Addition of bromine in the presence of water

- When water is present in the reaction of \( \text{Br}_2 \) with a \( \text{C} = \text{C} \) bond, a 1,2-bromoalcohol (bromohydrin) is formed.
- Mechanism similar but water acts as the nucleophile in the second step.
- If both \( \text{Br}^- \) and \( \text{H}_2\text{O} \) acted as a nucleophile would produce a mixture of bromohydrin and 1,2-dibromide.
- \( \text{Br}^- \) stronger nucleophile but major product depends on the concentration of the nucleophile as this increases the rate of the ring opening.
- Reaction with water is regioselective- will attack the more substituted \( \text{C} \) in the bromonium ion- this atom form a longer and weaker bond to the Br because better at stabilizing the positive charge (overcomes fact that sterically hindered).
- In the transition state for ring opening of the bromonium ion, breaking of the C-Br bond occurs to a greater extent than formation of the new \( \text{C} = \text{O} \) bond- described as a loose \( S_N2 \) transition state.

Hydration reaction

- Alkenes react with water in the presence of a strong acid to form alcohols- water adds to the \( \text{C} = \text{C} \) bond.
- The \( \text{C} = \text{C} \) bond is protonated to form a carbocation- regioselective for unsymmetrical alkenes- tertiary carbocation formed more readily- leads to selectively formed Markovnikov product.
- A nucleophile then reacts with the carbocation- nucleophile can be water or the conjugate base of the acid- nature depends on concentration of the acid- when dilute water reacts, when concentrated conjugate base reacts.
- Oxonium ion is formed and water reacts with this to form an alcohol.
- All steps reversible- dehydration possible.
Addition of borane to alkynes followed by oxidation

- Aldehydes/ketones formed from alkynes by reaction of the C=C bond with diborane followed by oxidation using hydrogen peroxide/sodium hydroxide
- Terminal alkyne RCCH reacts for form aldehyde, internal alkyne RCCR reacts to form ketone
- Mechanism similar to that of addition of an alkene but stage 3 produces an enol that rearranges to form an aldehyde
- The equilibrium between an aldehyde/ketone and an enol is called tautomerism