

91164



911640



NEW ZEALAND QUALIFICATIONS AUTHORITY
 MANA TOHU MĀTAURANGA O AOTEAROA

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

2

SUPERVISOR'S USE ONLY

Level 2 Chemistry, 2018

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

9.30 a.m. Monday 26 November 2018
 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 in the Resource Booklet 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.

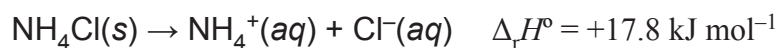
YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

TOTAL

ASSESSOR'S USE ONLY

QUESTION ONE

- (a) The equation for the dissolving of ammonium chloride, NH_4Cl , in water is shown below.



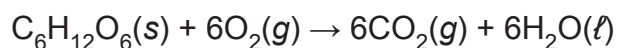
Circle the term that best describes this reaction:

endothermic

exothermic

Give a reason for your choice.

- (b) (i) Respiration is the process by which energy is released from glucose.



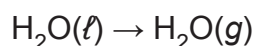
Circle the term that best describes this reaction:

endothermic

exothermic

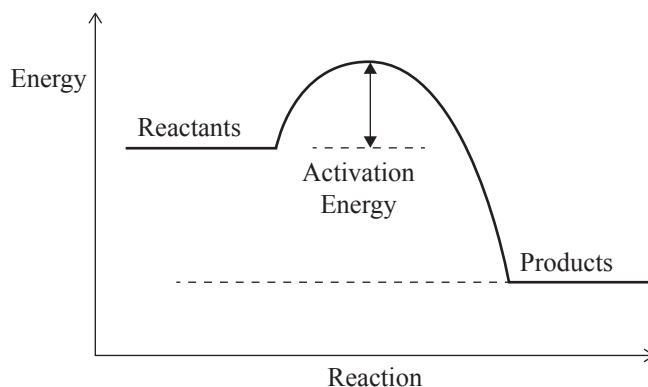
Give a reason for your choice.

- (ii) Water formed in the respiration reaction evaporates.



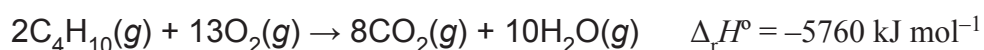
Explain whether this process is endothermic or exothermic

- (c) (i) Butane is used to fuel a camping stove. Butane burns readily in oxygen.
The following is an energy profile diagram for the combustion of butane.



Explain how the diagram shows that the enthalpy change for this reaction is negative.

- (ii) The following is the equation for the combustion of butane gas in oxygen.



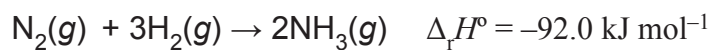
The fuel cylinder for the stove contains 450 g of butane gas.

Calculate the energy released when this mass of butane gas is burned completely in oxygen.

Show your working and include appropriate units in your answer.

$$M(\text{C}_4\text{H}_{10}) = 58.0 \text{ g mol}^{-1}$$

- (d) Nitrogen gas, $\text{N}_2(\text{g})$, reacts with hydrogen gas, $\text{H}_2(\text{g})$, to produce ammonia gas, $\text{NH}_3(\text{g})$, as shown by the following equation:



Calculate the average bond enthalpy of the **N–H** bond in NH_3 , using the average bond enthalpies in the table below.

Bond	Average bond enthalpy kJ mol^{-1}
$\text{N}\equiv\text{N}$	945
$\text{H}-\text{H}$	436

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

(b) Compare and contrast the shapes and bond angles of NH_3 and BF_3 .

- ASSESSOR'S
-
- USE ONLY

Molecule	$\text{H}-\text{C}\equiv\text{N}$	$\text{O}=\text{C}=\text{O}$
Polarity of molecule	Polar	Nonpolar

ASSESSOR'S
USE ONLY

Both molecules are linear.

Explain why the polarities of the molecules are different, even though their shapes are the same.

- (d) Methanol, $\text{CH}_3\text{OH}(l)$, is made industrially by reacting carbon monoxide, $\text{CO}(g)$, and hydrogen, $\text{H}_2(g)$.



Calculate the volume of methanol made when 4428 kJ of energy is released.

The mass of 1.00 L of methanol is 0.790 kg.

$$M(\text{CH}_3\text{OH}) = 32.0 \text{ g mol}^{-1}$$

(a) Complete the table below by choosing the appropriate type of solid that matches the properties shown in the table.

Solid	Melting point (°C)	Boiling point (°C)	Conducts electricity?	Soluble in water?	Type of solid
A	290	732	solid – no molten – yes	Yes, solution conducts electricity	
B	44	280	No	No	
C	1710	2230	No	No	
D	660	2470	Solid and molten – yes	No	

- Refer to the particles, structure, and bonding of this substance.

- (c) Elaborate on the differences in the melting points of solids **B** and **D** with reference to their particles, structure, and bonding.

ASSESSOR'S
USE ONLY

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

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.

ASSESSOR'S
USE ONLY

QUESTION
NUMBER

91164