

Exercise walk-through

1.5

Alkenes (Topic 5)

Pearson Edexcel · International A-Level · Chemistry

What does a jump establish?

Your turn

Three successive ionisation energies are close; the fourth is much larger. What follows from the jump alone?

- A. Three outer electrons; period still unknown
- B. Period 3; group still unknown
- C. Four outer electrons
- D. The atom has four occupied shells

Compare fuels using their whole pathway

- 1** Cracking makes smaller hydrocarbons including alkenes; balance atoms in proposed products.
- 2** CO reduces oxygen transport; nitrogen/sulfur oxides can contribute to acid pollution.
- 3** Bioethanol growth can absorb CO₂, but processing and transport still emit. Hydrogen production also matters.

Final transfer: a biased measurement

Your turn

A 0.480 g sample produces 0.240 dm³ of gas in a 1:1 reaction. Use $V_m = 24.0 \text{ dm}^3 \text{ mol}^{-1}$. A leak makes gas volume too low. What happens to inferred sample molar mass?

- A. It is too high
- B. It is too low
- C. It stays correct
- D. It becomes negative

Exercises 2.1·2.3

2.1 Explain why ethene does not show geometric isomerism but 1,2-dichloroethene does. [2]

2.2 In isomer A of 1-bromo-1-chloroprop-1-ene, Br and CH₃ are on the same side of the C=C bond. In isomer B they are on opposite sides. Assign E or Z to each. [2]

2.3 Draw the repeat unit of poly(propene). [1]

3 Exam-style questions

Exercises 2.1·2.3

2.1 Explain why ethene does not show geometric isomerism but 1,2-dichloroethene does.[2]

2.1 Ethene carries two identical H atoms on each double-bond carbon; geometric isomerism requires two DIFFERENT groups on each carbon, which 1,2-dichloroethene has.

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2.2 Compare groups separately on each double-bond carbon: Br > Cl on C1; C > H on C2. On C1 the high-priority group is Br; on C2 it is CH₃. A is Z; B is E.

2.3 Draw the repeat unit of poly(propene). [1]

3 Exam-style questions

2.3 Repeat unit $-(\text{CH}_2-\text{CH}(\text{CH}_3))_n$.

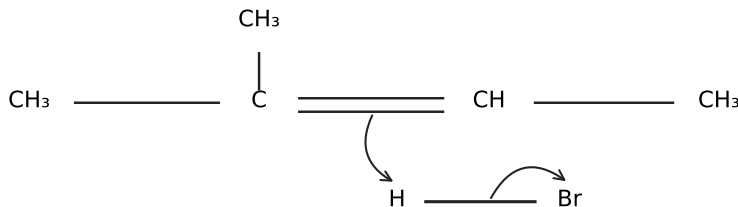
Exercise 3.1

3.1 Describe the mechanism for the reaction between HBr and 2-methylbut-2-ene. Include curly arrows, the intermediate, and the structure of the major product. [5]

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3.1 Curly arrow from the π bond to the H of H-Br, and from the H-Br bond to Br; the positive charge sits on the more substituted carbon – the TERTIARY carbocation; A curly arrow starts at a bromide lone pair and ends at the positively charged carbon; major product 2-bromo-2-methylbutane.



H bonds to the CH carbon; C2 becomes a tertiary carbocation.



A bromide lone pair supplies the new bond to C^+ .
Product: $CH_3-C(Br)(CH_3)-CH_2-CH_3$ (2-bromo-2-methylbutane)

Exercises 3.2·3.3

3.2 An unknown liquid decolourises bromine water. Explain what this observation supports and why it does not identify a unique compound. Write the structural equation for addition of Br_2 to ethene, and name the product. [4]

3.3 An alkene decolourises bromine water and has the molecular formula C_4H_8 . Draw the three structural isomers, state which show geometric isomerism, and name each using IUPAC rules. [5]

Exercises 3.2·3.3

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3.2 The observation supports a $\text{C}=\text{C}$ bond in an appropriate organic test, but many alkenes give the same result, and other reducing substances can also consume bromine. $\text{CH}_2=\text{CH}_2 + \text{Br}_2 \rightarrow \text{CH}_2\text{BrCH}_2\text{Br}$; 1,2-dibromoethane. This is addition: the two-carbon skeleton remains intact and one Br bonds to each carbon.

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3.3 $\text{CH}_2=\text{CHCH}_2\text{CH}_3$, but-1-ene; $\text{CH}_3\text{CH}=\text{CHCH}_3$, but-2-ene; $\text{CH}_2=\text{C}(\text{CH}_3)_2$, 2-methylpropane. Only but-2-ene shows E/Z isomerism: each double-bond carbon has H and CH_3 , whereas each other isomer has two H on one double-bond carbon.