND QUALIFICATIONS AUTHORITY  
 MANA TOHU MĀTAURANGA O AOTEAROA

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SUPERVISOR'S USE ONLY

## Level 3 Chemistry, 2012

### 90780 Describe properties of particles and thermochemical principles

2.00 pm Tuesday 20 November 2012

Credits: Five

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 L3-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.**

ASSESSOR'S USE ONLY		Achievement Criteria	
Achievement		Achievement with Merit	Achievement with Excellence
Describe properties of particles and thermochemical principles.	<input type="checkbox"/>	Explain and apply properties of particles and thermochemical principles.	<input type="checkbox"/>
			Discuss properties of particles and thermochemical principles.
Overall level of performance			<input type="checkbox"/>

You are advised to spend 45 minutes answering the questions in this booklet.

### QUESTION ONE

- (a) Complete the following table.

Symbol	Electron Configuration
Ge	
Cu	
Cu <sup>+</sup>	

- (b) Explain why some copper compounds are coloured, but others are not.  
Link your explanation to electron configuration.

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(c) Match the atoms and ions in the table below to the given radii.

Radii: 77 pm 123 pm 128 pm

Symbol	Radii
Ge	
Cu	
Cu <sup>+</sup>	

Justify your answer.

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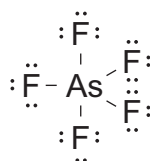
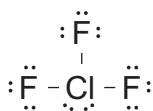
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## QUESTION TWO

(a) Complete the following table.

Molecule	SF <sub>6</sub>	SF <sub>4</sub>
Lewis diagram		
Diagram of shape		
Name of shape		

(b) The Lewis diagrams for ClF<sub>3</sub> and AsF<sub>5</sub> are shown below.



Compare and contrast the shape and polarity of these molecules.

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**QUESTION THREE**

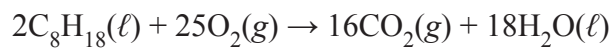
- (a) (i) Explain what is meant by the symbol  $\Delta_c H^\circ$

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- (ii) An equation for the combustion of octane is:



Calculate  $\Delta_c H^\circ(\text{C}_8\text{H}_{18}(\ell))$ , given the following data:

$$\Delta_f H^\circ(\text{C}_8\text{H}_{18}(\ell)) = -250 \text{ kJ mol}^{-1}$$

$$\Delta_f H^\circ(\text{CO}_2(\text{g})) = -394 \text{ kJ mol}^{-1}$$

$$\Delta_f H^\circ(\text{H}_2\text{O}(\ell)) = -286 \text{ kJ mol}^{-1}$$

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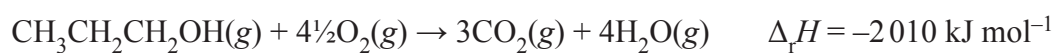
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(b) The equation for the combustion of propan-1-ol is:



Calculate the bond enthalpy for the C=O bond, using the enthalpy of the reaction above and the bond enthalpy data in the table.

Bond	Bond enthalpy/kJ mol <sup>-1</sup>
C–H	+414
C–O	+358
O=O	+498
C–C	+346
O–H	+463

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- (c) Define bond enthalpy and explain why the bond enthalpy value calculated for C=O is higher than the C–O bond enthalpy.

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## QUESTION FOUR

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- (a) (i) Write the equations which represent the enthalpy of fusion,  $\Delta_{\text{fus}}H^\circ$ , and vaporisation,  $\Delta_{\text{vap}}H^\circ$ , for water.

$\Delta_{\text{fus}}H^\circ(\text{H}_2\text{O})$  \_\_\_\_\_

$\Delta_{\text{vap}}H^\circ(\text{H}_2\text{O})$  \_\_\_\_\_

- (ii) Explain why  $\Delta_{\text{vap}}H^\circ(\text{H}_2\text{O}) = 40.7 \text{ kJ mol}^{-1}$  is greater than  $\Delta_{\text{fus}}H^\circ(\text{H}_2\text{O}) = 6.01 \text{ kJ mol}^{-1}$ .

In your answer you should include:

- a description of the attractive forces between the molecules in the different phases (states) of water
- a discussion of how these forces relate to the given enthalpy values.

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Question Four continues on page 10

- (b) Chloroethanol ( $\text{HOCH}_2\text{CH}_2\text{Cl}$ ) and chloropropane ( $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$ ) have similar molar masses, but significantly different boiling points.

Identify the substance with the higher boiling point, and justify your choice.

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