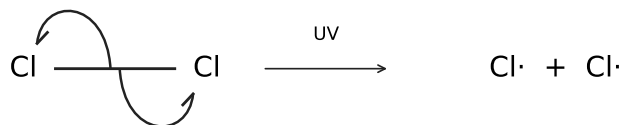


Solutions

Original authored guidance. Arrow starts must identify the actual bond or electron pair, not a positive charge.

2.1

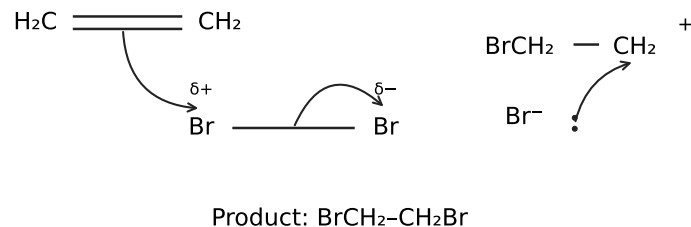


Homolysis: one electron from the bond goes to each chlorine atom.
Each curly half-arrow tracks one electron.

Award for $\text{Cl}_2 \rightarrow 2\text{Cl}\cdot$ and UV, two half-arrows starting at the bond and ending at different Cl atoms.

2.2 $\text{Cl}\cdot + \text{CH}_4 \rightarrow \text{HCl} + \text{CH}_3\cdot$; $\text{CH}_3\cdot + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{Cl}\cdot$; $2\text{CH}_3\cdot \rightarrow \text{C}_2\text{H}_6$. Propagation regenerates a radical, allowing further reaction with the remaining molecules. Termination consumes radicals without regenerating one.

2.3



Simple electrophilic-addition model: π pair $\rightarrow \text{Br}\delta^+$; $\text{Br}-\text{Br}$ pair $\rightarrow \text{Br}\delta^-$.
A bromide lone pair supplies the second C-Br bond.

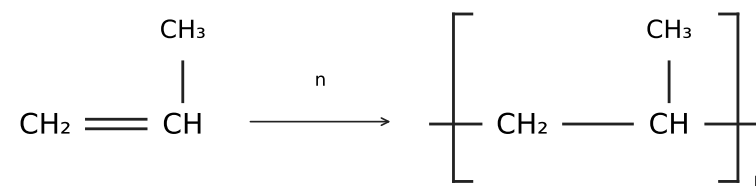
Award induced $\text{Br}\delta^+-\text{Br}\delta^-$ polarity, π -bond pair arrow to $\text{Br}\delta^+$ and $\text{Br}-\text{Br}$ pair arrow to $\text{Br}\delta^-$, $\text{BrCH}_2\text{CH}_2^+$ plus Br^- with a lone-pair arrow to the positive carbon, and 1,2-dibromoethane product. This syllabus-level model makes no claim about a unique stereochemical product from every substituted alkene.

3.1 $\text{CH}_3-\text{CH}^+-\text{CH}_3$ is secondary; $\text{CH}_3-\text{CH}_2-\text{CH}_2^+$ is primary. The secondary carbocation is more stable, so its route is favoured; Br^- attack gives 2-bromopropane as the major product. Product ratio is not explained by a carbon atom simply wanting more bonds.

3.2 Chloromethane can undergo further radical substitution to form dichloromethane.

Two methyl radicals can combine in termination to form ethane. Further substitution and competing termination products create a mixture requiring separation rather than one directly pure product.

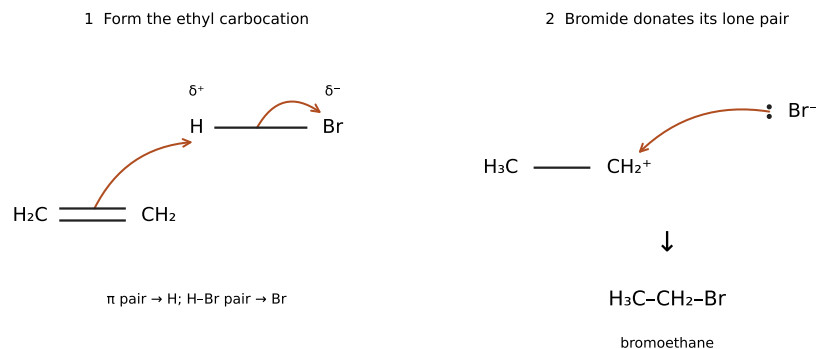
3.3



Propene $\rightarrow$ poly(propene); continuation bonds cross the brackets.
Side groups stay attached; no small molecule is eliminated.

Award correct monomer and methyl side group, single-bond backbone, continuation bonds/brackets/n and balanced n monomers. Both monomer C_3H_6 and repeat-unit composition have empirical ratio CH_2 , so empirical formula does not reveal molecular size or connectivity.

3.4



$\text{H}\delta^+-\text{Br}\delta^-$ polarity; pair arrow from $\text{C}=\text{C}$ to H and pair arrow from $\text{H}-\text{Br}$ to Br; CH_3CH_2^+ plus Br^- and bromide lone-pair arrow to the positive carbon; bromoethane $\text{CH}_3\text{CH}_2\text{Br}$. The two ethene carbons are equivalent, so either direction of proton addition leads to the same connectivity.