

90932



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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## Level 1 Chemistry, 2014

### 90932 Demonstrate understanding of aspects of carbon chemistry

9.30 am Wednesday 19 November 2014

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of aspects of carbon chemistry.	Demonstrate in-depth understanding of aspects of carbon chemistry.	Demonstrate comprehensive understanding of aspects of carbon chemistry.

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.**

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

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**QUESTION ONE: ORGANIC COMPOUNDS**

(a) Complete the following table by naming or drawing the structure of each organic compound.

	Name	Structure
(i)		$  \begin{array}{cccc}  & \text{H} & \text{H} & \text{H} & \text{H} \\  &   &   &   &   \\  \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} - \text{H} \\  &   &   &   &   \\  & \text{H} & \text{H} & \text{H} & \text{H}  \end{array}  $
(ii)	heptane	
(iii)	propene	
(iv)		$  \begin{array}{ccc}  & \text{H} & \text{H} \\  &   &   \\  \text{H} & - \text{C} & - \text{C} - \text{O} - \text{H} \\  &   &   \\  & \text{H} & \text{H}  \end{array}  $

Alkanes and alkenes are organic compounds made up of carbon and hydrogen atoms.

(b) Name the type of bonding that occurs between the atoms in these organic compounds.

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Explain your answer.

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(c) Explain how the chemical bonding in alkanes and alkenes affects the way they are used.

In your answer:

- give the general formulae of alkanes and alkenes
- describe the similarities and differences in chemical bonding
- identify ONE common use for each of alkanes and alkenes
- link the chemical bonding to the property or properties of each type of compound that makes them suitable for the identified use.

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**QUESTION TWO: CRACKING AND POLYMERS**

Cracking is a process used to break down the long-chain alkanes found in crude oil, into smaller molecules.

- (a) Complete a balanced symbol equation to show how the long-chain alkane decane,  $C_{10}H_{22}$ , breaks down to form pentane, ethene, and propene.



- (b) Explain why some long-chain alkanes need to undergo cracking.

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Polymers are very large molecules made up of many small repeating units.

- (c) Explain why an alkene such as ethene can be used to make polymers, while an alkane such as ethane cannot.

You may draw diagrams as part of your explanation.

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(d) Polymers are used in the production of plastics.

Plastic pollution is becoming a planet-wide problem, with much of the waste plastic ending up in our oceans. Polyethene (polythene) and polypropene (polypropylene) both float on the ocean's surface, forming part of the large floating islands of plastic waste that form where ocean currents meet.

Explain why the polymers polyethene and polypropene form part of these floating islands of plastic.

In your answer:

- describe the chemical structure and bonding of these polymers
- explain the chemical reactivity of these polymers.

**QUESTION THREE: PHYSICAL PROPERTIES**

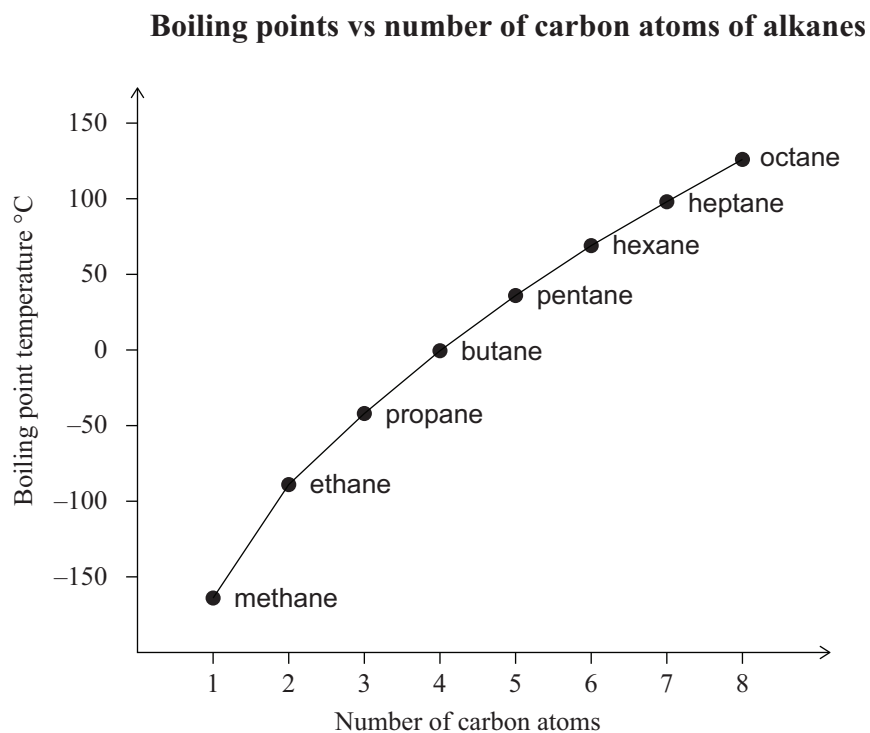
(a) Define the term 'boiling point'.

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The boiling points of some alkanes are shown in the graph below.



(b) Analyse the trend in boiling points of the first eight alkanes, as shown in the graph above.

In your answer:

- describe the trend
- explain why this trend occurs.

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- (c) Ethanol is soluble in water, ethane is not. Ethane has a much lower boiling point than ethanol.

Compare and contrast the chemical structures and bonding of ethane and ethanol to explain the difference in these physical properties.

In your answer:

- describe the structures and chemical bonding of ethane and ethanol
- link the chemical bonding and structure to each of the physical properties – solubility in water and boiling point – for both ethane and ethanol.

**QUESTION FOUR: METHANOL FROM NATURAL GAS**

In New Zealand methanol is produced from natural gas, methane, extracted from the Taranaki gas fields.

- (a) Draw the chemical structures for methane and for methanol.

Methane	Methanol

- (b) Write balanced symbol equations for both of the reactions involved in the production of methanol from methane.

- (i) **Reaction 1:** Methane and steam are reacted using a nickel catalyst, Ni, and a strong heat source, to form carbon monoxide gas and hydrogen gas.

- (ii) **Reaction 2:** Carbon monoxide gas and hydrogen gas are reacted at 250°C using a copper-zinc catalyst, Cu-Zn, to form methanol.





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