

27 Which intermediate ion forms in the greatest amount during the addition of HBr to propene?

- A $\text{CH}_3\text{CH}^+\text{CH}_3$
- B $\text{CH}_3\text{CH}_2\text{CH}_2^+$
- C $\text{CH}_3\text{CH}^-\text{CH}_2\text{Br}$
- D $\text{CH}_3\text{CHBrCH}_2^-$

27 What is the major product when 2-methylpent-2-ene reacts with hydrogen bromide?

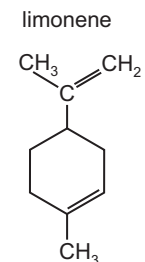
- A 1-bromo-2-methylpentane
- B 2-bromo-2-methylpentane
- C 3-bromo-2-methylpentane
- D 4-bromo-2-methylpentane

28 Pent-2-ene is reacted with cold, dilute, acidified manganate(VII) ions.

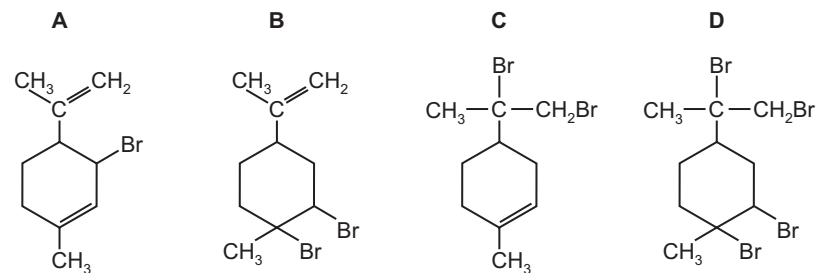
What is the major product?

- A $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}(\text{OH})\text{CH}_3$
- B $\text{CH}_3\text{CH}_2\text{COCOCH}_3$
- C a mixture of $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$
- D $\text{CH}_3\text{CH}_2\text{COOH}$ and CH_3COOH

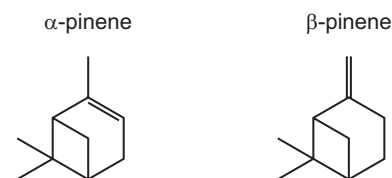
29 Limonene is an oil formed in the peel of citrus fruits.



Which product is formed when an excess of bromine, $\text{Br}_2(\text{l})$, reacts with limonene at room temperature in the dark?



29 Pinenes are unsaturated compounds. The structures of two pinenes are shown.



A mixture of these two pinenes reacts with hot concentrated acidified KMnO_4 .

What are the molecular formulae of the organic products?

- A $\text{C}_9\text{H}_{14}\text{O}$ and $\text{C}_{10}\text{H}_{16}\text{O}_3$
- B $\text{C}_9\text{H}_{14}\text{O}$ and $\text{C}_{10}\text{H}_{14}\text{O}_4$
- C $\text{C}_9\text{H}_{16}\text{O}_2$ and $\text{C}_{10}\text{H}_{16}\text{O}_3$
- D $\text{C}_9\text{H}_{16}\text{O}_2$ and $\text{C}_{10}\text{H}_{14}\text{O}_4$

4 Fig. 4.1 shows a possible synthesis of propene, C_3H_6 .

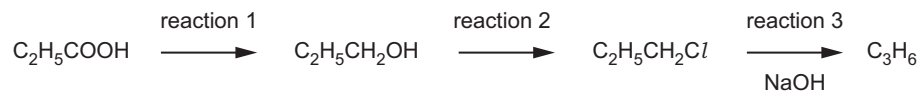


Fig. 4.1

(a) (i) Identify the type of reaction that occurs in reaction 1.

..... [1]

(ii) Suggest a suitable reagent for reaction 2.

..... [1]

(iii) Reaction 3 is an elimination reaction.

Write an equation for this reaction and identify the solvent and conditions used.

equation

solvent and conditions

[2]

(iv) $C_2H_5CH_2OH$ can be directly converted to C_3H_6 .

Suggest the reagent and conditions for this conversion.

..... [1]

(b) Under suitable conditions, propene polymerises to form poly(propene).

Poly(propene) exhibits stereoisomerism.

(i) Identify the type of polymerisation that forms poly(propene) from propene.

..... [1]

(ii) Define stereoisomerism.

.....

..... [2]

(iii) Draw a section of poly(propene), showing **two** repeat units.

Use your diagram to identify the type of stereoisomerism shown by poly(propene). Explain your answer.

section of poly(propene)

.....
.....
.....
.....

[3]

(iv) State **two** difficulties associated with the disposal of poly(propene).

1

2

[2]

(c) Under different conditions, two molecules of propene can combine to form compounds **X** and **Y**.



(i) Name **X**.

..... [1]

(ii) Fig. 4.2 shows the mass spectrum of either compound **X** or compound **Y**.

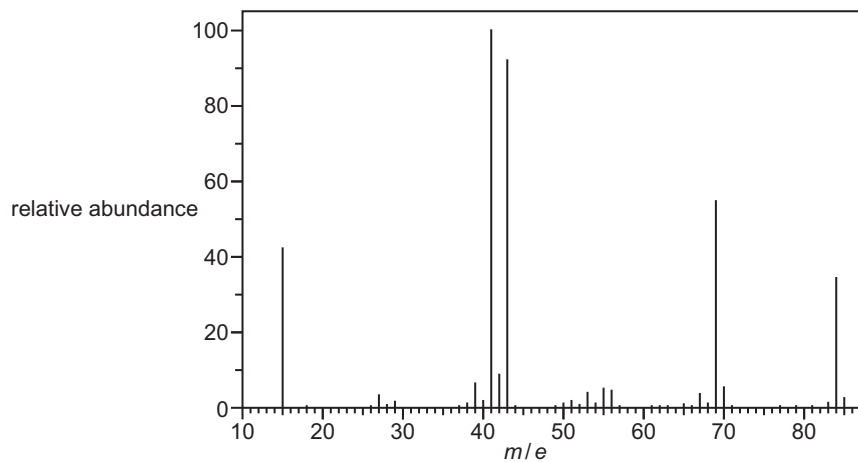


Fig. 4.2

Identify which of **X** and **Y** gives this mass spectrum.

Give **one** reason for your answer, referring to the fragmentation pattern.

.....
.....
..... [1]

(iii) The molecular ion peak in the spectrum in Fig. 4.2 has relative abundance 34.7.

Calculate the relative abundance of the $[M+1]^+$ peak in this spectrum.

relative abundance of $[M+1]^+$ peak = [1]

Important values, constants and standards

molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
Faraday constant	$F = 9.65 \times 10^4 \text{ C mol}^{-1}$
Avogadro constant	$L = 6.02 \times 10^{23} \text{ mol}^{-1}$
electronic charge	$e = -1.60 \times 10^{-19} \text{ C}$
molar volume of gas	$V_m = 22.4 \text{ dm}^3 \text{ mol}^{-1}$ at s.t.p. (101 kPa and 273 K) $V_m = 24.0 \text{ dm}^3 \text{ mol}^{-1}$ at room conditions
ionic product of water	$K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ (at 298 K (25 °C))
specific heat capacity of water	$c = 4.18 \text{ kJ kg}^{-1} \text{ K}^{-1}$ ($4.18 \text{ J g}^{-1} \text{ K}^{-1}$)

