

### Organic Reactions

#### Substitution Reactions

##### Alkanes:

☞ Alkane + Halogen → Haloalkane

##### Haloalkanes:

☞ Haloalkane + NaOH → Alcohol

☞ Haloalkane + NH<sub>3</sub> → Amine

#### Addition Reactions

##### Alkenes:

☞ Alkene + Hydrogen -Metal Catalyst → Alkane

☞ Alkene + H<sub>2</sub>O -H<sub>3</sub>PO<sub>4</sub> Catalyst → Alcohol

☞ Alkene + Hydrogen Halide → Haloalkane

☞ Alkene + Halogen → Dihaloalkane

#### Hydrolysis Reactions

##### Esters:

☞ Ester + H<sub>2</sub>O → 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<sub>2</sub>O

☞ Carboxylic Acid + NH<sub>3</sub> → Primary Amide + H<sub>2</sub>O

☞ Carboxylic Acid + Primary Amine → Secondary Amide + H<sub>2</sub>O

### Important Oxidants to Remember

☞ Potassium Dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>)

☞ Potassium Permanganate (KMnO<sub>4</sub>)

### 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<sub>2</sub>O

#### Alkenes & Alkynes

☞ Low BP

☞ Non-polar → insoluble in H<sub>2</sub>O

#### 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<sub>2</sub>O 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

$$\% \text{ Yield} = (\text{AY} \div \text{TY}) \times 100$$

Actual Yield (AY)	Theoretical Yield (TY)
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☞ 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 = (■%) × (★%) × ..., × 100

### Atom Economy

$$\text{Atom Economy} = (\text{Mr of wanted product} \div \text{Mr of ALL reactants}) \times 100$$

☞ Measure of how many atoms in reactants end up in wanted product → aim to maximise atom economy

☞ An indication of greenness (minimised waste & more products)

