

**A Level Chemistry B (Salters)**  
**H433/01** Fundamentals of chemistry

**Question Set 16**

- 1 (a) Long chain alkanes can be cracked to provide better fuels and raw materials for the chemical industry. One such cracking reaction is shown in **equation 31.1**.



In a cracking reaction 1.50 tonnes of dodecane ( $\text{C}_{12}\text{H}_{26}$ ) produce 478 kg of hexane ( $\text{C}_6\text{H}_{14}$ ).

Calculate the percentage yield of the reaction in **equation 31.1**.

percentage yield = % [3]

- 1 (b) (i) Some students want to investigate the usefulness of hexane as a fuel.

Describe an experiment they could use to determine the enthalpy change of combustion of liquid hexane in the laboratory. [1]

- 1 (b) (ii) Show how the result would be calculated from the measurements made when carrying out the experiment in part (b)(i). [1]

- 1 (b) (iii) Describe **two** ways in which the students could make the basic experiment more accurate.

1 .....

2 ..... [2]

- 1 (c) The students are given some enthalpy changes of formation and use them to check the accuracy of their answer.

Calculate the standard enthalpy change of combustion of hexane from the data given.

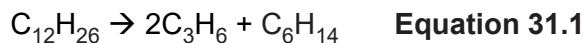
Substance	$\Delta_f H^\ominus / \text{kJ mol}^{-1}$
$\text{CO}_2(\text{g})$	-393
$\text{H}_2\text{O}(\text{l})$	-286
$\text{C}_6\text{H}_{14}(\text{l})$	-199

$\Delta_c H^\ominus$  hexane = .....  $\text{kJ mol}^{-1}$

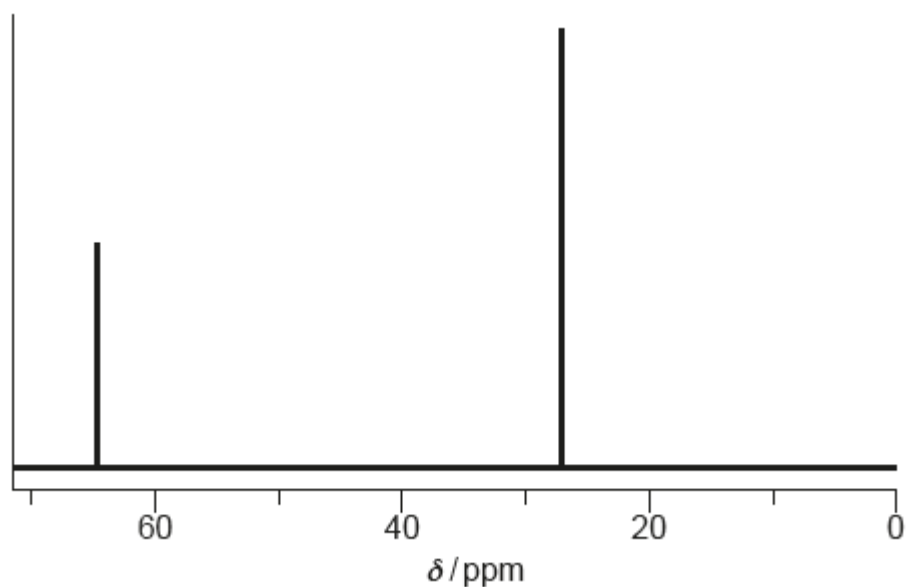
[2]

1 (d)

The propene produced in **equation 31.1** has many uses in the chemical industry.



One of the substances produced from propene is an alcohol used as a cleaner and de-icer. The  $^{13}\text{C}$  NMR spectrum of this alcohol is shown below.



Draw the **full** structural formula of the alcohol in the box below, giving your reasoning.

Reasoning .....

[2]

1 (e)

The alcohol from (d) can be oxidised to a carbonyl compound.

Give the reagents and conditions to carry out this oxidation.

Reagents .....

Conditions .....

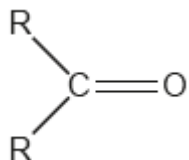
[1]

- 1 (f) The carbonyl compound from (e) can be reacted further to produce other raw materials. Forexample, it reacts with HCN.

The formula of a carbonyl compound is shown below.

Give the mechanism for the reaction of this compound with cyanide ions followed by  $H^+$ . Show curly arrows, relevant dipoles and charges and give the formula of the product.

Name the type of reaction



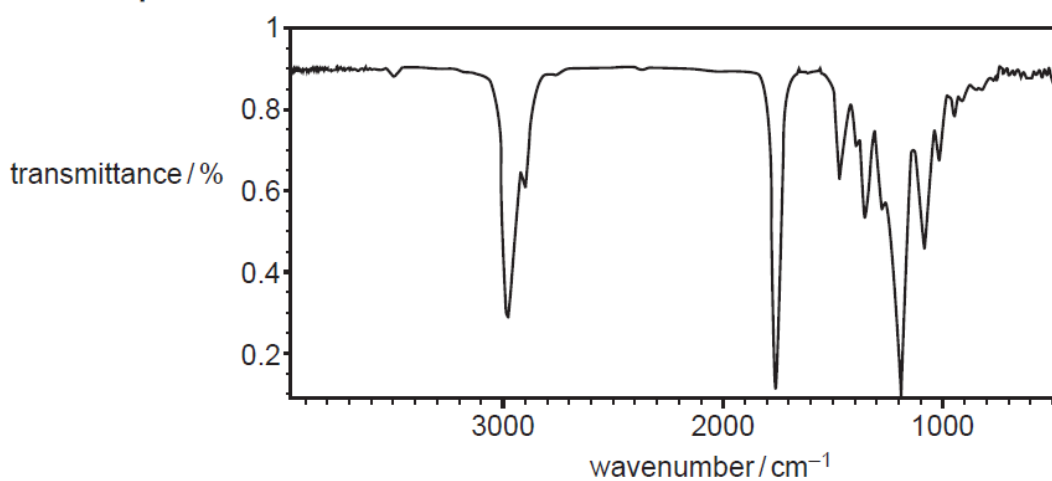
type of reaction

[4]

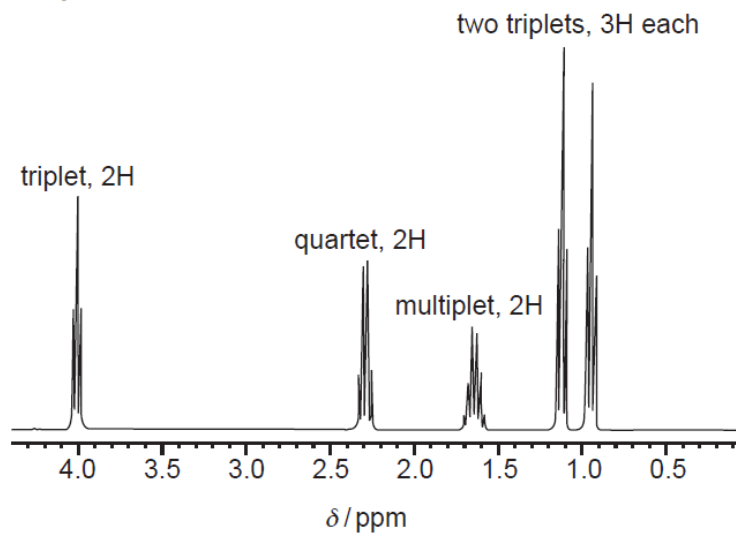
- 1 (g)\* Compound **A** has six carbon atoms and can be made from propene using several steps.

The infrared, proton NMR and mass spectra for compound **A** are shown.

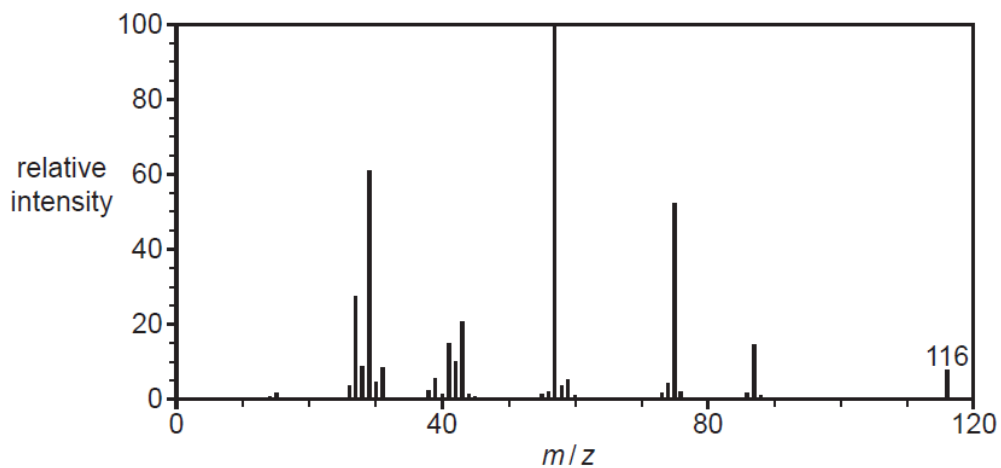
**Infrared spectrum**



### Proton NMR spectrum



### Mass spectrum



Use the information to work out the structure of **compound A**.

Explain your reasoning, using evidence from each spectrum.

Structure of compound **A**

[6]

**Total Marks for Question Set 16: 22**



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