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Level 1 Chemistry, 2019

90932 Demonstrate understanding of aspects of carbon chemistry

9.30 a.m. Monday 18 November 2019
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.

A periodic table and other reference material are provided in the Resource Booklet L1–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 2–11 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

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(a) Butane can be used as a fuel, and can undergo both complete and incomplete combustion.

Compare and contrast the complete and incomplete combustion of butane.

In your answer, you should:

- outline the conditions that would cause complete and incomplete combustion to occur
- name the products that are formed under the different conditions
- describe the appearance of the flames, and link this to any relevant products formed
- explain the effects of the products of **incomplete** combustion of butane on the environment.

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(b) Other alkanes and alkenes can also be used as fuels.

(i) Complete the following equations:

A word equation to show pentane undergoing complete combustion.

pentane + oxygen →

A balanced symbol equation to show ethene undergoing complete combustion.

C_2H_4 + O_2 →

(ii) Write balanced symbol equations for the following combustion reactions:

Propane forming water, carbon dioxide, and carbon monoxide.

→

Butane forming water and carbon monoxide.

→

QUESTION TWO

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Polyethene is a polymer made from a raw material that is found in crude oil. The process to make polyethene involves several stages.

(a) One stage is to break down large molecules from crude oil into smaller hydrocarbon molecules.

(i) What is the name of this process, and why is it necessary for the production of polymers?

(ii) Complete the balanced symbol equation to show heptane being broken down into pentane and ethene.

$C_7H_{16} \rightarrow$

(iii) Write a balanced symbol equation to show the products formed when $C_{15}H_{32}$ is broken down into the smaller hydrocarbon molecules of octane, ethene, and propene.

(b) The next stage is to use ethene to produce polyethene.

How do molecules of ethene form polyethene?

In your answer, you should refer to the structures of ethene and polyethene and draw a section of polyethene containing FOUR repeating units.

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Section of polyethene containing four repeating units:

(c) Polyethene is a type of plastic. Plastics are used to make many different things.

Complete the table below, giving two uses of plastics linked to the properties that are important for these uses.

Use	**Property / properties that are important for this use**

QUESTION THREE

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(a) The tables below show the boiling points of some alkanes and alkenes.

Alkanes

Name	Number of carbons	Boiling point / °C
Ethane	2	–88
Propane	3	–42
Butane	4	0
Pentane	5	36
Hexane	6	69

Alkenes

Name	Number of carbons	Boiling point / °C
Ethene	2	–104
Propene	3	–48
Butene	4	–6
Pentene	5	30
Hexene	6	64

(i) What is the relationship between the number of carbon atoms in an alkane molecule and the boiling point of the alkane molecule?

You should use information in the table above to explain your answer.

(ii) What does the information in the tables above show about any similarities and differences in the boiling points of alkanes compared to alkenes?

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(b) (i) Draw the structural formulae of methane and methanol in the boxes below.

methane	methanol

(ii) Explain how methanol is produced from methane.

In your answer, you should:

- write relevant balanced symbol equations
- describe any conditions needed.

Balanced symbol equations:

Question Three continues on the following page.

(c) The following table shows selected data for the compounds methanol, ethanol, and propene.

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Compare and contrast the data in the table, with reference to the type of organic compound and your knowledge of the structure and chemical properties of the compounds.

Compound	Solubility in water	Number of molecules of water produced per molecule of compound during complete combustion
methanol	soluble	2
ethanol	soluble	3
propene	insoluble	3

In your answer, you should explain how you used the information in the table to compare and contrast the solubility and combustion reactions of the compounds.

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

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