

14.2 Alkenes

Name: _____ Class: _____ Date: _____

Total: 13 marks

KEY WORDS electrophilic addition 亲电加成 • addition polymerisation 加成聚合 • bromine 溴
• alkenes 烯烃 • polymer 聚合物

Objective

Build the skills to answer exam questions on **alkenes** 烯烃 — making them, **electrophilic addition** 亲电加成, the **bromine** 溴 test, **addition polymerisation** 加成聚合, and **Markovnikov's rule** 马氏规则.

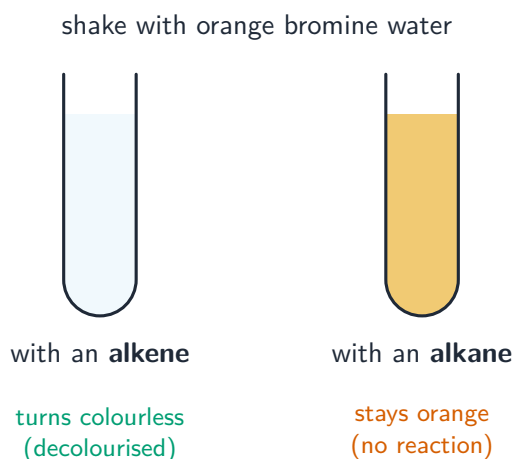
You must be able to:

- recall how alkenes are made and describe their addition reactions
- describe the electrophilic addition mechanism and use the bromine test
- explain carbocation stability and Markovnikov addition

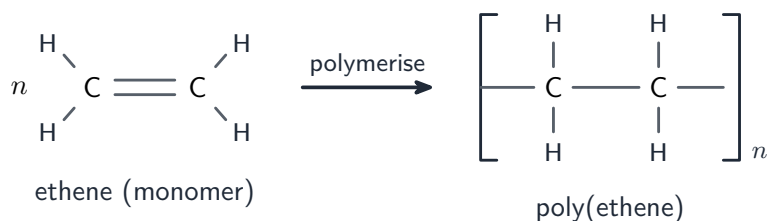
1 Worked examples

■ Reactions of alkenes

The C=C bond reacts by **electrophilic addition**: with H_2 (Pt/Ni) $\rightarrow$ alkane; steam (H_3PO_4) $\rightarrow$ alcohol; HX $\rightarrow$ halogenoalkane; X_2 $\rightarrow$ dihalide. Cold dilute KMnO_4 $\rightarrow$ diol; hot conc. KMnO_4 breaks the C=C.

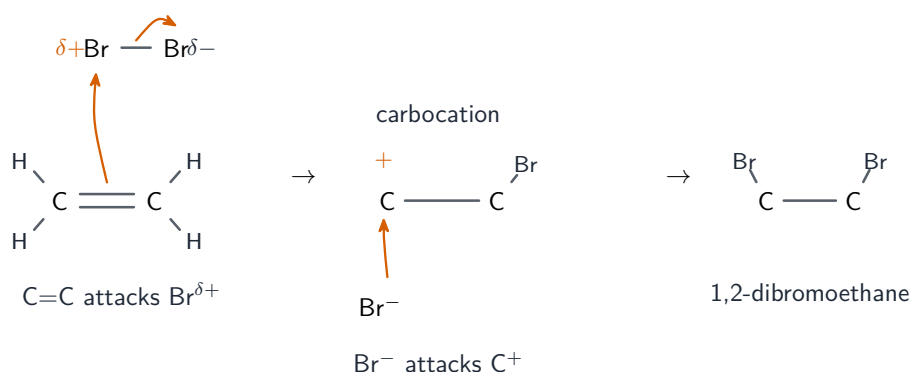


Test for C=C: an alkene decolourises orange bromine water; an alkane does not

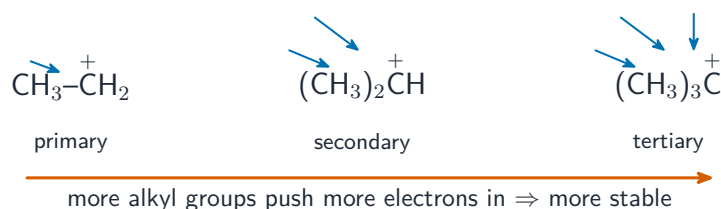


Addition polymerisation: many ethene molecules join into poly(ethene), with no other product

■ Mechanism and Markovnikov



Electrophilic addition: the electron-rich C=C attacks the electrophile, forming a carbocation, then the nucleophile attacks



Markovnikov: HBr adds so the *more stable* carbocation forms

Alkyl groups push electrons in (inductive effect), so tertiary > secondary > primary — the basis of Markovnikov's rule

2 Practice

2.1 State the reagent and condition for making an alcohol from an alkene.

[2]

2.2 Describe the test for a C=C double bond and the positive result. [2]

3 Exam-style questions

3.1 Which reagent converts ethene into a halogenoalkane? [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** H₂ / Ni
B steam / H₃PO₄
C HBr at room temperature
D hot KMnO₄

3.2 During electrophilic addition, the positive intermediate formed is a: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** free radical
B carbocation
C nucleophile
D diol

3.3 (a) Describe the mechanism of the electrophilic addition of bromine to ethene (use curly arrows or words). [3]

(b) Write the equation for the addition polymerisation of ethene to poly(ethene). [1]

3.4 When HBr adds to propene, 2-bromopropane is the major product. Explain why, using carbocation stability. [3]
