

### Obtaining useful substances from crude oil

1. The flow chart shows the stages in the breakdown of large hydrocarbon molecules.

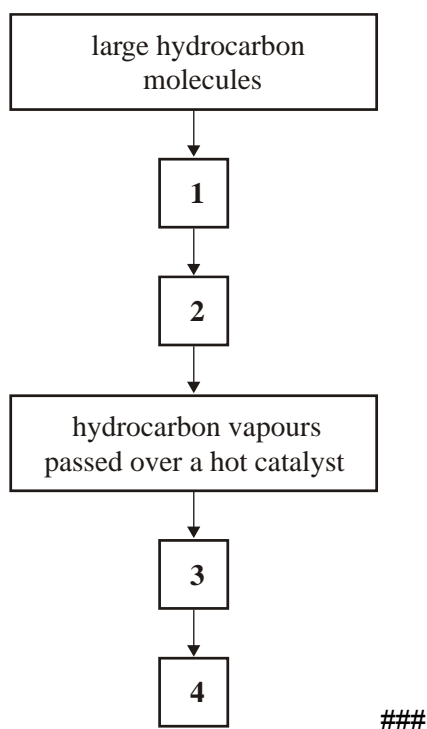
Match phrases, **A**, **B**, **C** and **D**, with the numbers 1– 4 in the flow chart.

**A** hydrocarbons undergo thermal decomposition

**B** hydrocarbons are heated

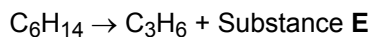
**C** hydrocarbons vaporise

**D** small hydrocarbon molecules



2. In each part choose only **one** answer.

The equation shows the thermal decomposition of a hydrocarbon.



- A** What name is given to this process?
- 1 combustion
  - 2 condensation
  - 3 cracking
  - 4 hydrogenation
- B** In this process, . . .
- 1 hot gases are mixed with water.
  - 2 hot vapours are passed over a hot catalyst.
  - 3 liquids are mixed with water.
  - 4 liquids are passed over a catalyst.
- C** Substance **E** will have the formula . . .
- 1  $\text{CH}_4$
  - 2  $\text{C}_3\text{H}_8$
  - 3  $\text{C}_6\text{H}_3$
  - 4  $\text{C}_9\text{H}_{20}$
- D** The substance with the formula  $\text{C}_3\text{H}_6$  is . . .
- 1 an alkane.
  - 2 an alkene.
  - 3 a saturated hydrocarbon.
  - 4 a polymer.

3. This question is about cracking large hydrocarbon molecules.

Cracking is achieved by using either a high temperature and pressure without a catalyst, or a low temperature and pressure with a catalyst.

Whichever method is chosen:

- the energy for cracking is provided by burning fossil fuels;
- the zeolite catalysts used are not very expensive;
- the catalyst is not used up in the process;
- the cracking plant is often built near the oil refinery.

- (a) Which of the following occurs during cracking?

- 1 Small hydrocarbon molecules join together.
- 2 The hydrocarbon molecules become saturated.
- 3 The hydrocarbon molecules react together.
- 4 The hydrocarbon molecules are decomposed.

- (b) In which equation do the products include two different alkenes?

- 1  $C_{15}H_{32} \rightarrow 2C_2H_4 + C_3H_6 + C_8H_{18}$
- 2  $C_{15}H_{32} \rightarrow C_2H_2 + C_5H_{10} + C_8H_{18} + H_2$
- 3  $C_{15}H_{32} \rightarrow C_8H_{18} + C_7H_{14}$
- 4  $C_{15}H_{32} \rightarrow C_7H_{16} + C_8H_{16}$

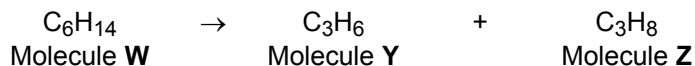
- (c) Which of the following shows only products that could be directly obtained by cracking  $C_{10}H_{22}$ ?

- 1 alkanes up to  $C_{20}H_{44}$ , hydrogen and ethene
- 2 alkanes up to  $C_8H_{18}$ , carbon dioxide and ethene
- 3 propene, poly(ethene) and hydrogen
- 4 alkanes up to  $C_8H_{18}$ , ethene and propene

Unit C1, C1.5.1

4. In each part choose only **one** answer.

A molecule of a hydrocarbon, formula  $C_6H_{14}$ , can be cracked to produce two different hydrocarbons with smaller molecules.

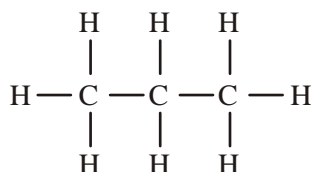


**A** The large hydrocarbon molecule can be cracked by . . .

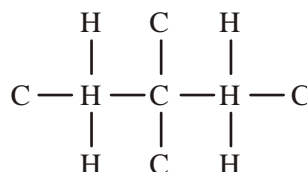
- 1 distillation
- 2 polymerisation.
- 3 thermal decomposition.
- 4 vaporisation.

**B** The structural formula for molecule **Z** is . . .

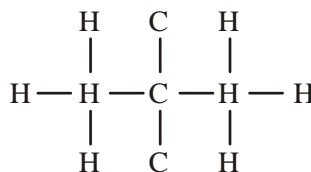
1



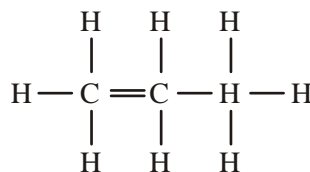
2



3



4



**C** Which of the three molecules, **W**, **Y** and **Z**, have double bonds?

- 1 Molecules **W** and **Y**
- 2 Molecules **W** and **Z**
- 3 Molecule **W** only
- 4 Molecule **Y** only

**D** What types of hydrocarbons are molecules **Y** and **Z**?

	Molecule Y	Molecule Z
1	saturated	saturated
2	saturated	unsaturated
3	unsaturated	saturated
4	unsaturated	unsaturated