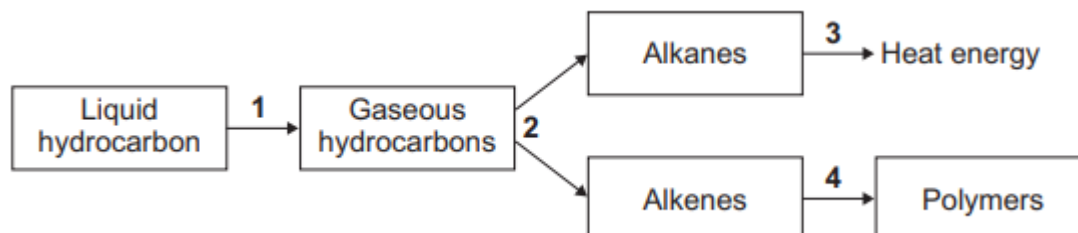


HYDROCARBONS 8

Q1. The flow chart is about hydrocarbons.

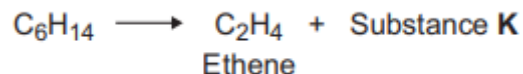


Match words, A, B, C and D, with the numbers 1– 4 in the flow chart.

- A Crack
- B Evaporate
- C Polymerise
- D Burn

(4 marks)

Q2. The equation shows the thermal decomposition of a hydrocarbon.



(a) What is the formula for substance K?

- 1 CH₄
- 2 C₂H₆
- 3 C₄H₁₀
- 4 C₈H₁₈

(1 mark)

(b) Ethene, C₂H₄ is . . .

- 1 an alkane.
- 2 an alkene.
- 3 a saturated hydrocarbon.
- 4 a polymer.

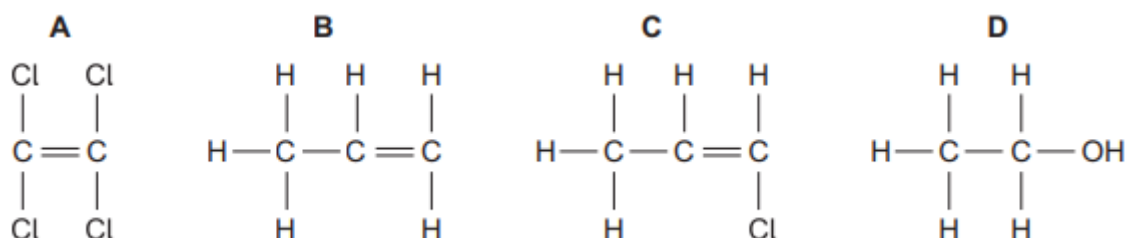
(1 mark)

- (c) Ethene, C₂H₄ can form polymers because . . .
- 1 it contains both carbon atoms and hydrogen atoms.
 - 2 it contains twice as many carbon atoms as hydrogen atoms.
 - 3 the carbon atoms and hydrogen atoms are linked by single bonds.
 - 4 there is a double bond between the carbon atoms.

(1 mark)

Q3. Plastic waste was taken to a recycling centre. At the recycling centre, the plastic was sorted and treated chemically. The chemical treatment broke down the plastic.

Breaking down the plastic produced new substances. The formulae for some of the substances produced are shown below.



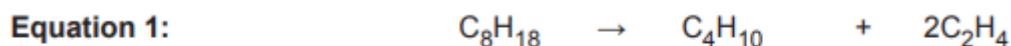
Match formulae, A, B, C and D, with the numbers 1– 4 in the table.

1	It is a hydrocarbon.
2	It could be made from propene, C ₃ H ₆
3	It is formed by reacting ethene with steam, H ₂ O
4	It would not produce water vapour if burnt in air.

(4 marks)

Q4. Ethanol can be produced from octane (C₈H₁₈).

The two chemical equations represent the production of ethanol from octane.



In Equation 1 the products are a mixture of two gases. Describe a chemical test that would indicate the presence of ethene (C₂H₄) in the mixture.

(2 marks)

Q5. 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	
Alkane	Formula
hexane	C_6H_{14}
heptane	
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Air	
Gas	Percentage (%)
nitrogen	78
oxygen	21
carbon dioxide	0.035
Small amounts of other gases and water vapour	

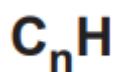
(a) Use the information above to answer these questions.

(i) Give the formula for heptane.

(1 mark)

(ii) Complete the general formula of alkanes.

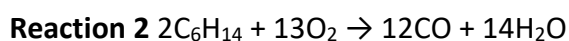
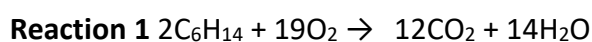
n = number of carbon atoms



(1 mark)

(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.

(1 mark)

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

(1 mark)

Q6. Olive oil can be used in the manufacture of margarine.

Olive oil has a melting point of $-6\text{ }^{\circ}\text{C}$ and contains about 11 % saturated fat and 89 % unsaturated fat.

- (i) Describe a test to show that olive oil contains unsaturated compounds.

Give the result of the test.

(2 marks)

- (ii) To make margarine from olive oil the percentage of unsaturated fat needs to be decreased. Give one reason why.

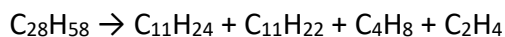
(1 mark)

- (iii) Describe how to decrease the percentage of unsaturated fat in olive oil.

(1 mark)

Q7. Ethene is used as a starting material for the production of many other substances, including ethanol.

Ethene is produced when hydrocarbons are cracked. To do this hydrocarbons are heated to vaporise them. The vapours are then passed over a hot catalyst. The symbol equation shows the reaction for one hydrocarbon.



One of the products is a different type of hydrocarbon to the other products.

Complete the sentences.

The formula of the product that is a different type of hydrocarbon is _____.

The chemical structure of this product is different to the other products because

(2 marks)

Q8. The table shows information about four fuels, A, B, C and D.

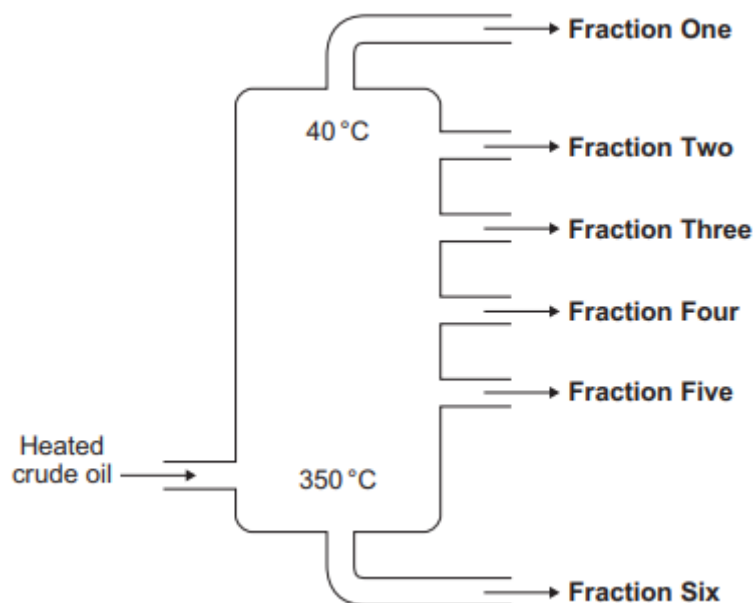
	Fuel	Type of substance	Number of carbon atoms per molecule	Energy released per gram of fuel	Mass of carbon dioxide produced per gram of fuel
A	LPG	Alkanes	3 or 4	50 kJ	3.0 g
B	Diesel	Alkanes	16–20	53 kJ	3.1 g
C	Ethanol	Alcohol	2	30 kJ	1.9 g
D	Hydrogen	Element	0	118 kJ	0.0 g

Match fuels, A, B, C and D, with the sentences 1– 4 below.

- 1 This fuel has the lowest boiling point of the alkane fuels.
- 2 This fuel does not produce carbon dioxide when burned.
- 3 This fuel releases the least amount of energy per gram when burned.
- 4 This fuel has the most carbon atoms in its molecules.

(4 marks)

Q9. In a fractionating column, crude oil is separated into a number of fractions.



(a) Each fraction contains . . .

- 1 only alkanes that are liquids.
- 2 only alkanes that condense at temperatures above 40 °C.
- 3 alkanes with similar boiling points.
- 4 alkanes with the same chemical formula.

(1 mark)

(b) Which statement is true for the alkanes in Fraction One?

- 1 They burn to produce carbon dioxide and sulfur dioxide only.
- 2 They have the general formula C_nH_{2n-2}
- 3 They are saturated compounds.
- 4 They are compounds of carbon, hydrogen and oxygen.

(1 mark)

(c) When compared with the alkanes in Fraction Five, the alkanes in Fraction Two . . .

- 1 will ignite more easily.
- 2 will be more viscous.
- 3 will have higher boiling points.
- 4 will have larger molecules.

(1 mark)

(d) Propane is an alkane. There are eight hydrogen atoms in one molecule of propane.

The formula for propane is . . .

- 1 C₂H₈
- 2 C₃H₈
- 3 C₄H₈
- 4 C₃H₈O

(1 mark)

Q10. This question is about hydrocarbons.

Match words, A, B, C and D, with the numbers 1– 4 in the sentences.

- A alkanes
B fuels
C monomers
D polymers

Hydrocarbons are cracked to produce smaller molecules.

Some of the products of cracking can be used in cars as . . . 1

The products of cracking include alkenes and saturated hydrocarbons called . . . 2

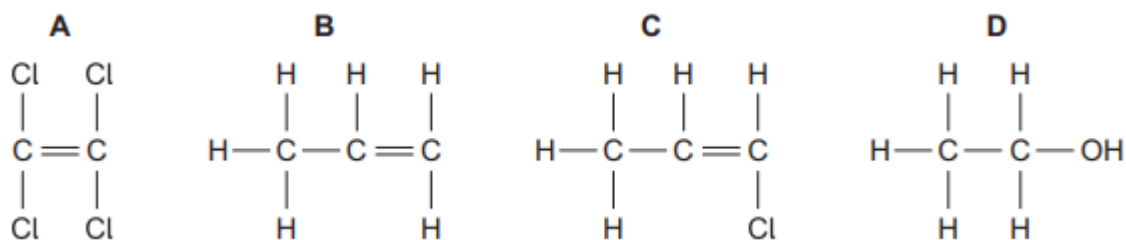
Alkenes can be used in reactions to make . . . 3 . . . such as poly(ethene) and poly(propene).

In these reactions, many small molecules known as . . . 4 . . . join together to produce very large molecules.

(4 marks)

Q11. Some plastic waste was taken to a recycling centre. At the recycling centre, the plastic was sorted and treated chemically. The chemical treatment broke down the plastic.

Breaking down the plastic produced new substances. The formulae for some of the substances produced are shown below.



Match formulae, A, B, C and D, with the numbers 1– 4 in the table.

1	It is a hydrocarbon.
2	It could be made from propene, C ₃ H ₆
3	It is made when ethene reacts with steam, H ₂ O
4	It would not produce water vapour if burnt in air.

(4 marks)

Q12. The table shows five hydrocarbons.

Compound	State at room temperature (20 °C)	Boiling point in °C
ethane, C ₂ H ₆	gas	–89
butane, C ₄ H ₁₀	gas	0
hexane, C ₆ H ₁₄	liquid	+69
pentadecane, C ₁₅ H ₃₂	liquid	+270
heptadecane, C ₁₇ H ₃₆	solid	+302

Tick (✓) two correct statements about the five compounds.

Statement	Tick (✓)
ethane has the smallest molecules	
hexane and pentadecane are liquid at 100 °C	
heptadecane has the highest boiling point	
butane boils at 100 °C	

(2 marks)

Total marks (41)