Organic Reactions

Substitution Reactions

Alkanes:

- Alkane + Halogen → Haloalkane

Haloalkanes:

- Haloalkane + NaOH → Alcohol
- Haloalkane + NH_3 → Amine

Addition Reactions

Alkenes:

- Alkene + Hydrogen -Metal Catalyst→ Alkane
- Alkene + H_2O -H_3PO_4 Catalyst→ Alcohol
- Alkene + Hydrogen Halide → Haloalkane
- Alkene + Halogen → Dihaloalkane

Hydrolysis Reactions

Esters:

- Ester + H_2O → Carboxylic Acid + Alcohol

Oxidation Reactions

Alcohols:

- Primary Alcohol + Inorganic Oxidant → Aldehyde (Low Temp) or Carboxylic Acid (High Temp)
- Secondary Alcohol + Inorganic Oxidant → Ketone
- Tertiary alcohols can't undergo oxidation

Aldehydes:

- Aldehyde + Inorganic Oxidant → Carboxylic Acid

Condensation Reactions

Carboxylic Acids:

- Esterification: Carboxylic Acid + Alcohol → Ester + H_2O
- Carboxylic Acid + NH_3 → Primary Amide + H_2O
- Carboxylic Acid + Primary Amine → Secondary Amide + H_2O

Important Oxidants to Remember

- Potassium Dichromate ($K_2Cr_2O_7$)
- Potassium Permanganate ($KMnO_4$)

Organic Compound Physical Properties

Alkanes

- Low BP due to dispersion forces & 1x bonds
- Straight chains compress more closely → higher BP & dispersion forces
- Non-polar → insoluble in H_2O

Alkenes & Alkynes

- Low BP
- Non-polar → insoluble in H_2O

Haloalkanes

- Weak dispersion forces, but allows stronger dipole-dipole attractions
- Higher BP than alkanes
- Low solubility due to insignificant dipole-dipole interactions

Alcohols, Carboxylic Acids, Amines & Amides

- All have functional groups that form H-bonds (strongest intermolecular force)
- High BP due to H-bonds
- Highest-lowest BP for alcohol types: primary, secondary, tertiary
- Soluble

Aldehydes, Ketones & Esters

- Held by dipole-dipole attractions
- Low BP due to no H-bonding with each other
- Soluble in H_2O due to H-bonding

Physical Properties

- Boiling Point → increases with size
- Solubility → decreases with size
- **Viscosity:** A fluid's resistance to flow. Increases by chain length and/or greater intermolecular force attractions
- **Flashpoint:** The lowest temp that a substance in vapour form combusts/ignites. Works hand-in-hand with BP, but is always lower than BP

Percentage Yield Formula

% Yield = (AY÷TY) x 100

Actual Yield (AY)	Theoretical Yield (TY)
Actual amount made	Estimated amount made by stoichiometry
Usually given in question	

Calculating The Overall % Yield

If A→B has ■% yield and the following reaction is B→C with ★%, and ..., then overall yield = (■%) x (★%) x ..., x 100

Atom Economy

Atom Economy = (M_r of wanted product ÷ M_r of **ALL** reactants) x 100

- Measure of how many atoms in reactants end up in wanted product → aim to maximise atom economy
- An indication of greeness (minimised waste & more products)