Summary of organic reaction mechanisms needed for AS Chemistry

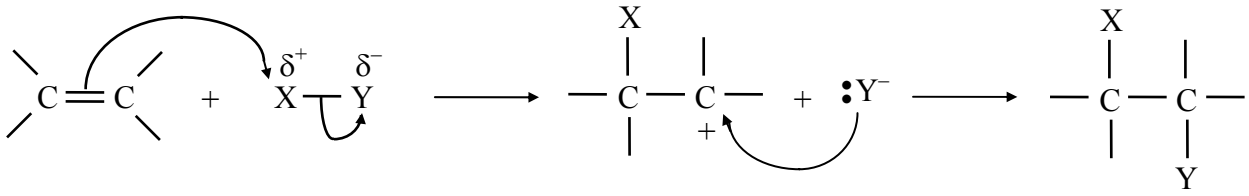
Remember:

- the curly arrow represents the movement of a pair of electrons
- the electrons move from the tail of the arrow to its head
- don't put curly arrows in dodgy places – the examiner will not choose for you!
- show lone pairs of electrons and charges clearly

Type of reaction	Specific example(s)
Electrophilic addition	Alkenes with HBr, Br_2 and H_2SO_4
Nucleophilic substitution	Primary haloalkanes with OH^-, CN^- and NH_3
Elimination	Formation of alkenes from alcohols
Concurrent displacement and elimination	2° haloalkanes with potassium hydroxide
Free radical substitution	Chlorination of methane

Electrophilic addition

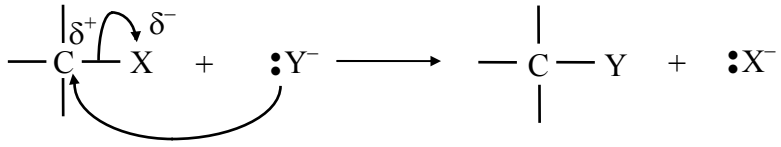
H–Br, Br–Br and H_2SO_4 (treat this as H–OSO_2OH).



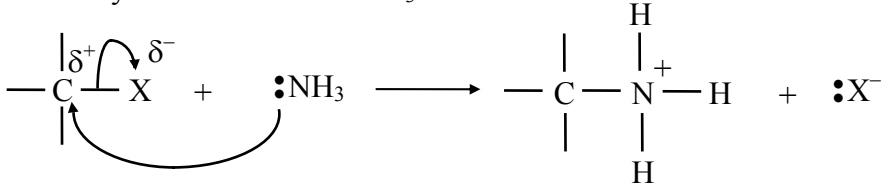
Remember: if the alkene is asymmetrical, look for the most stable carbocation to predict the major product. Tertiary carbocations are the most stable; primary carbocations are the least stable.

Nucleophilic substitution

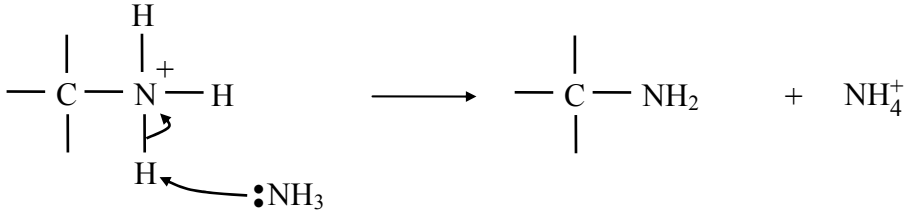
a) Primary haloalkanes with OH^- and CN^-.



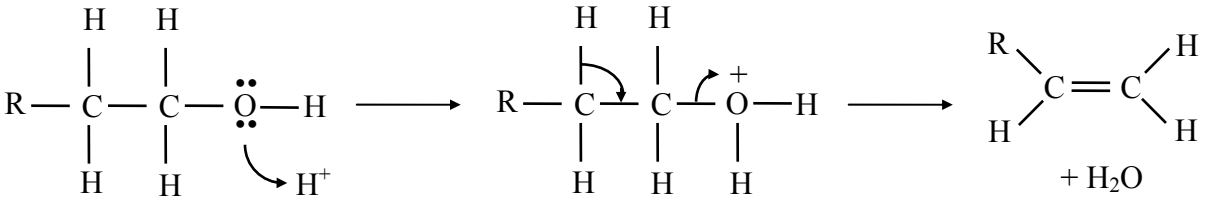
b) Primary haloalkanes with NH_3.



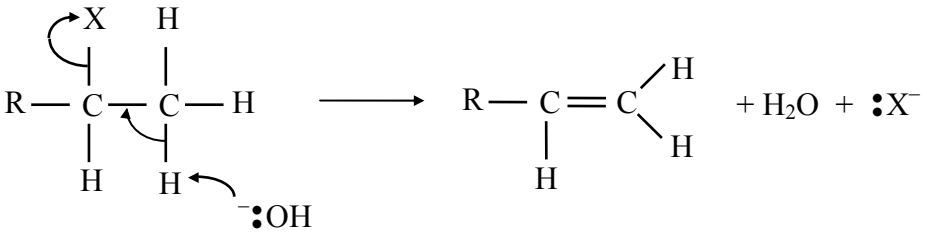
… then …



Elimination in alcohols to form alkenes



Concurrent displacement and elimination in secondary haloalkanes to form alkenes



The hydroxide ion acts as a base in the elimination reaction, because it accepts a proton. However, it can also act as a nucleophile, leading to a substitution reaction. Whether you get elimination or substitution depends upon the reaction conditions. The table below will help you decide what should happen

Reaction	Conditions		
	Base	Solvent	Temperature
elimination	strong	ethanol	high
substitution	weak	water	low

Chlorination of methane (free radical substitution)

Initiation

Homolysis of the Cl–Cl bond using energy from absorbed UV light or supplied heat:

$Cl_2 \rightarrow 2Cl\bullet$

Note: Homolysis of the C–H bond is also possible, but less energy is needed to break the Cl–Cl bond (bond energy terms are 435 kJ mol^{-1} and 242 kJ mol^{-1} respectively).

Propagation

$Cl\bullet + CH_4 \rightarrow HCl + \bullet CH_3$

$\bullet CH_3 + Cl_2 \rightarrow CH_3Cl + Cl\bullet$

Termination

$Cl\bullet + Cl\bullet \rightarrow Cl_2$

$\bullet CH_3 + \bullet CH_3 \rightarrow C_2H_6$

$Cl\bullet + \bullet CH_3 \rightarrow CH_3Cl$

Other reactions are also possible.