

Carbon compounds as fuel and feedstock – GCSE Chemistry1. **No.3**

This question is about hydrocarbons.

Hexane and hexene are hydrocarbons containing six carbon atoms in each molecule.

Hexane is an alkane and hexene is an alkene.

Draw **one** line from each hydrocarbon to the formula of that hydrocarbon.

[2 marks]

Hydrocarbon	Formula
	C₆H₈
Hexane	C₆H₁₀
	C₆H₁₂
Hexene	C₆H₁₄
	C₆H₁₆

Bromine water is added to hexane and to hexene.

What would be observed when bromine water is added to hexane and to hexene?

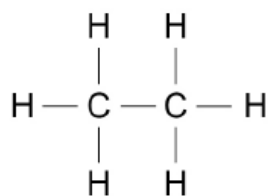
[2 marks]

Hexane _____

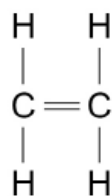
Hexene _____

Figure 1 shows the displayed structural formulae of ethane and of ethene.

Figure 1



Ethane



Ethene

Compare ethane with ethene.

You should refer to:

- their structure and bonding
- their reactions.

[6 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

2. No.7

This question is about carboxylic acids.

Carboxylic acids belong to a homologous series.

Table 3 shows information about the first three carboxylic acids in this homologous series.

Table 3

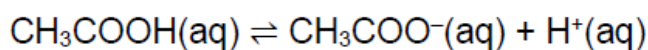
Name	Formula	pH of a 0.01 mol/dm ³ solution
Methanoic acid		2.91
Ethanoic acid	CH ₃ COOH	3.39
	CH ₃ CH ₂ COOH	3.44

Complete **Table 3**.

[2 marks]

Ethanoic acid ionises in water.

The equation for the reaction is:



Explain how the equation shows that ethanoic acid is a weak acid.

[2 marks]

A student adds a solution of ethanoic acid to zinc carbonate in an open flask on a balance.

Explain what happens to the mass of the flask and its contents during the reaction.

[3 marks]

The student compares the rates of the reaction of zinc carbonate with:

- 0.01 mol/dm³ methanoic acid
- 0.01 mol/dm³ ethanoic acid.

The rate of the reaction with methanoic acid is greater than the rate of the reaction with ethanoic acid.

Explain why.

You should refer to ions in your answer.

Use **Table 3**.

[3 marks]

Ethanoic acid reacts with ethanol to produce an ester.

Give the name of the ester produced when ethanoic acid reacts with ethanol.

[1 mark]

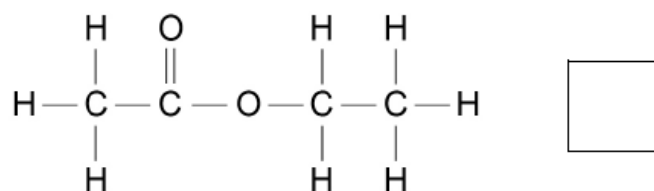
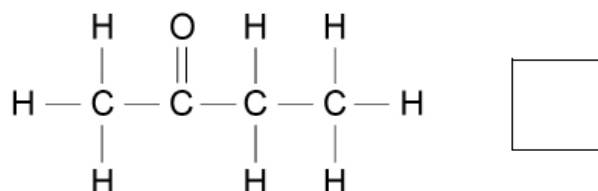
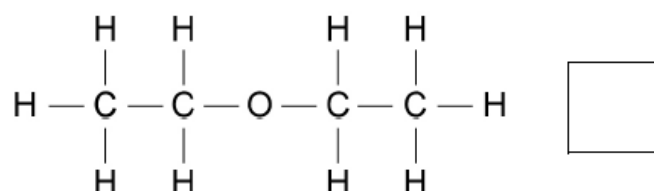
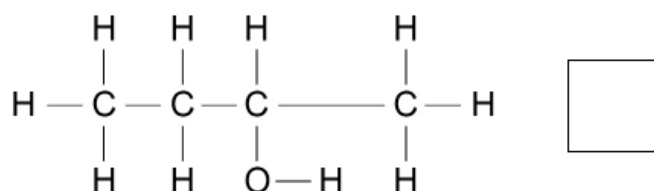
Hexanedioic acid and ethanediol join together to produce a polyester.

Ethanoic acid and ethanol join together in the same way to produce an ester.

Which is the displayed structural formula of the ester produced when ethanoic acid reacts with ethanol?

[1 mark]

Tick (✓) **one** box.



3. No.9.3

How many functional groups are there in the molecule in **Figure 6**?

[1 mark]

Tick (✓) **one** box.

1

☐

2

☐

3

☐

4

☐

4. No.9.4

Glycine reacts by condensation polymerisation to produce a polypeptide and one other substance.

Name the other substance produced.

[1 mark]

5. No.5

Figure 3 shows a surfer on a surfboard.

Figure 3



Some surfboards are made from addition polymers.

Addition polymers are made from small alkene molecules.

Which type of bonding is present in small alkene molecules?

[1 mark]

Tick (✓) **one** box.

Covalent

☐

Ionic

☐

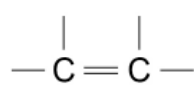
Metallic

☐

What is the functional group in these small alkene molecules?

[1 mark]

Tick (✓) **one** box.


☐

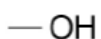
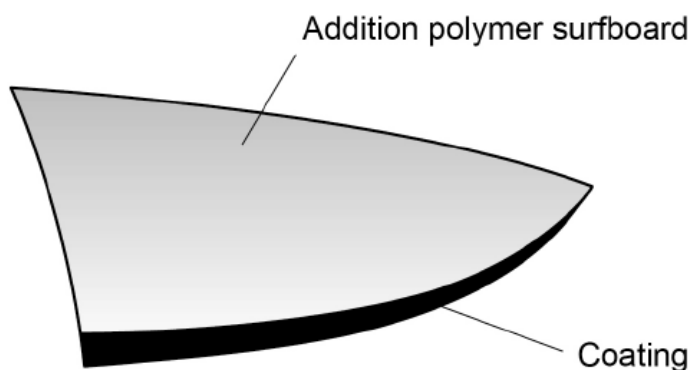
☐

☐

Figure 4 shows the structure of part of an addition polymer surfboard.

The outer surface of the surfboard is coated.

Figure 4



The coating is made from soda-lime glass fibres surrounded by a plastic.

What type of material is the coating of the surfboard?

[1 mark]

Tick (✓) **one** box.

Alloy

☐

Ceramic

☐

Composite

☐

Nanotube

☐

Complete the sentence.

Choose answers from the box.

[2 marks]

air	ammonia	copper
	limestone	sand

The materials used to make the soda-lime glass fibres are sodium carbonate,

_____ and _____.

Suggest **two** reasons why surfboards are coated.

[2 marks]

1 _____

2 _____

Some surfboards are made from wood.

Table 3 contains information about the materials in an addition polymer surfboard and a wooden surfboard.

Table 3

	Addition polymer surfboard	Wooden surfboard
Relative strength	14	38
Cost (£ per m ³)	140	390
Density (kg/m ³)	50	150
Disposal at end of life	Difficult to recycle	Can be used as fuel

Suggest **two** advantages and **two** disadvantages of using addition polymers rather than wood to make surfboards.

Use **Table 3**.

[4 marks]

Advantages of addition polymers _____

Disadvantages of addition polymers _____

Calculate the volume of wood in a wooden surfboard of mass 5.25 kg

Use **Table 3** and the equation:

$$\text{Density in kg/m}^3 = \frac{\text{Mass in kg}}{\text{Volume in m}^3}$$

[3 marks]

Volume = _____ m³

6. No.8

This question is about crude oil and hydrocarbons.

Figure 6 shows a fractionating column used to separate crude oil into fractions.

Figure 6

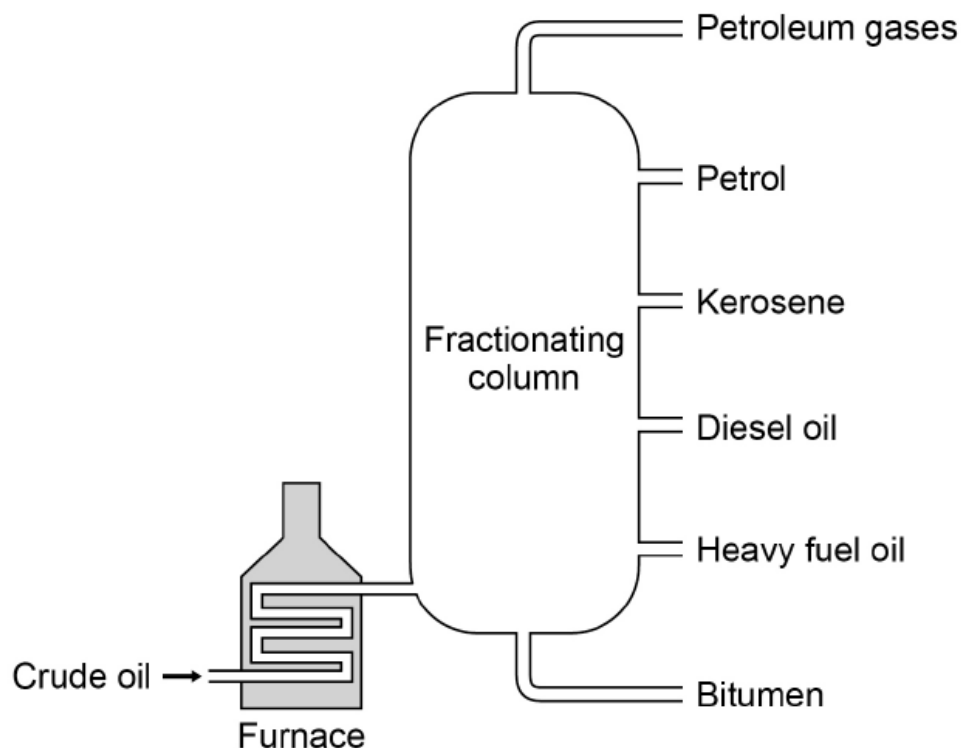


Table 5 gives information about some of the fractions.

Table 5

Fraction	Boiling point range in °C
Petroleum gases	Below 30
Petrol	40–110
Kerosene	180–260
Diesel oil	260–320
Heavy fuel oil	320–400
Bitumen	400–450

Suggest a suitable temperature for the furnace in **Figure 6**.

[1 mark]

_____ °C

Explain why diesel oil collects above heavy fuel oil but below kerosene in the fractionating column.

Use **Table 5**.

[2 marks]

Suggest **two** reasons why bitumen is **not** used as a fuel.

[2 marks]

1 _____

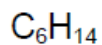
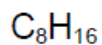
2 _____

Petrol contains mainly alkanes.

Which of the following compounds is an alkane?

[1 mark]

Tick (✓) **one** box.

☐☐☐☐

Large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

Describe the conditions needed to crack hydrocarbon molecules from the diesel oil fraction.

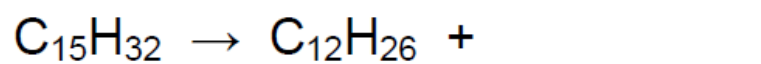
[2 marks]

Explain why large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

[2 marks]

Complete the equation for the cracking of $C_{15}H_{32}$

[1 mark]



7. No.1

This question is about crude oil and hydrocarbons.

Figure 1 shows a fractionating column used to separate crude oil into fractions.

Figure 1

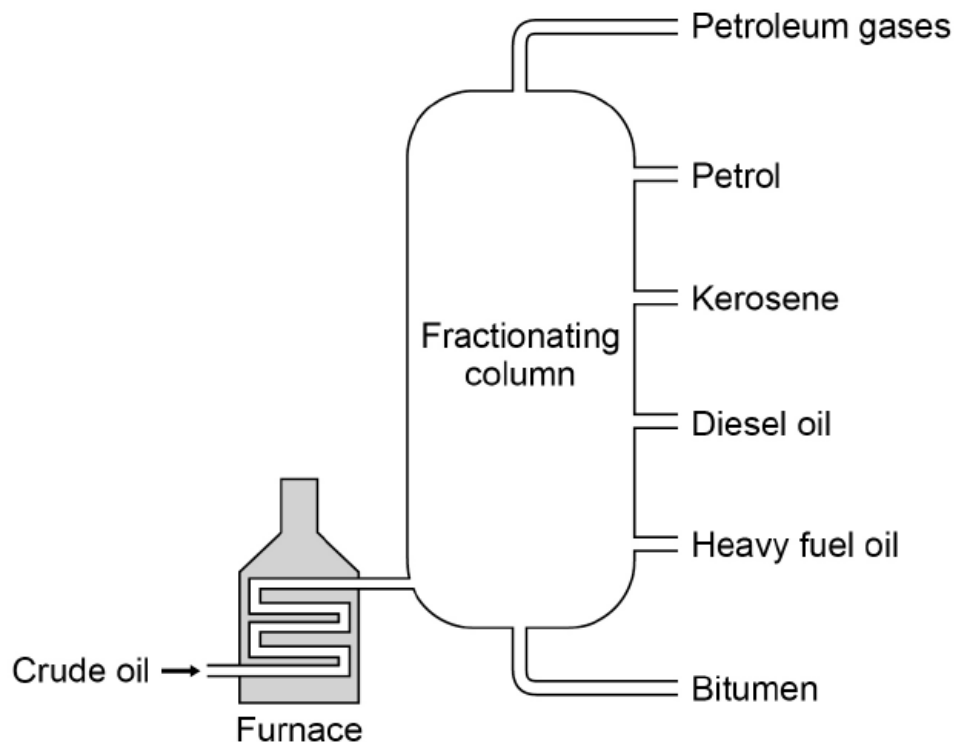


Table 1 gives information about some of the fractions.

Table 1

Fraction	Boiling point range in °C
Petroleum gases	Below 30
Petrol	40–110
Kerosene	180–260
Diesel oil	260–320
Heavy fuel oil	320–400
Bitumen	400–450

Suggest a suitable temperature for the furnace in **Figure 1**.

[1 mark]

_____ °C

Explain why diesel oil collects above heavy fuel oil but below kerosene in the fractionating column.

Use **Table 1**.

[2 marks]

Suggest **two** reasons why bitumen is **not** used as a fuel.

[2 marks]

1 _____

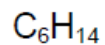
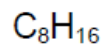
2 _____

Petrol contains mainly alkanes.

Which of the following compounds is an alkane?

[1 mark]

Tick (✓) **one** box.

☐☐☐☐

Large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

Describe the conditions needed to crack hydrocarbon molecules from the diesel oil fraction.

[2 marks]

Explain why large hydrocarbon molecules in the diesel oil fraction are cracked to produce smaller hydrocarbon molecules.

[2 marks]

Complete the equation for the cracking of $C_{15}H_{32}$

[1 mark]

