Organic Reactions Summary

Substitution

→ An atom/group in the chain is replaced by another

Family	Reacts with	Catalyst	Products
Alkanes	Halogens	UV Light	Haloalkane + hydrogen halide
Aromatics	Halogens	FeBr3 or AlCl3	Halobenzene + hydrogen halide
Aromatics	Alkyl Halides	AlCl3	Alkylbenzene + hydrogen halide
Aromatics	Nitric Acid	Sulphuric Acid	Nitrobenzene + water
Alcohols	Hydrogen halide	ZnCl2 (Lucas Reagent)	Alkyl Halide + Water
Ethers	2 binary acids	Heat	2 alkyl halides + water
Ammonia	Alkyl Halide	NA	Amine + Hydrogenhalide

Addition

→ Adding groups (or atoms) to a chain by breaking a C=C bond

Family	Reacts with	Catalyst	Products
Alkenes	Hydrogen	Platinum (Pt)	Alkane
Alkenes	Halogens	CCl4	Haloalkane (2 halogen atoms)
Alkenes	Hydrogen Halide	N/A	Haloalkene (1 halogen atom)
Alkenes	Water	H2SO4 + 100 C	Alcohol
Alkynes: *Same as alkenes, but require 2 moles of the 2nd column to fully saturate the triple bond.*			

Elimination

→ Removal of 2 atoms/groups to form a double bond

Family	Reacts With	Catalyst	Products
Alcohols		H2SO4, 100 C	Alkene + water
Alkyl halides	Hydroxide ion	n/a	Alkene + water + halide ion

Oxidation

→ loss of electrons by the carbon atom (ox # goes down)

Reactions:

- Alkenes are oxidized by either KMnO4 or K2Cr2O7 to produce an alkane with two alcohol groups ("diols")
- Each C in the C=C bond gets an –OH group

- Alcohols are oxidized by the same as above to produce:
  - Primary alcohol → aldehyde → carboxylic acid
  - Secondary alcohol → ketone
  - Tertiary alcohol → won't react

- Aldehydes are oxidized by the same as above to produce a carboxylic acid.
- Ketones can't be oxidized. These properties can be a qualitative test to distinguish between an aldehyde and a ketone

Oxidizing Agents:

- KMnO4 turns from purple to brown in an aldehyde, and stays purple in a ketone.
- K2Cr2O7 turns from orange to green in aldehyde, stays orange in ketone
- Fehling's Solution: Copper (II) solution. Blue to orangish brown precipitate in aldehyde, stays blue in ketone
- Tollen's Reagent (silver ions in ammonia) clear & colourless **black** precipitate with silver mirrored coating in aldehyde, stays colourless in ketone

Condensation Reactions

- Linking 2 molecules together by linking an H and an OH to produce water

Family	Reacts With	Catalyst	Products
Alcohols	Each other	H_2SO_4 + heat	Ether + water
Alcohols	Carboxylic Acid	H_2SO_4 + heat	Ester + water
Amines	Carboxylic acid	H_2SO_4 + heat	Amide + water

Hydrolysis Reactions

→ splitting apart of a molecule by adding water

Family	Reacts With	Catalyst	Products
Esters – Reversible	Water	H_2SO_4 + heat	Alcohol + carboxylic acid
Esters – Irreversible	Water + Base		Alcohol + carboxylate ion + metal ion
Amides	Water	H_2SO_4 + heat	Amine + Carboxylic Acid