# Crude oil and hydrocarbons

AQA GCSE Chemistry (8462) · Foundation and Higher

Show your working where needed. Check the worked answers when you finish.

Name _____ Date _____

## 1. What counts as a hydrocarbon

Which of these formulae represent hydrocarbons? $CH_4$, $CH_3OH$, $C_3H_8$, $CO_2$. Explain how you decided.

## 2. The next member of a series

Write the general formula of the alkanes. Use it to find the molecular formula of an alkane with five carbon atoms. Explain what makes it saturated.

## 3. Separated fractions

In a fractionating column, one fraction is collected near the cool top and another much lower down. Compare the typical chain lengths and boiling points of their molecules.

**Scan to try fresh questions online**

Try a core or harder question. Use clues and worked answers.

gcse.chemistryhelp.co.uk/worksheets/aqa-hydrocarbons/

# Crude oil and hydrocarbons

AQA GCSE Chemistry (8462) · Foundation and Higher

### 4. Propane in excess oxygen

Propane has the molecular formula $C_3H_8$. Write a balanced symbol equation for its complete combustion in oxygen.

### 5. Faulty fuel burning

A gas flame leaves black deposits on a pan. State the substance in the deposit and explain what a limited oxygen supply can do to the products of combustion.

### 6. A refinery reaction

A refinery cracks one molecule of a hydrocarbon with formula $C_{12}H_{26}$ to form one molecule of $C_8H_{18}$ and one other molecule. Work out the other formula. Explain how cracking can meet the demand for two different kinds of product.

**Scan to try fresh questions online**

Try a core or harder question. Use clues and worked answers.

gcse.chemistryhelp.co.uk/worksheets/aqa-hydrocarbons/

# Crude oil and hydrocarbons

AQA GCSE Chemistry (8462) · Foundation and Higher

### 7. Interpreting a colour change

Bromine water stays orange with sample A and becomes colourless with sample B. The samples are ethane and ethene. Identify both. Draw the product of B reacting with bromine, showing all its bonds.

### 8. A surplus of heavy fractions

A refinery has surplus long-chain hydrocarbons and needs more petrol-range fuel and more feedstock for making polymers. An operator proposes distilling the surplus a second time. Explain why that will not achieve both aims. Suggest a process that could.

### 9. Extra challenge · Follow the cracking products

A refinery cracks one molecule of $C_{14}H_{30}$ into one molecule of $C_9H_{20}$ and one other molecule. Both products have open chains. Work out the other formula and predict what the substance would do to bromine water.

Give the general conditions for steam cracking and explain why fractional distillation alone cannot supply this product.

**Scan to try fresh questions online**

Try a core or harder question. Use clues and worked answers.

gcse.chemistryhelp.co.uk/worksheets/aqa-hydrocarbons/

# Worked answers

Crude oil and hydrocarbons · AQA GCSE Chemistry (8462) · Foundation and Higher

### 1. What counts as a hydrocarbon

$CH_4$ and $C_3H_8$. Both contain only carbon and hydrogen. $CH_3OH$ and $CO_2$ also contain oxygen.

### 2. The next member of a series

The general formula is $C_nH_{2n+2}$. For n = 5, 2 × 5 + 2 = 12, so the molecular formula is $C_5H_{12}$. The molecule has only single bonds between its carbon atoms.

### 3. Separated fractions

The upper fraction contains shorter-chain hydrocarbons with lower boiling points. Their vapours rise further before the column is cool enough for them to condense.

### 4. Propane in excess oxygen

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$. Complete combustion gives carbon dioxide and water. The three carbon atoms give $3CO_2$ and the eight hydrogen atoms give $4H_2O$. The products contain ten oxygen atoms.

### 5. Faulty fuel burning

The black deposit is carbon (soot). With limited oxygen the fuel can burn incompletely, giving carbon and/or carbon monoxide instead of converting all the carbon to carbon dioxide. Water is also formed.

**Scan to try fresh questions online**

Try a core or harder question. Use clues and worked answers.

gcse.chemistryhelp.co.uk/worksheets/aqa-hydrocarbons/

# Worked answers

Crude oil and hydrocarbons · AQA GCSE Chemistry (8462) · Foundation and Higher

### 6. A refinery reaction

The other molecule contains 12 − 8 = 4 carbon atoms and 26 − 18 = 8 hydrogen atoms, giving $C_4H_8$.

Cracking can supply shorter-chain molecules used as fuels and alkenes used as feedstock for making polymers.

### 7. Interpreting a colour change

A is ethane. B is ethene, whose C=C bond reacts with bromine by addition. The product is $CH_2BrCH_2Br$.

Draw a single C-C bond with each carbon joined to two H atoms and one Br atom. The bromine is used up, so its orange colour disappears.

### 8. A surplus of heavy fractions

Distillation separates molecules already present by their boiling ranges, so it cannot make useful shorter molecules from long ones. Cracking breaks long molecules into shorter ones. It can supply short-chain fuel molecules and alkenes for making polymers.

### 9. Extra challenge · Follow the cracking products

The other molecule is $C_5H_{10}$, an alkene in this cracking reaction. Its C=C bond reacts with bromine, turning orange bromine water colourless.

Vaporise the hydrocarbon, mix it with steam and heat it to a high temperature. Fractional distillation separates existing hydrocarbons by boiling range. Cracking changes molecules by breaking carbon chains.

**Scan to try fresh questions online**

Try a core or harder question. Use clues and worked answers.

gcse.chemistryhelp.co.uk/worksheets/aqa-hydrocarbons/