

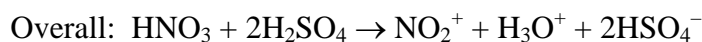
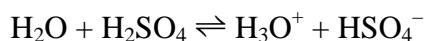
Summary of Reaction Mechanisms Required for A2 Chemistry

Module 3 Introduction to Organic Chemistry

- Electrophilic addition – symmetrical alkenes with HBr, Br₂ and H₂SO₄.
- Nucleophilic substitution – primary haloalkanes with OH⁻, CN⁻ and NH₃.
- Formation of alkenes from alcohols (elimination reaction in terms of the loss of a proton from a carbonium ion generated from the protonated alcohol).
- Concurrent displacement and elimination – 2° haloalkanes with potassium hydroxide
- Free radical substitution – methane + chlorine (initiation, propagation and termination steps).

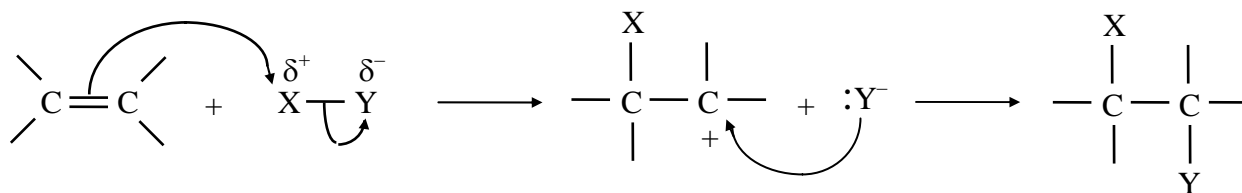
Module 4 Further Physical and Organic Chemistry

- Electrophilic addition – asymmetrical alkenes with HBr and H₂SO₄.
- Electrophilic substitution – nitration, alkylation and acylation of benzene.
- Nucleophilic addition-elimination – acyl chlorides with water, alcohols, ammonia and 1° amines.
- Nucleophilic substitution – haloalkanes with ammonia and amines to form 1°, 2° and 3° amines and 4° ammonium salts.
- Elimination reactions – alkenes from haloalkanes (and alcohols – see CHM03).
- Generation of the nitronium ion, NO₂⁺ (below):



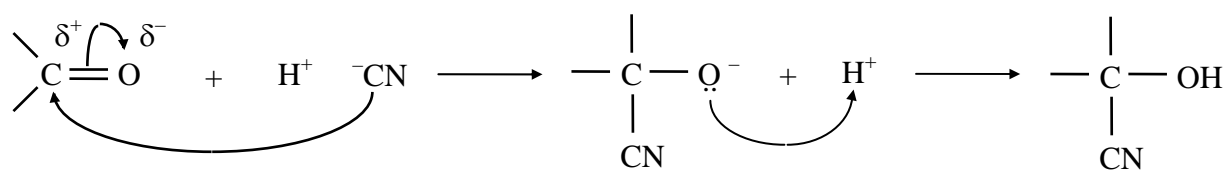
Electrophilic addition

e.g. of H-Br, Br-Br, H₂SO₄ (view as H-OSO₂OH)



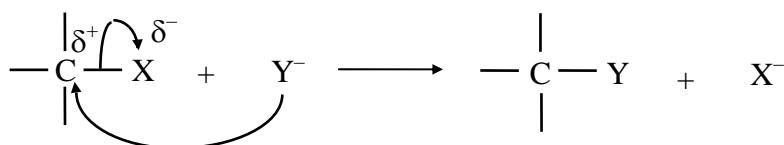
Nucleophilic addition

i.e. of carbonyl compounds with HCN to make hydroxynitriles

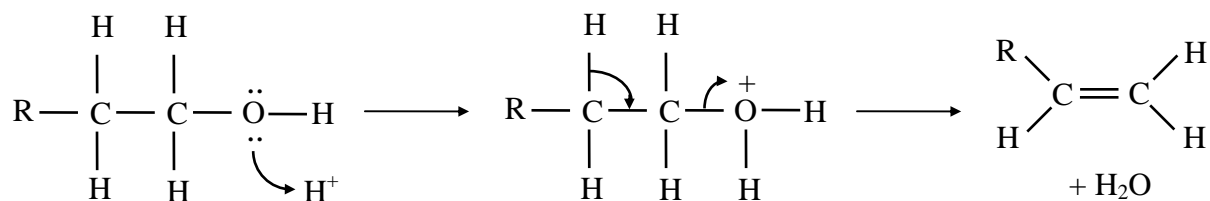


Nucleophilic substitution

e.g. of haloalkanes with OH⁻ and CN⁻

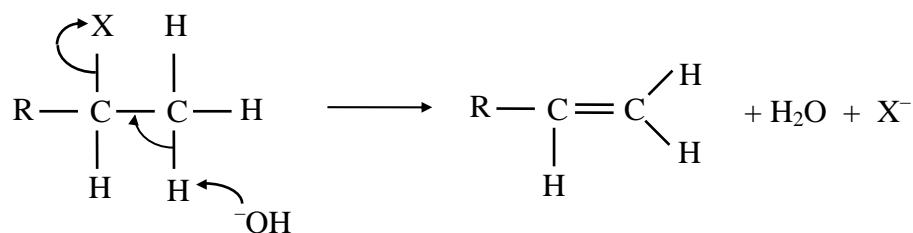


Elimination in alcohols to form alkenes



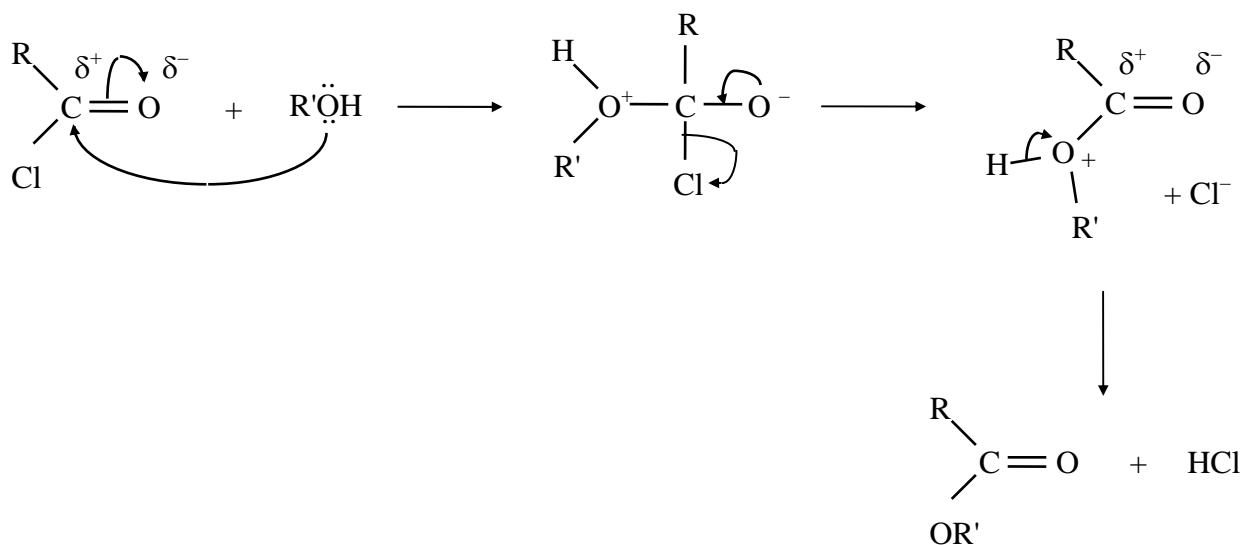
Elimination in haloalkanes to form alkenes

(favoured by using alcoholic solutions of concentrated alkali)



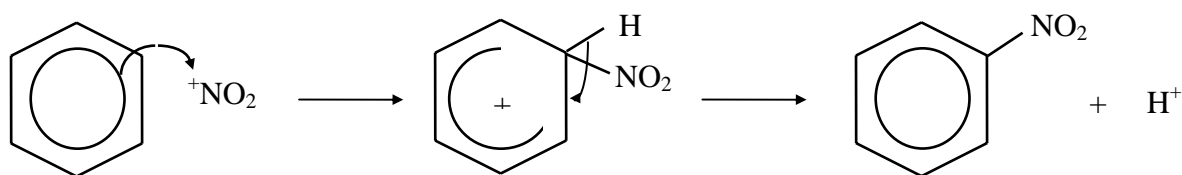
Nucleophilic addition-elimination

e.g. acyl chlorides with water, alcohols, ammonia and amines



Electrophilic substitution (nitration of benzene)

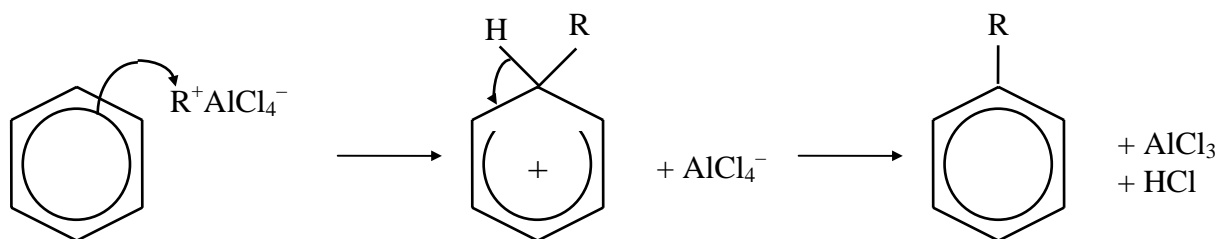
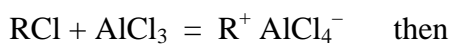
Remember the reactions involved in production of the nitronium ion (see first page).



Electrophilic substitution

e.g. Friedel-Crafts alkylation of benzene

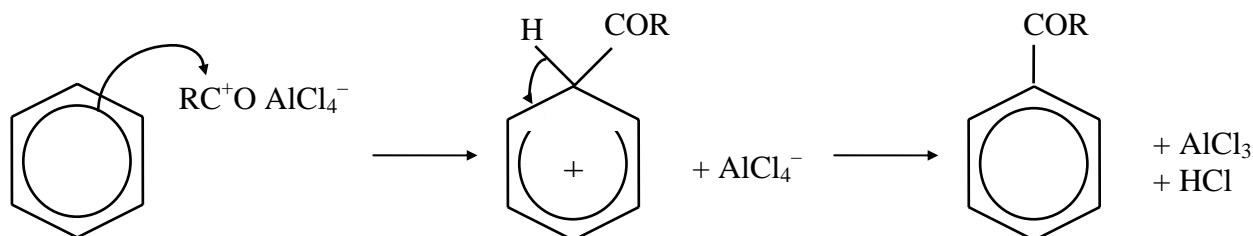
Generation of the electrophile, e.g. as a carbocation complex:



Electrophilic substitution

e.g. Friedel-Crafts acylation of benzene

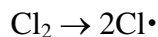
Generation of the electrophile, e.g. as an acyl cation complex:



Chlorination of methane (free radical substitution)

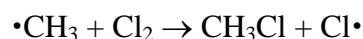
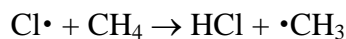
Initiation

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

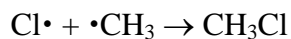


Note: Homolysis of the C-H bond is also possible, but less energy is needed to break the Cl-Cl bond (bond energy terms are 435 kJ mol^{-1} and 242 kJ mol^{-1} respectively).

Propagation



Termination



Other reactions are possible.