Handout: Organic Chemistry Reactions

Reactions Organized by Compound Families

Alkanes
1. Combustion
2. Halogenation

Alkenes and Alkynes
1. Additions: hydrogenation, halogenation,
   hydrohalogenation, hydration
2. Polymerization

Aromatic Compounds
Substitutions: nitration, halogenation, sulfonation

Alcohols
1. Elimination: dehydration
2. Oxidations

Thiols
Oxidation

Amines
Acid-Base reactions

Aldehydes and Ketones
1. Addition: Acetal/hemiacetal formation by alcohol
   addition
   (Reverse rxn: Acetal hydrolysis with acid)
2. Oxidation and Reduction for aldehydes
   (*Ketones go through reduction only)

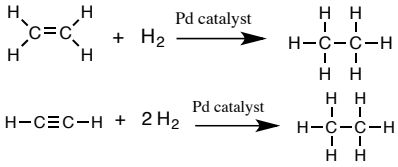
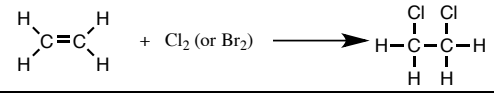
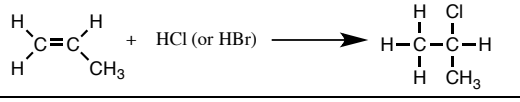
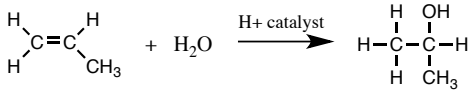
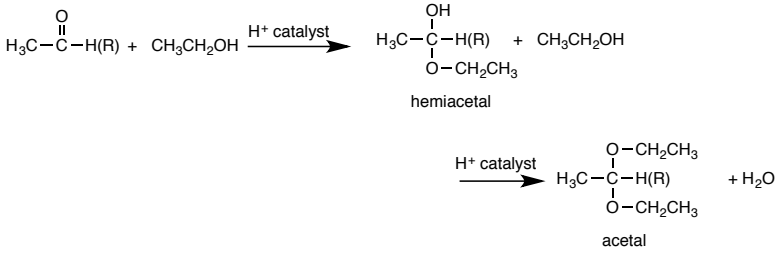
Carboxylic Acids
1. Substitutions: esterification, amidation
   (Reverse rxns: ester hydrolysis with acid or base, amide hydrolysis with acid or base)
2. Acid-base reactions

Phosphoric acid and Phosphates
Phosphoric acid: Esterification with alcohol
Phosphates: Phosphorylation

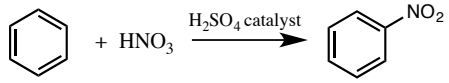
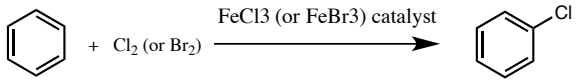
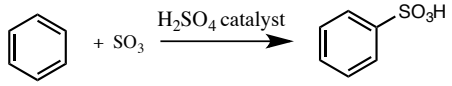
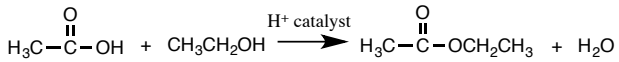
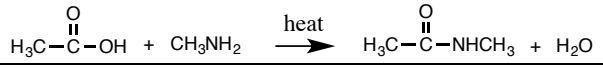
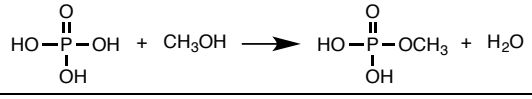
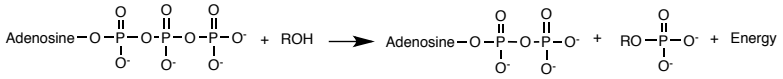
Reactions Organized by Reaction Type

Family | Reaction | Example

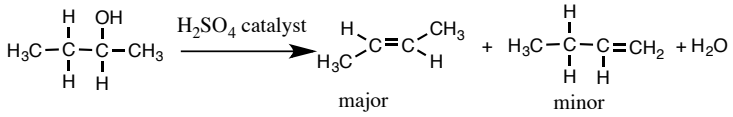
1. ADDITION

Alkenes and alkynes	Hydrogenation	
	Halogenation	
	Hydro-halogenation	 Markonikov's Rule applies: H adds to C with more Hs already.
	Hydration	 Markonikov's Rule applies.
Aldehydes and ketones	Addition of alcohol to get hemiacetals or acetals	

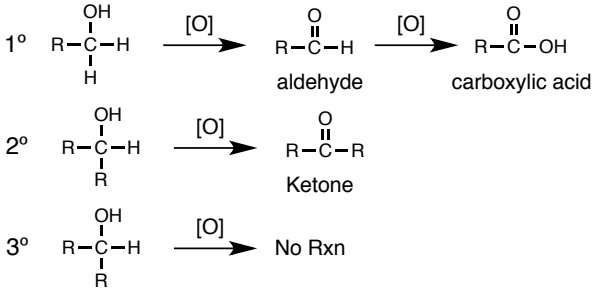
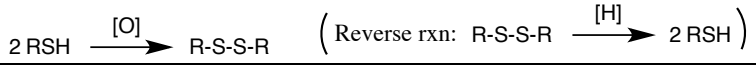
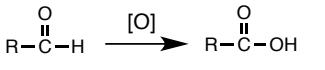
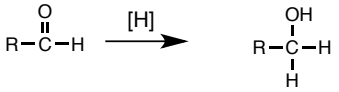
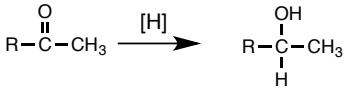
2. SUBSTITUTION

Aromatic compounds	Nitration	
	Halogenation	
	Sulfonation	
Carboxylic acids	Esterification with alcohol	
	Amidation with amine	
Phosphoric acid and Phosphates	Phosphoric acid: Esterification with alcohol	
	Phosphates: Phosphorylation	

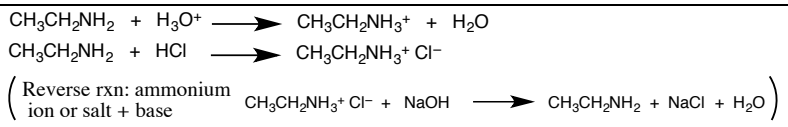
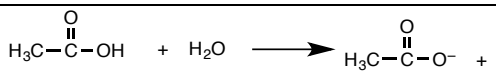
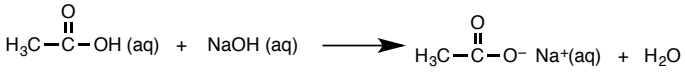
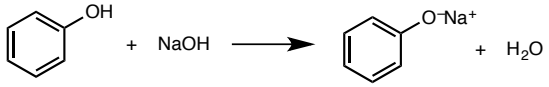
3. ELIMINATION

Alcohols	Dehydration	 Zaitsev's Rule applies: More highly substituted alkene is major product.

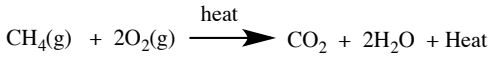
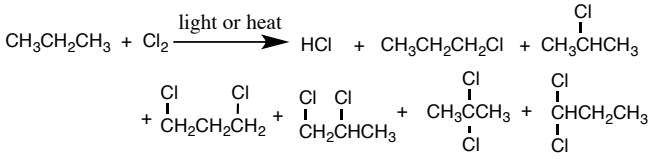
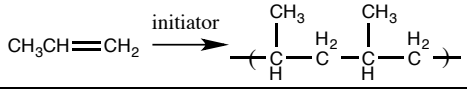
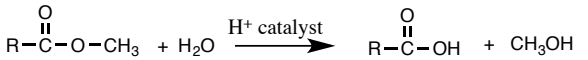
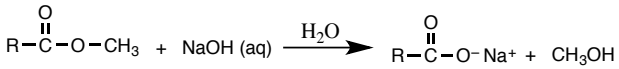
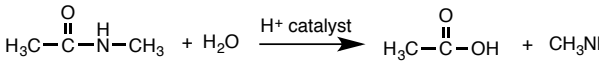
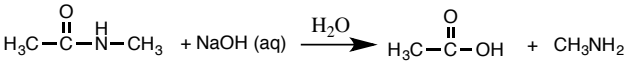
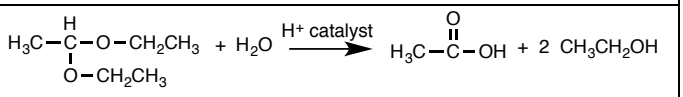
4. OXIDATION/REDUCTION

Alcohols	Oxidation	
Thiols	Oxidation	
Aldehydes	Oxidation	
	Reduction (also addition)	
Ketones	Reduction (also addition)	

5. ACID-BASE

Amines (Basic)	Rxn with water	
	Neutralization with strong acid to get ammonium ion or salt	
Carboxylic acids (Acidic)	Rxn with water	
	Neutralization with strong base to get carboxylic acid salt	
Phenols (<u>very</u> weakly acidic)	Neutralization with strong base to get salt	

Other Reaction Types

Family	Reaction	Example
RADICAL REACTIONS		
Alkanes	Combustion (Also oxidation/reduction reaction)	
	Halogenation	 Mixed products
Alkenes	Polymerization	
HYDROLYSIS		
Esters (Reverse rxns of carboxylic acid esterification)	Acid hydrolysis to get carboxylic acid and alcohol	
	Saponification: Base hydrolysis to get carboxylic acid salt and alcohol	
Amides (Reverse rxns of carboxylic acid amidation)	Acid hydrolysis to get amine	
	Base hydrolysis to get amine	
Acetals (Reverse reaction of acetal formation from aldehydes/ketones)	Acid hydrolysis to get aldehydes of ketones (reverse of acetal formation)	

*Note that organic chemistry reactions can be classified in several different ways.