

1.5.1 Alkene conditions, polymers and disposal

Name: _____ Class: _____ Date: _____ **Total: 22 marks**

KEY WORDS addition polymerisation • repeat unit
• biodegradable

Objective

Choose alkene reaction conditions, distinguish a formula from evidence for a double bond, and reconstruct addition-polymer monomers and repeat units.

1 Key knowledge and worked examples

■ Count rings as well as double bonds

An acyclic monoalkene has formula C_nH_{2n} . A cycloalkene with one ring and one $C=C$ has C_nH_{2n-2} . A saturated single-ring cycloalkane has C_nH_{2n} , so formula alone cannot prove a double bond.

Hydrogen/Ni adds H across $C=C$. Steam with an acid catalyst forms an alcohol. Cold dilute acidified potassium manganate(VII) gives a diol. Bromine decolourisation is a test for unsaturation under suitable conditions.

■ Preserve side groups in a repeat unit

Addition polymerisation opens the double bond into two single backbone bonds. For propene, the repeat unit is $[-CH_2-CH(CH_3)-]_n$: the methyl group remains attached to the same backbone carbon. Show continuation bonds through the brackets. No water or other small molecule is eliminated.

2 Practice

2.1 Give the molecular formula of cyclohexene and explain why it differs from hex-1-ene. [2]

2.2 State reagents/conditions and the organic product for hydrogenation, hydration and mild oxidation of ethene. [6]

2.3 Two pure liquids each have formula C_5H_{10} . One rapidly decolourises bromine water in the dark; the other does not. Give a possible compound for each and explain why the formula alone was insufficient. [3]

3 Exam-style questions

3.1 Name the alkene monomer corresponding to the repeat unit $[-CH_2-CH(CH_2CH_3)-]_n$, giving its structural formula. Explain why the pendant ethyl group is not inserted into the main polymer backbone. [3]

3.2 A student says that any alkene with different groups attached to its $C=C$ shows E/Z isomerism. Use 2-methylpropene and pent-2-ene to evaluate the statement, stating the condition separately for each double-bond carbon. [4]

3.3 Compare recycling, incineration with gas treatment, and developing biodegradable polymers as ways to limit disposal problems. Explain one limitation of each and why the label biodegradable does not mean immediate breakdown in every environment. [4]
