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90648

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TAEA

Level 1 Chemistry, 2004

90648 Describe properties and reactions of carbon and its compounds

Credits: Three
9.30 am Wednesday 10 November 2004

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 answer ALL the questions in this booklet.

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

A metal activity series, solubility rules, a table of ions and a periodic table are provided in the Resource Booklet in your Level 1 Chemistry package.

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.

Achievement Criteria *For Assessor's use only*		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe properties and reactions of carbon and its compounds. ☐	Link properties and reactions of carbon and its compounds. ☐	Apply an understanding of properties and reactions of carbon and its compounds. ☐
Overall Level of Performance ☐		

You are advised to spend 30 minutes answering the questions in this booklet.

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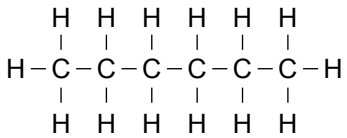
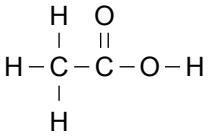
QUESTION ONE: ORGANIC COMPOUNDS

Complete the table below by writing the structural formula or the name of the compound as required.

Structural formula	Name
	methanol
	propene
	
	

QUESTION TWO: CARBON DIOXIDE

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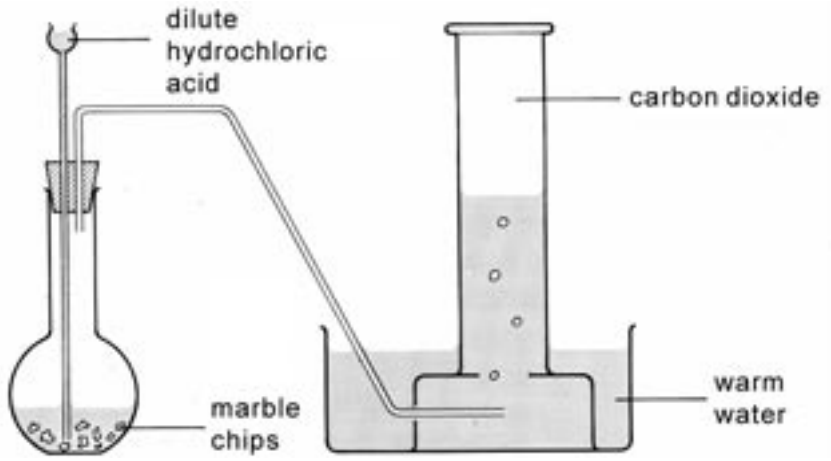
Part A: Making carbon dioxide

To make carbon dioxide gas in the laboratory Student A set up the apparatus shown in the diagram below.



(a) State why **warm** water rather than cold water is used for the collection of the gas.

(b) Write a balanced equation for the reaction of marble chips (calcium carbonate) with hydrochloric acid.

Part B: Collecting the gas

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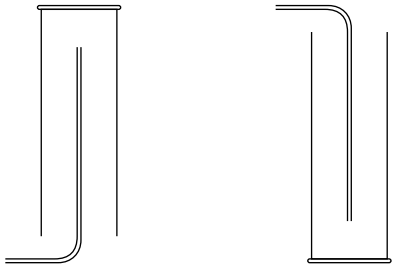
Student B used the same reaction to produce some carbon dioxide but decided to collect the gas by a different method. Two possible methods are shown below.

Method 1 **Method 2**



(c) State a property of carbon dioxide gas that allows it to be collected by Method 2 but not by Method 1.

(d) Describe how Student B could use litmus paper to test if the gas jar was full of carbon dioxide. State an observation that would be made in the test and give a reason for the observation.

(i) Test:

(ii) Observation:

(iii) Reason for the observation:

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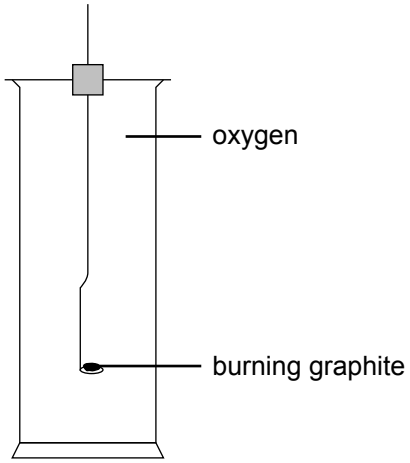
Part C

Student C decided to make a gas jar of carbon dioxide by setting alight some powdered graphite and plunging it into a gas jar of pure oxygen.



The graphite burned brightly in the oxygen but some smoke and soot were formed before the flame went out. There was some unburned graphite in the spoon.

(e) Name a gas other than carbon dioxide that would be formed in the gas jar during this reaction.

_____

(f) Explain why the gas in (e) would be formed.

_____

_____

_____

(g) Write a balanced equation for the formation of this gas.

QUESTION THREE: ALLOTROPES OF CARBON

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The structures of three allotropes of carbon are shown below.

graphite **diamond** **C_{60}**

(a) Describe what the '60' in the formula of the C_{60} allotrope means.

(b) Complete the statements below about graphite and diamond to link the use given for the allotrope to its structure.

(i) Graphite can be used as a lubricant because

(ii) Diamond is a very hard substance used in drills because

Some of the physical properties of diamond and graphite are given in the table below.

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Physical property	Diamond	Graphite
Melting point	3550°C	Sublimes (solid to gas) at 3652°C
Hardness	One of the hardest substances known	Soft solid with a greasy feel
Electrical conductivity	None	Good

(c) Predict the characteristics of melting point, hardness and electrical conductivity for C_{60}. Justify your predictions by using the structures of the three allotropes of carbon.

QUESTION FOUR: ETHANOL – THE FUEL OF THE FUTURE?

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Limited crude oil and natural gas supplies and environmental issues mean that new fuels must be developed for cars.

The table below gives some information about ethanol and propane.

	Ethanol	**Propane**
Source other than crude oil and method of production.	Fermentation of plant sugars in sugar beet.	Removing other compounds from natural gas.
Energy given out by burning 100 g of fuel.	2958 kJ	5027 kJ
State at 25°C	liquid	gas
Storage in motor vehicles.	As a liquid in 'petrol' tank.	As a liquid in heavy, pressurised cylinder.
Mass of carbon dioxide produced from 100 g of fuel.	191 g	299 g
Observation during burning in air.	Burns with an almost invisible flame. No soot remains.	Burns with a yellow flame. Some soot forms.

(a) Write a balanced equation for the complete combustion of **ethanol**.

(b) Compare ethanol and propane in terms of:

- the impact of the combustion of each fuel on people and the global environment
- the energy produced by the burning of each fuel
- safety considerations in handling and storing the fuels.

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QUESTION FIVE: FRACTIONAL DISTILLATION OF CRUDE OIL

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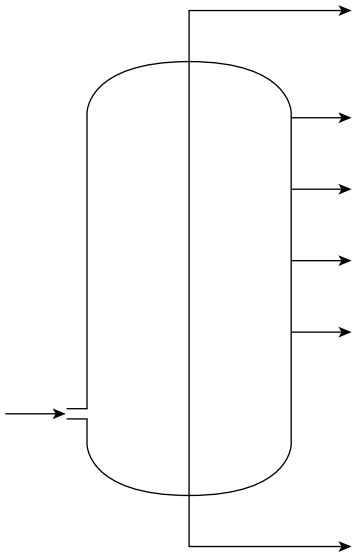
Use the physical properties of hydrocarbons to **explain** how crude oil can be separated into its components using the process of fractional distillation. You may label the diagram below and refer to it in your explanation.



**Extra paper for continuation of answers if required.
Clearly number the question.**

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Question number