



AS Level Chemistry B

H033/02 Chemistry in depth

Question Set 9

1 Catalytic cracking of hydrocarbons is carried out in the petrochemical industry. Hot vaporised hydrocarbons and a powdered catalyst are fed into the bottom of a tube and forced upwards by steam.

(a) (i) Decane, $C_{10}H_{22}$, can be cracked to give an **alkene** with four carbon atoms and another alkane.

Write a chemical equation for this reaction using **molecular** formulae.

[1]

(ii) 2,2,3-Trimethylheptane is an isomer of decane.

Draw the **skeletal formula** of 2,2,3-trimethylheptane.

[1]

(b) A student wishes to crack a sample of liquid decane in the laboratory and collect the gaseous products.

Fig. 1.1 shows the apparatus that a student drew before doing this.

What modifications would be required for this apparatus to work?

Explain your answers.

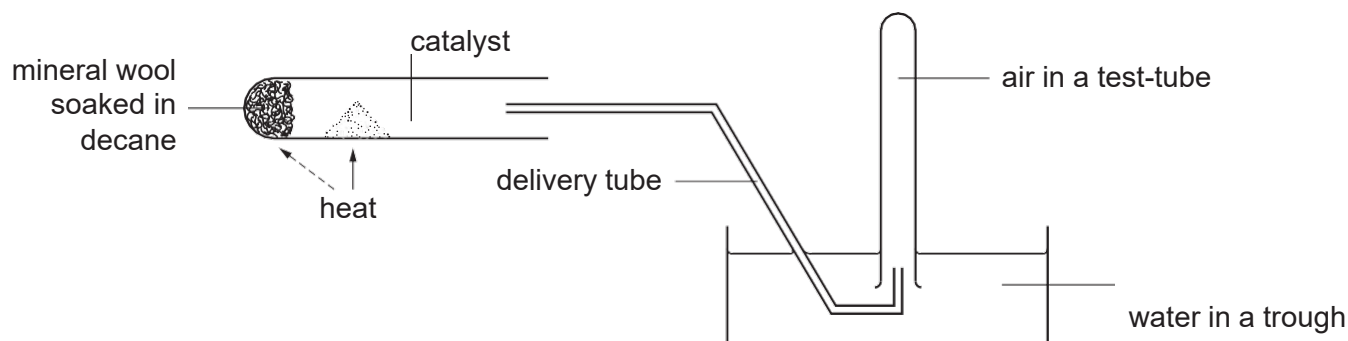


Fig. 1.1

..... [4]

- (c) Small alkenes produced in cracking can be used for making polymers.

The structure of a polymer chain is shown in **Fig. 1.2**.

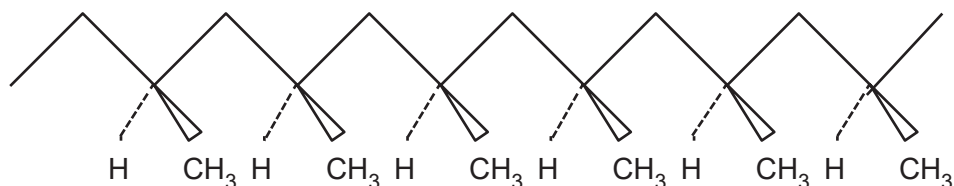


Fig. 1.2

Give the **name** of the monomer that forms the polymer in **Fig. 1.2**.

..... [1]

- (d) Another alkene that can be polymerised is but-2-ene, $\text{CH}_3\text{CH}=\text{CHCH}_3$.

Explain why stereoisomerism can occur in but-2-ene.

..... [2]

- (e) When but-1-ene, $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$, reacts with ICl the main product is 1-iodo-2-chlorobutane, $\text{CH}_3\text{CH}_2\text{CHClCH}_2\text{I}$.

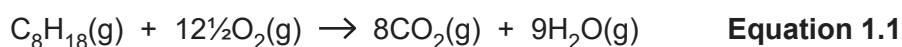
Suggest a mechanism for this reaction.

Show full and partial charges and 'curly arrows'.

[3]

- (f) Petrol contains hydrocarbons like octane, C_8H_{18} .

Equation 1.1 shows the complete combustion of octane.



3.42 g of octane are burned per second in a vehicle engine.

The exhaust gases are produced at a temperature of 550°C and a pressure of $1.50 \times 10^5 \text{ Pa}$.

Calculate the volume of exhaust gases, in dm^3 , produced per second.

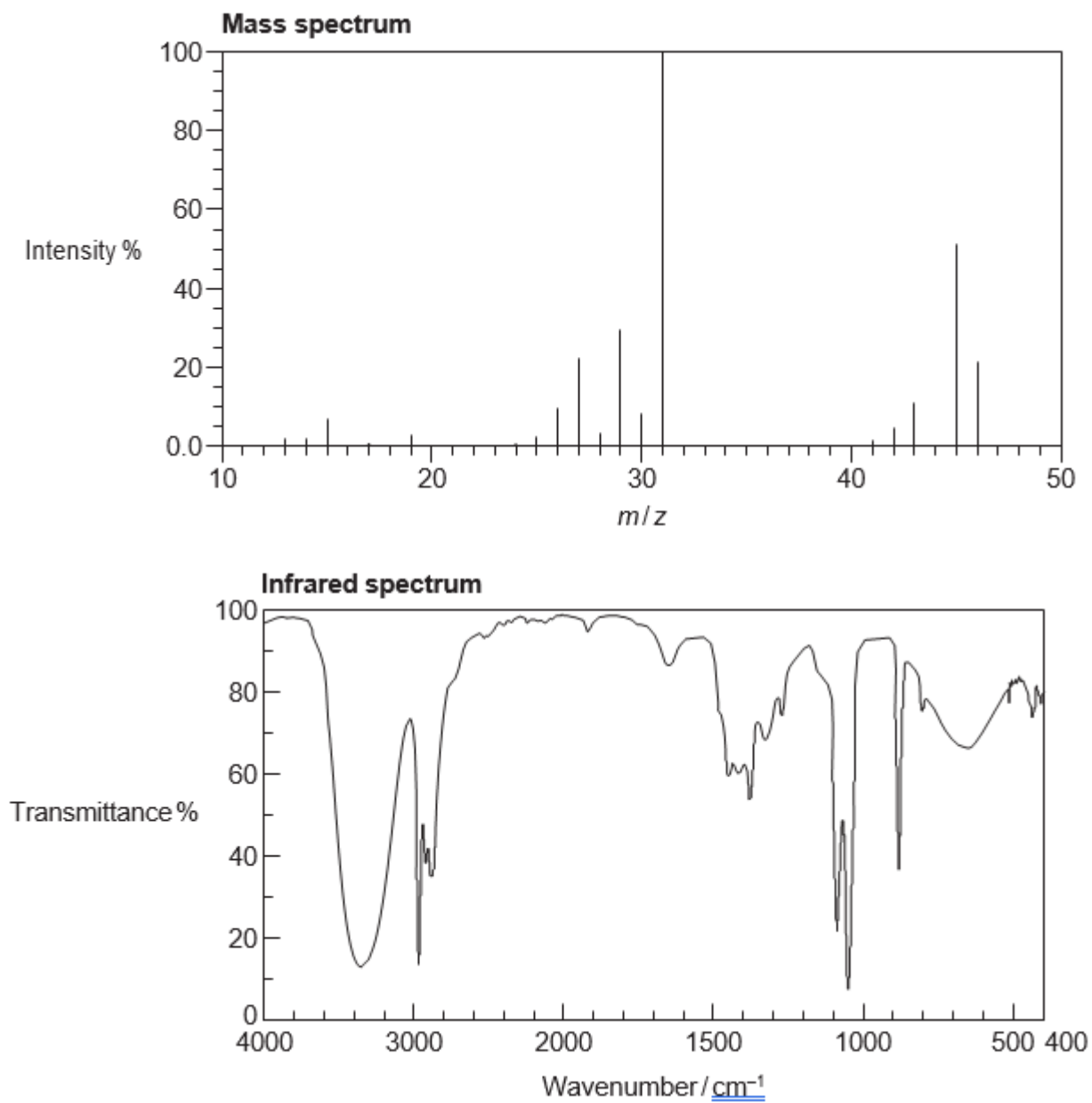
Assume that carbon dioxide and water vapour are the only gases present in the exhaust.

volume of exhaust gases = dm^3 [4]

- (g) Biofuels are increasingly providing alternatives to petrol.

One of the compounds in a biofuel has the following mass spectrum and infrared spectrum.

The biofuel contains carbon, hydrogen and oxygen only.



(i) Identify the biofuel given by the mass spectrum and infrared spectrum.

[1]

(ii) Give **one** piece of evidence from the mass spectrum to support your answer to (g)(i). [1]

(iii) Give **one** piece of evidence from the infrared spectrum to support your answer to (g)(i). [1]

(h)* Discuss the advantages and disadvantages of using biofuels as fuels for cars compared with fossil fuels. [6]

Total Marks for Question Set 9: 25



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge