

Carbon Compounds as Fuels + Feedstock

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.7 Organic Chemistry
Sub-Topic	Carbon Compounds as Fuels + Feedstock
Difficulty Level	Standard Level
Booklet	Question Paper 1

Time Allowed: 55 minutes

Score: /54

Percentage: /100

Grade Boundaries:

Q1.(a) The hydrocarbon $C_{16}H_{34}$ can be cracked.

Balance the equation for cracking $C_{16}H_{34}$



(1)

(b) Describe the differences between cracking and distillation.

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(2)

(c) What type of reaction is cracking?

Tick **one** box.

Combustion

☐

Decomposition

☐

Neutralisation

☐

Precipitation

☐

(1)

(d) Ethene is used to make poly(ethene).

Poly(ethene) is used to make plastic bags.

the table below shows data from a Life Cycle Assessment (LCA) for a plastic bag and a paper bag.

	Plastic bag	Paper bag
Raw materials	Crude oil or natural gas	Wood
Energy used in MJ	1.5	1.7
Mass of solid waste in g	14	50
Mass of CO ₂ produced in kg	0.23	0.53
Volume of fresh water used in dm ³	255	4 520

A company stated: 'A Life Cycle Assessment shows that using plastic bags has less environmental impact than using paper bags'.

Evaluate this statement. Use your knowledge and the information from above the table above.

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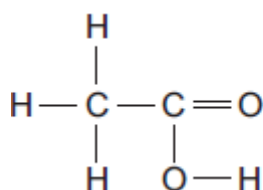
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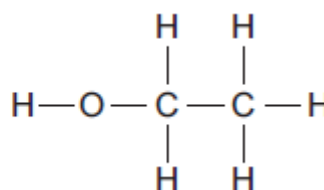
(6)
(Total 10 marks)

Q2. The diagrams represent two compounds, **A** and **B**.

Compound A



Compound B



- (a) (i) Compound **B** is an alcohol.

Name compound **B**.

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(1)

- (ii) Use the correct answer from the box to complete the sentence.

burned	decomposed	oxidised
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To form compound **A**,

compound **B** is

(1)

- (iii) Compounds **A** and **B** are both colourless liquids.

A test tube contains a colourless liquid, which could be either compound **A** or compound **B**.

Describe a simple **chemical** test to show which compound, **A** or **B**, is in the test tube.

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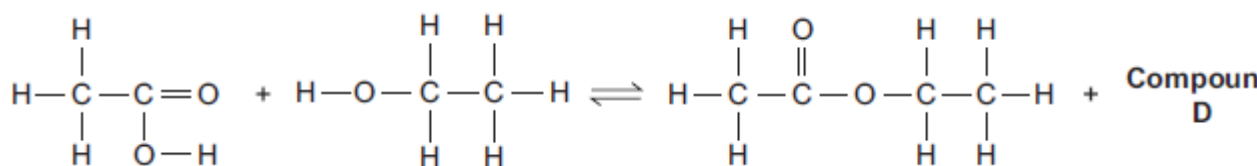
(2)

- (b) Compounds **A** and **B** react to produce compound **C** and compound **D**.

Compound A

Compound B

Compound C



- (i) What is the formula of compound **D**?

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(1)

- (ii) Compound **C** is an ester.

Name compound **C**.

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(1)

- (iii) State **one** use of esters.

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(1)

(Total 7 marks)

- Q3.** A mixture of petrol and air is burned in a car engine.
Petrol is a mixture of alkanes. Air is a mixture of gases.

The tables give information about the composition of petrol and the composition of air.

Petrol		Air	
Alkane	Formula	Gas	Percentage (%)
hexane	C_6H_{14}	nitrogen	78
heptane		oxygen	21
octane	C_8H_{18}	carbon dioxide	0.035
nonane	C_9H_{20}	Small amounts of other gases and water vapour	
decane	$C_{10}H_{22}$		

- (a) Use the information above to answer these questions.

- (i) Give the formula for heptane

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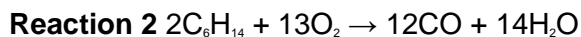
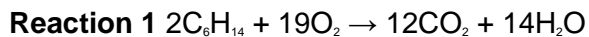
(1)

- (ii) Complete the general formula of alkanes.
n = number of carbon atoms



(1)

- (b) Alkanes in petrol burn in air.
The equations represent two reactions of hexane burning in air.



Reaction 2 produces a different carbon compound to **Reaction 1**.

- (i) Name the carbon compound produced in **Reaction 2**.

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(1)

- (ii) Give a reason why the carbon compounds produced are different.

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(1)

- (c) The table shows the percentages of some gases in the exhaust from a petrol engine.

Name of gas	Percentage (%)
nitrogen	68
carbon dioxide	15
carbon monoxide	1.0
oxygen	0.75
nitrogen oxides	0.24
hydrocarbons	0.005
sulfur dioxide	0.005
other gases	

- (i) What is the percentage of the other gases in the table?

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(1)

- (ii) What is the name of the compound that makes up most of the other gases?

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(1)

- (iii) Give a reason why sulfur dioxide is produced in a petrol engine.

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(1)

- (iv) State how nitrogen oxides are produced in a petrol engine.

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(2)

- (d) Many scientists are concerned about the carbon dioxide released from burning fossil fuels such as petrol.

Explain why.

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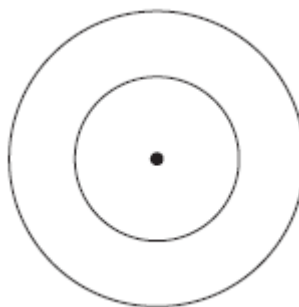
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(Total 11 marks)

Q4. Fossil fuels contain carbon and hydrogen.

- (a) (i) Use the Chemistry Data Sheet to help you to answer this question.

Complete the figure below to show the electronic structure of a carbon atom.



(1)

- (ii) Complete the word equation for the oxidation of hydrogen.

hydrogen + oxygen \longrightarrow

(1)

- (b) Coal is a fossil fuel.

Coal contains the elements hydrogen, sulfur, oxygen and carbon.

Name **two** products of burning coal that have an impact on the environment.

What impact does each of the products you named have on the environment?

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(4)

(Total 6 marks)

Q5. This question is about oil reserves.

- (a) Diesel is separated from crude oil by fractional distillation.

Describe the steps involved in the fractional distillation of crude oil.

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(3)

- (b) Diesel is a mixture of lots of different *alkanes*.

What are *alkanes*?

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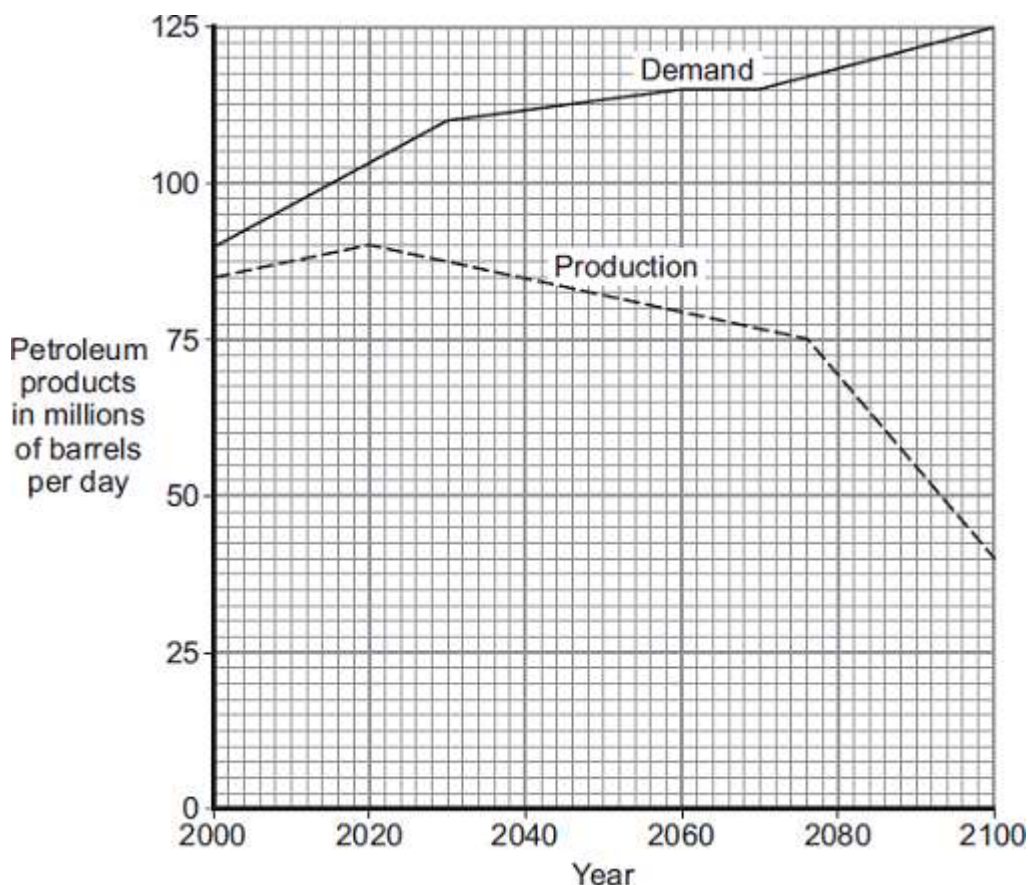
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(2)

- (c) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Petroleum products, such as petrol, are produced from crude oil.

The graph shows the possible future production of petroleum products from crude oil and the expected demand for petroleum products.



Canada's oil sands hold about 20% of the world's known crude oil reserves.

The oil sands contain between 10 to 15% of crude oil. This crude oil is mainly bitumen.

In Canada the oil sands are found in the ground underneath a very large area of forest. The trees are removed. Then large diggers and trucks remove 30 metres depth of soil and rock to reach the oil sands. The oil sands are quarried. Boiling water is mixed with the quarried oil sands to separate the bitumen from the sand. Methane (natural gas) is burned to heat the water.

The mixture can be separated because bitumen floats on water and the sand sinks to the bottom of the water. The bitumen is cracked and the products are separated by fractional distillation.

Use the information given and your knowledge and understanding to suggest the advantages and disadvantages of extracting petroleum products from oil sands.

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(6)
(Total 11 marks)

Q6.Crude oil is a mixture of many different chemical compounds.

(a) Fuels, such as petrol (gasoline), can be produced from crude oil.

(i) Fuels react with oxygen to release energy.

Name the type of reaction that releases energy from a fuel.

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(1)

(ii) Fuels react with oxygen to produce carbon dioxide.

The reaction of a fuel with oxygen can produce a different oxide of carbon.

Name this different oxide of carbon and explain why it is produced.

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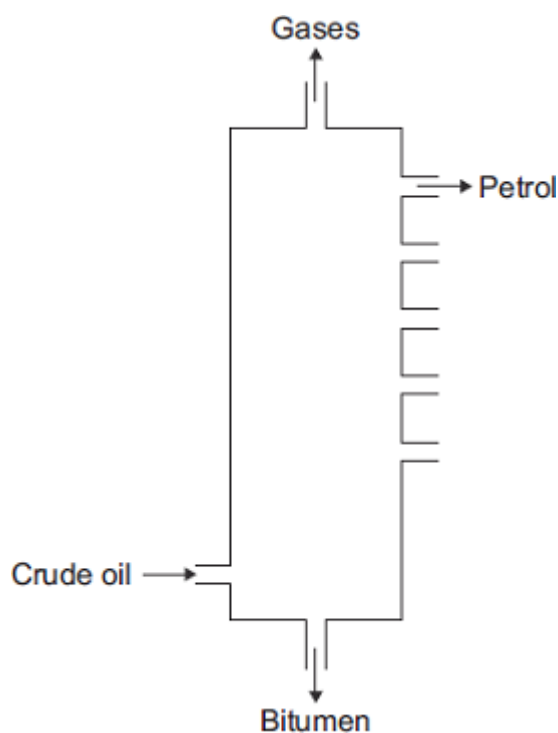
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(2)

- (b) Most of the compounds in crude oil are hydrocarbons.
Hydrocarbons with the smallest molecules are very volatile.



In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Describe and explain how **petrol** is separated from the mixture of hydrocarbons in crude oil.

Use the diagram and your knowledge to answer this question.

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(6)
(Total 9 marks)