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Level 1 Chemistry, 2015

90932 Demonstrate understanding of aspects of carbon chemistry

9.30 a.m. Tuesday 24 November 2015
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 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 2–10 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

TOTAL 9

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Annotated Exemplar: Achieved

Achieved exemplar for 90932 2015		Total score	09
Q	**Grade score**	**Annotation**	
1	A3	The candidate has given at least two correct structures/name for part (a), identified propane is a gas, stated that propane would undergo incomplete combustion when there is a shortage of oxygen, briefly explained the effect of carbon monoxide on human health, and written a word equation. If the candidate had linked an observation to a reaction occurring during incomplete combustion, e.g. the flame would be yellow due to specks of hot carbon, this would have provided evidence towards M5. Alternatively, if the candidate had explained why butane has a higher boiling point than propane, this would also have provided evidence towards M5.	
2	A4	The candidate has named at least two of the processes in part (a), identified that ethene has a double bond, stated one condition for Process 2, completed the symbol equation for the cracking of dodecane, recognised that the process of fractional distillation is based on differences in boiling points, and named two products from fractional distillation. If the candidate had explained that the double bond in ethene breaks to form single bonds in polyethene, and had linked the magnitude of the boiling point to either the size of the hydrocarbon or the relative height at which the hydrocarbon is collected in the tower, this would have provided evidence towards M5.	
3	N2	The candidate has explained why alcohols are not hydrocarbons, identified at least two conditions required for fermentation to occur, and identified the products of the complete combustion of ethanol (evidence provided by unbalanced symbol equation). If the candidate had given observations to distinguish ethanol and octane using solubility (octane forms two layers) rather than simply state their differing solubilities, and stated that ethanol undergoes complete combustion, this would have provided evidence towards A3.	

QUESTION ONE

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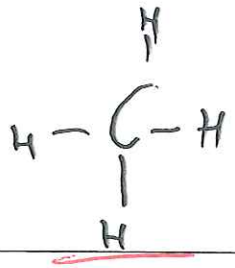
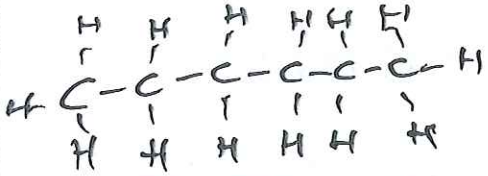
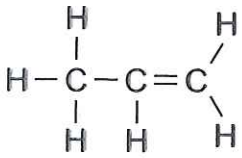
(a) Complete the table below by naming or drawing the structure of each organic compound.

Name	Structure
Methane	
Hexane	
Propene	

(b) Butane and propane are both used as fuel in camping burners.
Propane has a boiling point of −42°C.

(i) What state would propane be at room temperature (18°C)?

gas

(ii) State whether the boiling point of butane will be higher or lower than propane.

Give a reason for your answer using your knowledge of the structure and properties of alkanes.

Boiling point of butane would be: **higher** **lower**
(*circle correct answer*)

Reason:

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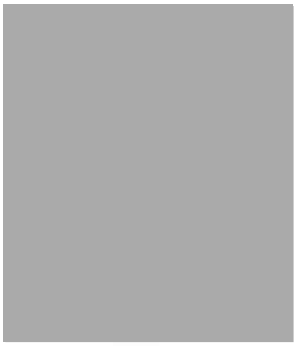
(c) Camping burners usually have a warning notice instructing people to always use them in a well-ventilated place (plenty of oxygen) otherwise serious injury or death may occur.



http://www.huntingandfishing.co.nz/camping-tramping/cookware-coolers/msr-pocket-rocket-stove.html

Elaborate on why this warning is given on camping burners.

Use a burner that contains **propane** as an example.

In your answer, you should:

- state the type of combustion reaction that occurs when there is a shortage of oxygen
- describe the observations that may be seen if there was a shortage of oxygen, and link these to the reaction occurring
- explain two effects that the combustion products can have on human health when there is a shortage of oxygen
- write a word equation and a balanced symbol equation for the reaction occurring.

In the absence of Oxygen the Propane will burn Incompletely. (Incomplete combustion) Instead of Complete combustion producing Carbon dioxide, Incomplete Combustion produces Carbon monoxide which is Poisonous as room full of this gas will suffocate anyone in it. Carbon monoxide will board your red blood cells and stop them carrying oxygen around the body.

Word equation:

Propane + Oxygen → Water + Carbon Monoxide

Balanced symbol equation:

$2C_3H_8 + 11O_2 \rightarrow 8H_2O + 6CO$

A3

QUESTION TWO

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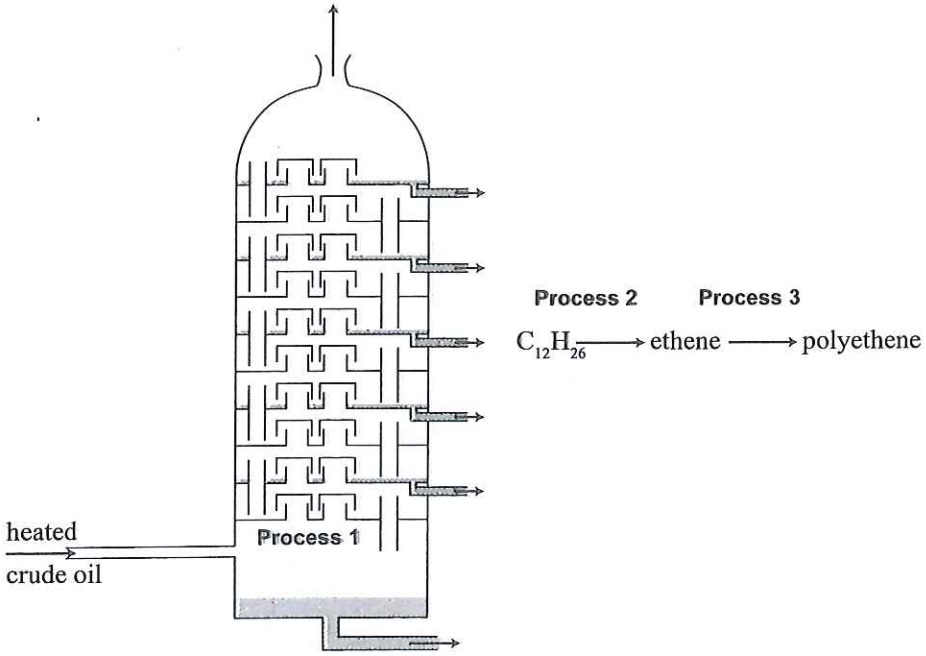
Crude oil, a mixture of many compounds, undergoes several processes to produce useful products. The diagram below shows three of the processes that may be involved.



(a) (i) Give the name of each of the processes identified in the diagram above.

Process	Name of process
1	fractional distilation
2	Cracking
3	Polymerisation

(ii) Explain how the structure of ethene allows it to undergo **Process 3**, to form polyethene.

Ethene shown by the ene has a Carbon to Carbon double bond if you break these apart you have empty bonds that can join to one another.

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(b) Dodecane, $C_{12}H_{26}$, can be reacted in **Process 2**, to form ethene and octane.

(i) State one condition that is needed during **Process 2**.

Pressure Heat

(ii) Complete the following symbol equation for the reaction of dodecane during **Process 2**.

Remember to balance the equation.

$C_{12}H_{26} \xrightarrow{Heat}$ [illegible] $2C_2H_4 + C_8H_{18}$

(c) Give a detailed account of **Process 1**, as shown in the diagram on the opposite page.

In your answer, you should:

- explain why **Process 1** is necessary
- elaborate on what occurs during **Process 1**, and link this to the structure and properties of the hydrocarbons in crude oil.
- name two products, other than dodecane, that are formed during **Process 1**.

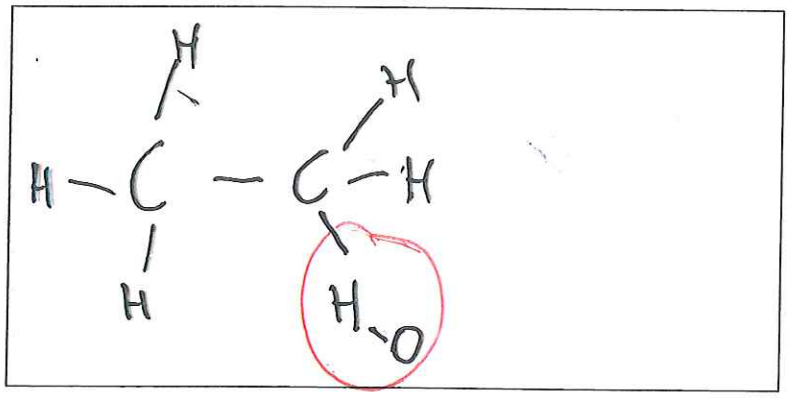
Crude Oil goes into the fractional distilation tower this gets heated and most of the crude oil will rise untill it reaches the boiling point of the particular product. this produces. Petroleum, diesel, LPG and more.

A4

QUESTION THREE

Alcohols, such as ethanol, are carbon compounds, but are not hydrocarbons like alkanes and alkenes.

(a) (i) Draw the structural formula of ethanol in the box below.



(ii) Explain why alcohols are not hydrocarbons, but alkanes and alkenes are.

because alkanes and alkenes only involve Carbons and Hydrogen. alcohols have oxygen.

(iii) Describe how a sample of ethanol could be distinguished from a sample of octane using only water.

Explain how the physical properties of the compounds allow them to be identified in this way.

ethanol is soluble in water where Octane is not. the Oxygen present in the ethanol allows this to happen.

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(b) One method of producing ethanol is by fermentation.

Explain how ethanol is produced by fermentation.

In your answer, you should:

- complete the following word equation and balanced symbol equation
- identify and elaborate on any conditions required for fermentation to occur.

Word equation:

glucose + ~~[illegible]~~ yeast → yeast, heat, time, moisture, anaerobic

Balanced symbol equation:

$2C_6H_{12}O_6$ + ~~[illegible]~~ yeast → (anaerobic, heat, moisture, time) $2C_2H_5OH$ + $4CO_2$

This requires the yeast & food (Glucose) to have moisture, ~~[illegible]~~ warmth, anaerobic conditions and time.

(c) Ethanol made from sugar cane can be mixed with petrol to produce a biofuel for cars.

Ethanol burns in air with an almost invisible flame, and has some useful advantages as a biofuel compared to some hydrocarbons found in petrol, such as heptane, C_7H_{16}.

www.renewablegreenenergypower.com/biofuel-101/

Evaluate the use of ethanol in biofuels for cars.

In your answer, you should:

- state the type of combustion reaction that ethanol usually undergoes, and name the products formed
- explain two effects that the combustion products of ethanol can have on the environment
- elaborate on the advantages of using ethanol as a biofuel compared to hydrocarbon fuels, such as those containing heptane
- include a balanced symbol equation for the combustion of ethanol.

the bi product of ethanol is water which is much better than [redacted]

Balanced symbol equation:

$2C_2H_5OH + 9O_2 \rightarrow 12H_2O + 6CO_2$

$2C_2H_5OH + 9O_2 \rightarrow 12H_2O + 6CO_2$

N2

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

QUESTION NUMBER

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