Reaction Type	Functional group	With	Products	Catalyst	Notes	Example
Combustion	All	-	Complete: $CO_2 + H_2O$ Incomplete: $CO_2 + H_2O +$ $CO + C$	-		
Substitution	Alkanes	Halogens		UV light	• For every halogen you want on the chain you must use one mole of the diatomic	
	Aromatics	Halogen	Halobenzene & Hydrogen halide	FeBr3 AlCl3		
		Alkyl Halide	Alkyl benzene & Hydrogen halide	AlCl3		

Substitution	Aromatics	Nitric Acid	Nitrobenzene & Water	Sulfuric Acid		
	Alcohols	Hydrogen halide	Alkyl halide & Water	ZnCl2	• Lucas test – can be used as a qualitative test to determine is an alcohol is primary, secondary, or tertiary • When –OH is on the end it is most soluble (primary) and decreases in solubility as it becomes secondary and tertiary • Alpha carbon – carbon with functional group	
	Ethers	2 Binary Acids	2 Alkyl halides & Water	Heat		
	Amines (Ammonia)	Alkyl halides	Amine & Hydrogen halide	-		

Addition	Alkenes	Hydrogen	Alkane	Pt		
		Halogens	Haloalkane (2 halogen atoms)	CCl4		
		*Hydrogen Halide	Haloalkane (1 halogen atom)	-		
		*Water	Alcohol	H2SO4 + 100 C		
	Alkynes	Same as alkenes but 2 moles of each reactant to saturate triple bonds				

Addition	Aldehydes & Ketones	Hydrogen (reduction)	Alcohol	Pt + 101MPa	• Aldehyde makes primary alcohol • Ketone makes secondary alcohol	
Elimination	Alcohols	-	Alkene & Water			
	Alkyl Halides	Hydroxide ion	Alkene + Water + Halide ion	-		
Oxidation	Alkenes	-	"diol" (each C in double bond gets an –OH)	Ox Agent: MnO4 & Cr2O7-2	• Colour change • Used to qualitatively test presence of aldehyde or ketone • Dichromate (orange) → Chromium +3 (green) • Permanganate (purple) → Manganese (IV) oxide (brown)	
	Alcohols	-	Depends on type of alcohol: 1. Primary→ aldehyde→ carboxylic acid 2. Secondary→ Ketone 3. Tertiary→ no rxn	Ox Agent: MnO4 & Cr2O7-2		

Oxidation	Aldehydes	-	Carboxylic Acid	Ox Agent: *MnO4-: purple→ brown *Cr2O7-2: orange→ green *Fehling's solution (Copper II solution): blue→orange/brown ppt *Tollen's Reagent (silver ions in ammonia): clear→black precipitate with a silver mirror coating on the glass wear (known as silver mirror test) **If colour stays the same that means it is a ketone. If colour changes, aldehyde.*		
Condensation	Alcohols	Alcohol	Ether and Water	H2SO4 + 140 C	• Carboxylic acid will lose –OH and alcohol will lose H	
		Carboxylic Acid	Ester and Water	H2SO4 + Heat		

Condensation	Amines	Carboxylic Acid	Amide and Water	H2SO4 + Heat		
Hydrolysis	Esters	Reversible: Water	Alcohol and Carboxylic Acid	H2SO4 + Heat		
		Irreversible: Water and Base	Alcohol, Carboxylic acid, Metal ion	-		
	Amide	Water	Amine and Carboxylic Acid	H2SO4 + Heat		