

HYDROCARBONS 9

Q1. This question is about compounds produced from crude oil.

The table below shows four of these compounds.

| Compound | Melting point in °C | Boiling point in °C |
|--|---------------------|---------------------|
| methane (CH ₄) | -183 | -164 |
| ethene (C ₂ H ₄) | -169 | -104 |
| decane (C ₁₀ H ₂₂) | -30 | +174 |
| icosane (C ₂₀ H ₄₂) | +37 | +343 |

(a) Tick (✓) two correct statements about the four compounds.

| Statement | Tick (✓) |
|---|----------|
| Methane has the lowest melting point and icosane has the highest boiling point. | |
| Ethene and methane are alkanes. | |
| Methane and decane are gases at room temperature (20 °C). | |
| Decane and icosane are liquid at 100 °C. | |

(2 marks)

(b) Petrol contains a mixture of compounds, including octane (C₈H₁₈).

Complete the word equation for the complete combustion of octane.

octane + oxygen → +

(2 marks)

Q2. The car with a steel body uses petrol for fuel.

Draw a ring around the correct answer to complete each sentence.

(i)

Petrol is made from

| |
|-------------|
| air. |
| crude oil. |
| metal ores. |

(1 mark)

(ii)

Petrol is a mixture of

| |
|--------------|
| carbonates |
| hydrocarbons |
| polymers |

including C_8H_{18}

(1 mark)

(iii)

In the car engine petrol reacts with

| |
|----------|
| argon |
| nitrogen |
| oxygen |

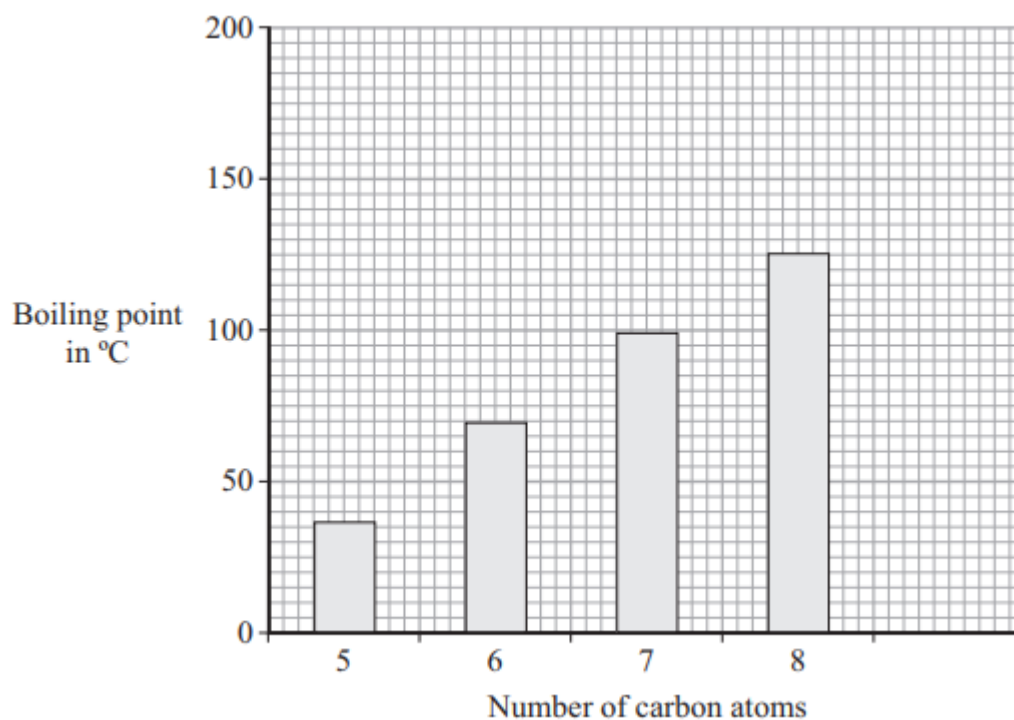
to produce carbon dioxide and water.

(1 mark)

Q3. The hydrocarbons used to make ethene come from crude oil. The properties of hydrocarbons are linked to the number of carbon atoms in their molecules.

| | | | | | |
|-------------------------------|----|----|----|-----|-----|
| Number of carbon atoms | 5 | 6 | 7 | 8 | 9 |
| Boiling point in °C | 36 | 69 | 99 | 125 | 151 |

(i) Use the data in the table to complete the bar chart.



(2 marks)

(ii) What happens to the boiling point of a hydrocarbon as the number of carbon atoms increases?

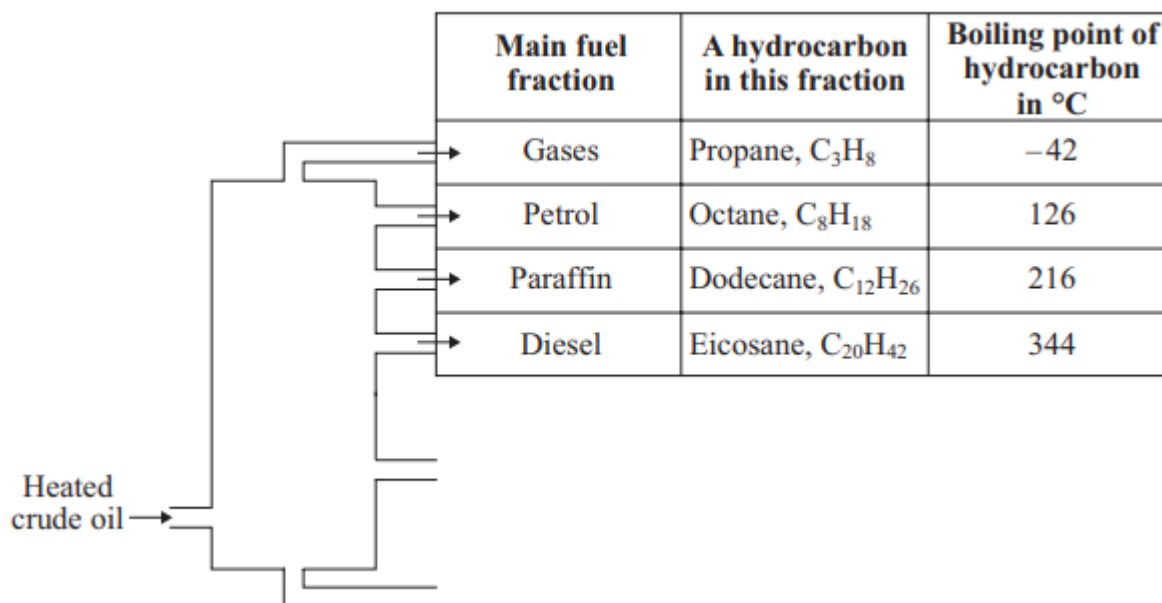
(1 mark)

(iii) All the hydrocarbons in the table are found in petrol. Petrol is one of the fractions separated from crude oil. Describe how the fractions are separated from crude oil.

(2 marks)

Q4. Crude oil is a resource from which fuels can be separated.

The name of the main fuel fractions and one of the hydrocarbons in each fraction are shown in the table.



(i) How does the number of carbon atoms in a hydrocarbon affect its boiling point?

(1 mark)

(ii) Suggest the lowest temperature to which crude oil needs to be heated to vaporise all the hydrocarbons in the table.

Temperature = °C

(1 mark)

(iii) Dodecane boils at 216 °C. At what temperature will dodecane gas condense to liquid?

Temperature = °C

(1 mark)

Q5. Fuels are substances that release energy.

(i) Name the reaction that releases energy from a fuel such as gasoline (petrol).

(1 mark)

(ii) Describe how fuel oil is broken down into smaller, more useful molecules such as petrol.

(2 marks)

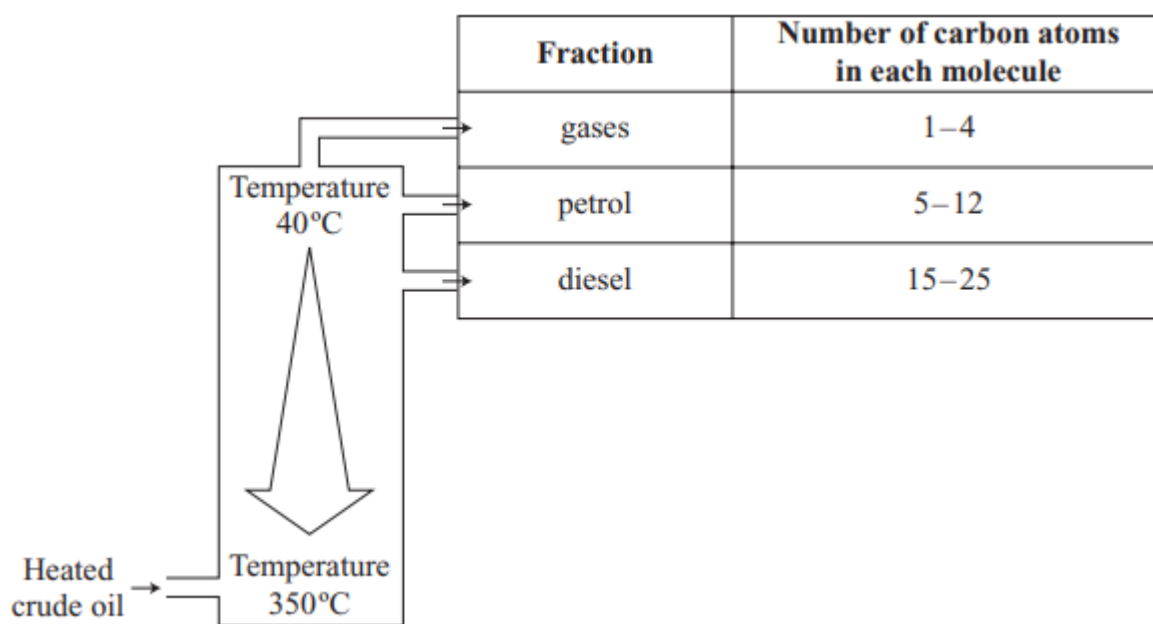
Q6. Crude oil is a natural resource from which useful fuels can be separated.

(a) Crude oil is a mixture of hydrocarbons. Complete the sentence about a hydrocarbon molecule.

A hydrocarbon molecule is made up of and carbon atoms only.

(1 mark)

(b) Many fuels come from crude oil. Some of these fuels are shown in the diagram.



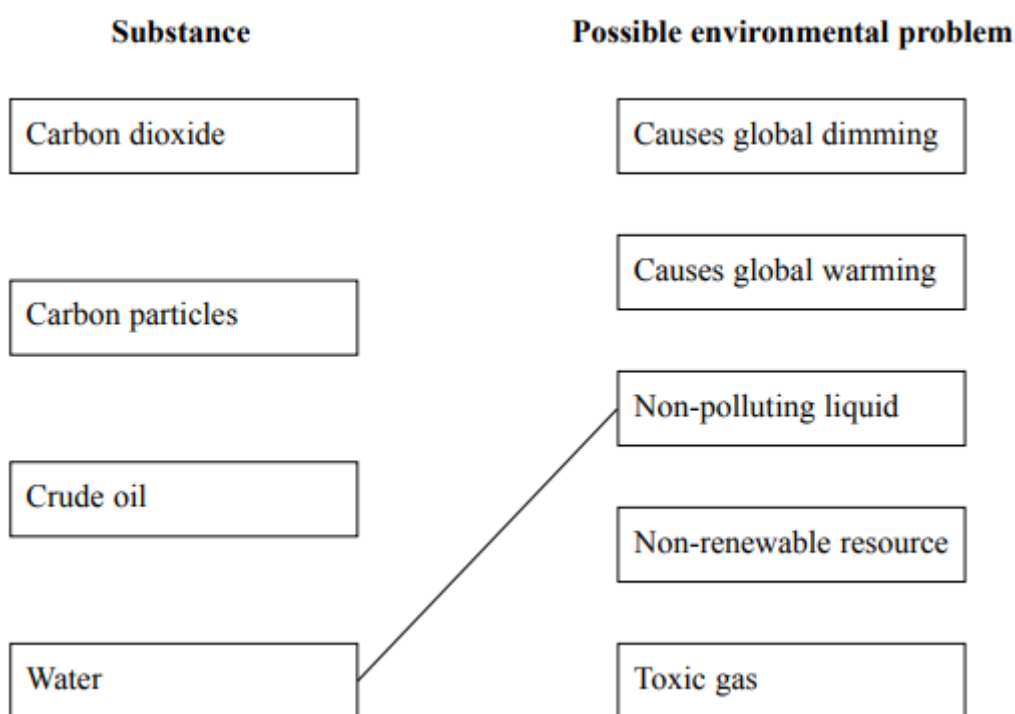
Suggest two properties of these fuels that allow them to be separated from crude oil.

(2 marks)

(c) Fuels from crude oil burn to provide heat energy.

When a fuel burns, it combines with oxygen in the air and produces carbon dioxide and water. When there is not enough oxygen, the fuel burns and also produces carbon monoxide and carbon particles.

Draw a straight line from each substance that links it to a possible environmental problem. One has been done for you.



(3 marks)

Q7. Cooking oils contain unsaturated fats. Unsaturated fats are more healthy than saturated fats. Unsaturated fats change bromine water from orange to colourless. A scientist from a food company called Vegio wanted to find the amount of unsaturated fat in cooking oils. The scientist tested Vegio's own brand of oil and oils from four other companies, A, B, C and D. The scientist used the same volume of oil for each test.

The scientist's results are shown in the table.

| Company | Number of drops of bromine water that reacted | | |
|---------|---|--------|--------|
| | Test 1 | Test 2 | Test 3 |
| Vegio | 14 | 13 | 16 |
| A | 25 | 17 | 27 |
| B | 17 | 18 | 16 |
| C | 5 | 6 | 4 |
| D | 10 | 9 | 7 |

(a)(i) Describe how the bromine water is used to obtain these results.

(3 marks)

(ii) Choose one result from Table 2 that should be tested again.

Result: Company Test

Why did you choose this result?

(2 marks)

(iii) The same volume of each oil was used for each test. Suggest one other variable that should be controlled in these tests.

(1 mark)

- (b) The Vegio food company claims that its cooking oil has more unsaturated fat than other cooking oils. Compare the results for Vegio's cooking oil with the results of the other companies, A, B, C and D. Give three conclusions that can be made from the results.

(3 marks)

- Q8. The table shows the boiling points of four hydrocarbons.

| Hydrocarbon | Boiling point in °C |
|---|---------------------|
| methane, CH ₄ | -162 |
| butane, C ₄ H ₁₀ | 0 |
| pentane, C ₅ H ₁₂ | +36 |
| decane, C ₁₀ H ₂₂ | +175 |

Tick two statements that are correct about these hydrocarbons.

| Statement | Tick (✓) |
|---------------------------------------|----------|
| decane has the largest molecules | |
| pentane is a liquid at 40°C | |
| methane and butane are gases at 20°C | |
| methane has the highest boiling point | |
| butane does not boil | |

(2 marks)

Total marks (35)

