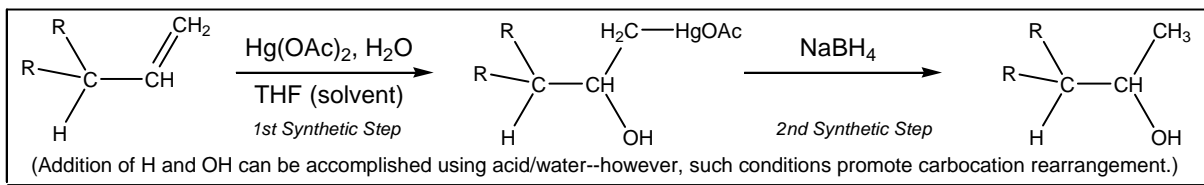
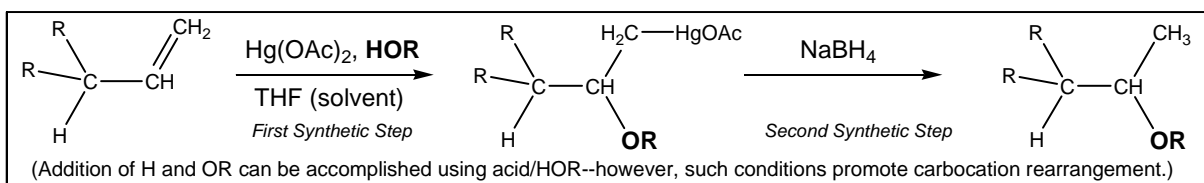


Appendix: Synthetic Transformations

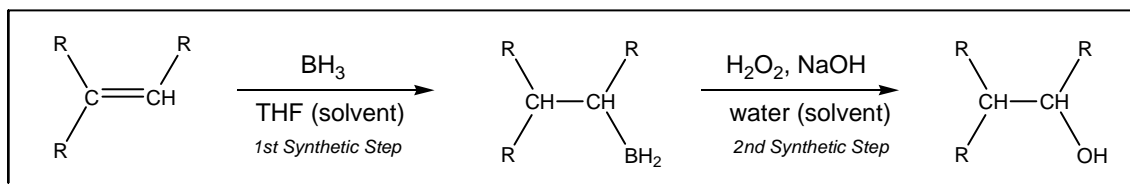
Synthetic Transformation 8.1: Addition of H and OH without rearrangement (Oxymercuration-Demercuration)



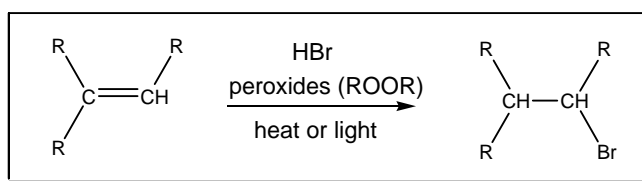
Synthetic Transformation 8.2: Addition of H and OR without rearrangement (Alkoxymercuration-Demercuration)



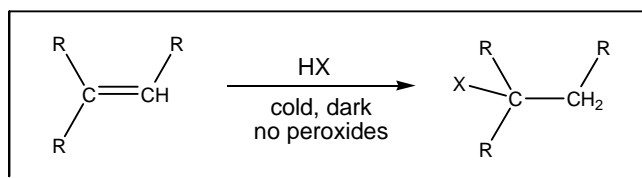
Synthetic Transformation 8.3: Anti-Markovnikov Addition of H and OH

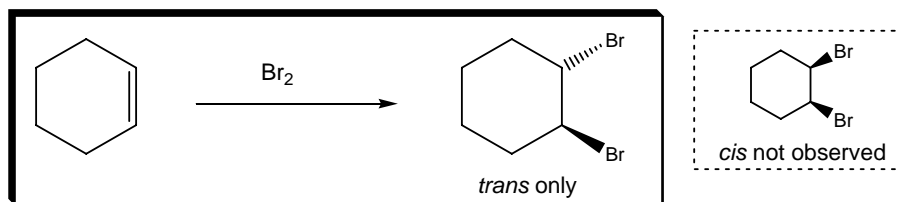


Synthetic Transformation 8.4: Anti-Markovnikov Addition of H and Br

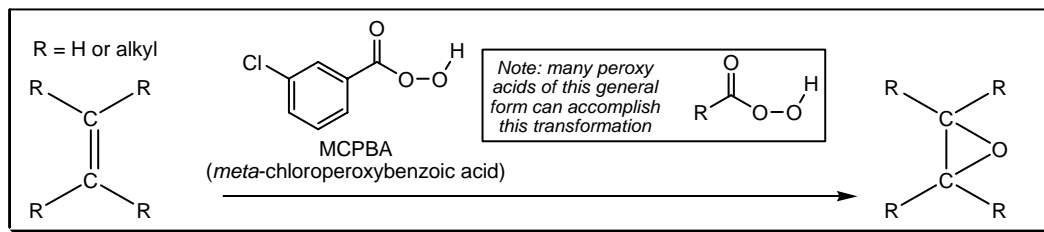


(from Part A) Synthetic Transformation 8.5: Markovnikov Addition of H and X (X = Cl, Br, or I)

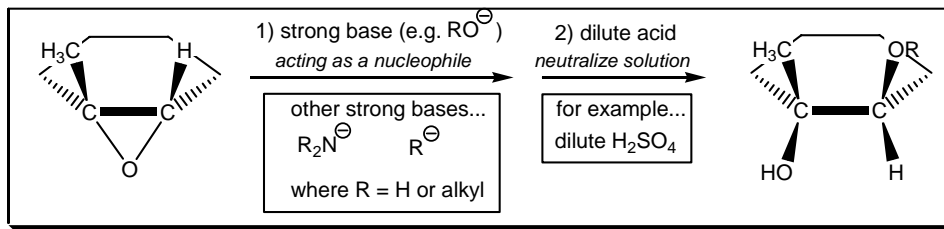


Synthetic Transformation 9.1: Addition of Br₂ to an Alkene

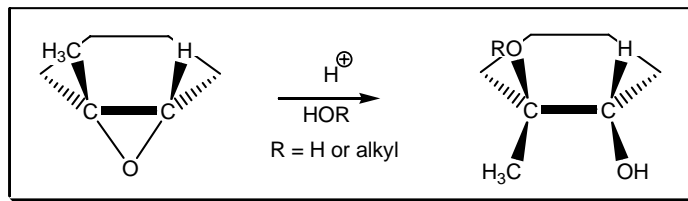
Synthetic Transformation 9.2: Oxidation of an Alkene to an Epoxide



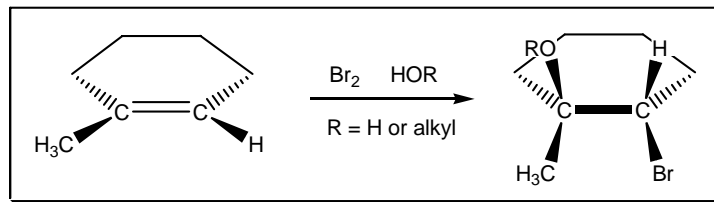
Synthetic Transformation 9.3: anti-Markovnikov Epoxide Ring Opening (Basic Conditions)



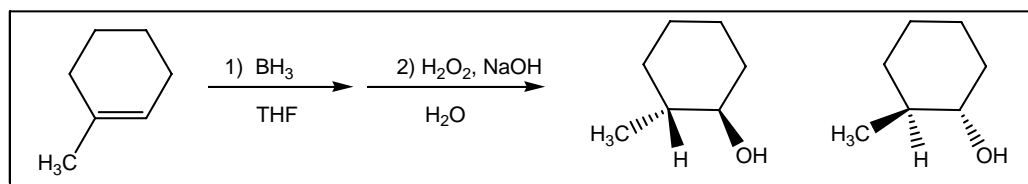
Synthetic Transformation 9.4: Markovnikov Epoxide Ring Opening (Acidic Conditions)



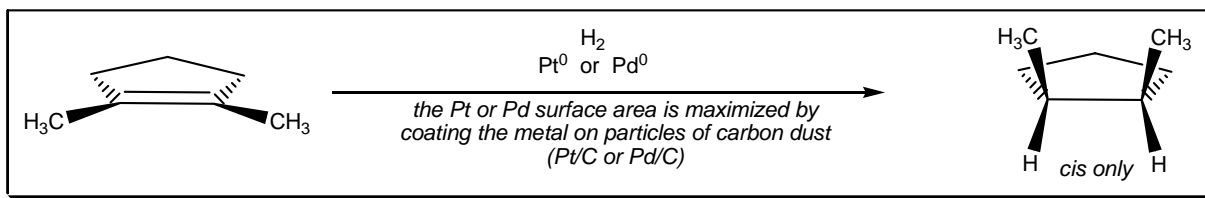
Synthetic Transformation 9.5: Markovnikov Addition of Br and OR to an Alkene



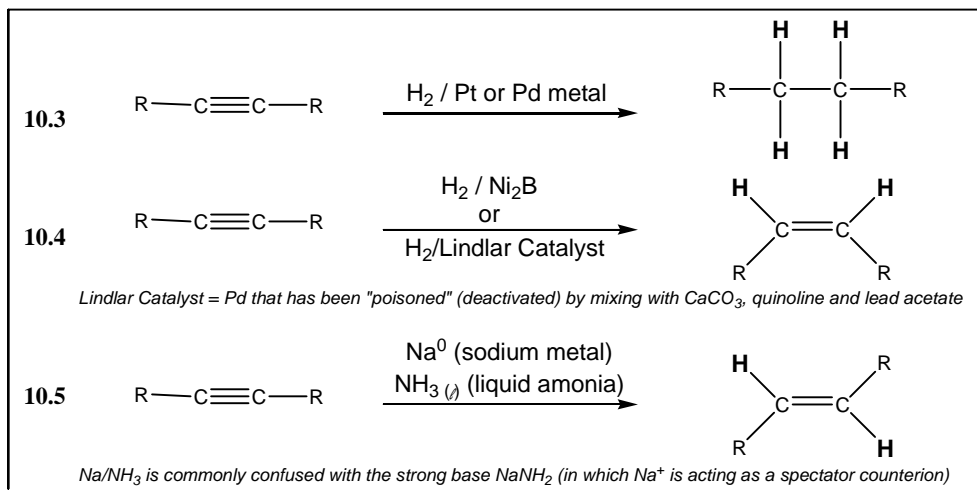
Synthetic Transformation 10.1: Hydroboration-Oxidation



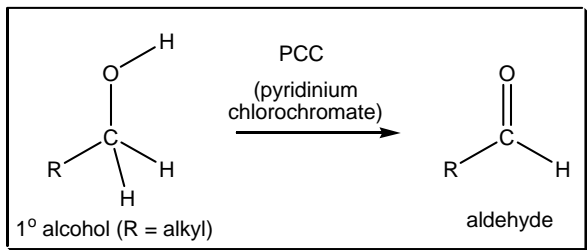
Synthetic Transformation 10.2: Catalytic Hydrogenation



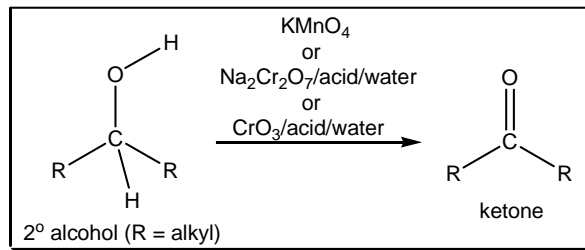
Synthetic Transformations 10.3-10.5: Stereoselective Alkyne Reductions



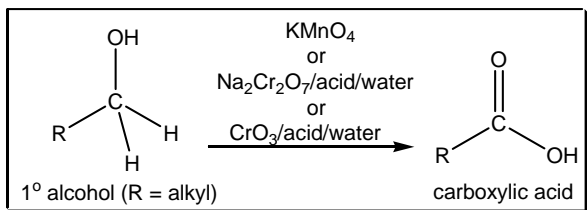
Synth Transf 10.6: Oxidation of 1° Alcohol to an Aldehyde



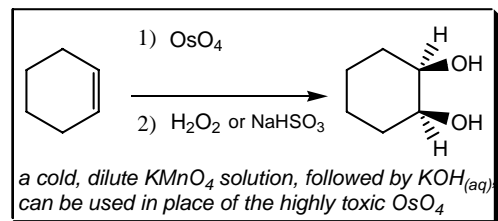
Synth Transf 10.7: Oxidation of 2° Alcohol to a Ketone



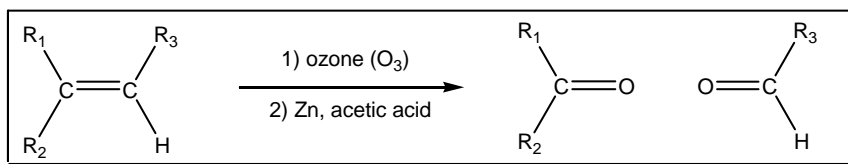
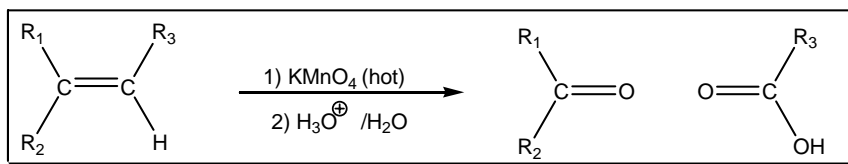
Synth Transf 10.8: Oxidation of 1° Alcohol to a CA



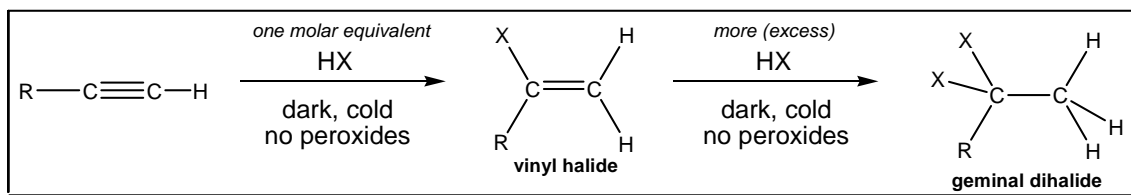
Synth Transf 10.9: Syn Addition of 2 OH Groups

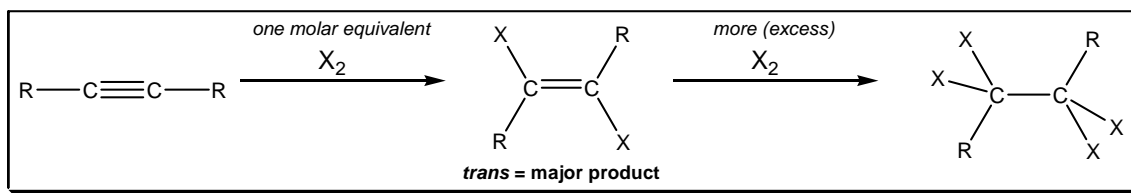
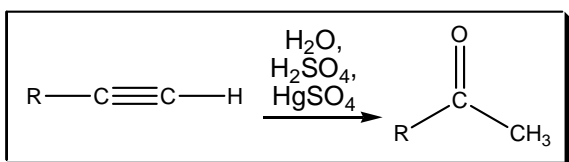
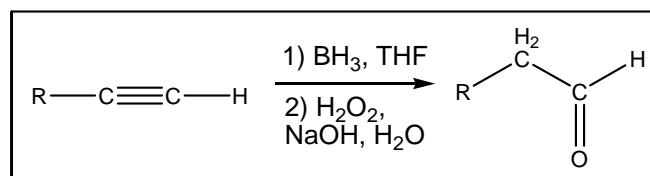


Synthetic Transformation 10.10: Cleavage of a C=C Double Bond using Ozone (Ozonolysis)

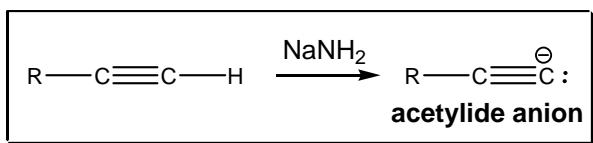
Synthetic Transformation 10.11: Cleavage of a C=C Double Bond using Permanganate (MnO_4^-)

Synthetic Transformation 11.1: Markovnikov Addition of H and X (X = Cl, Br, or I)

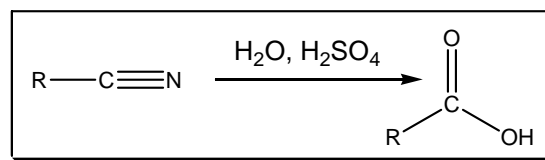


Synthetic Transformation 11.2: Addition of X₂ (X = Cl or Br)Synth Transf 11.3: Markov. Addition of H₂O to an AlkyneSynth Transf 11.4: anti-Markov. Add'n of H₂O to Alkyne

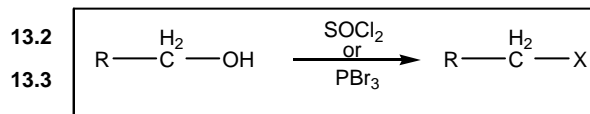
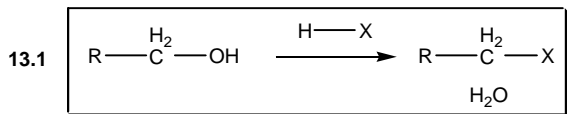
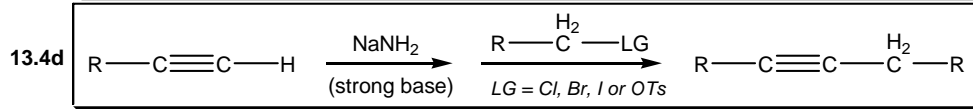
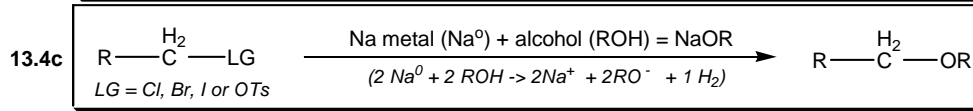
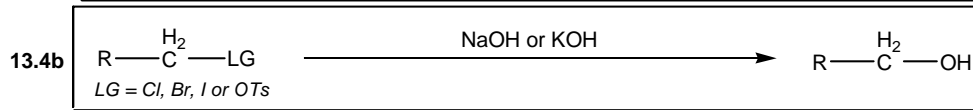
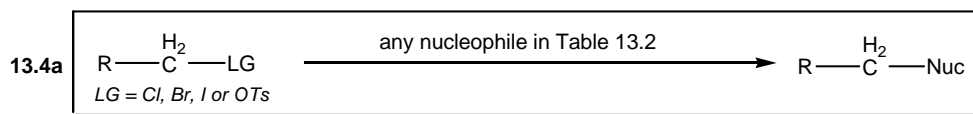
Synth Transf 11.5: Deprotonation of an Alkyne



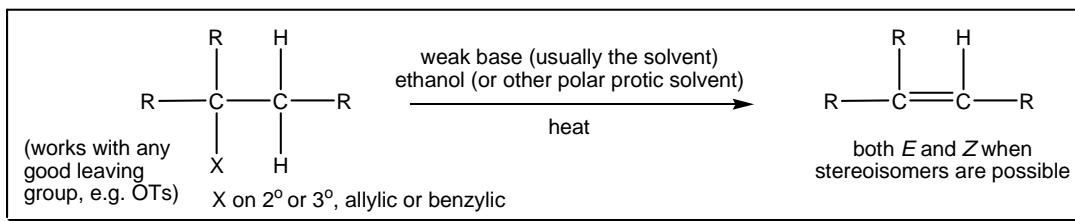
Synth Transf 11.6: Hydrolysis of a Nitrile



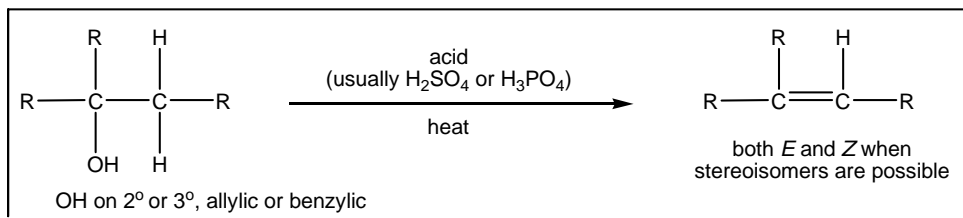
Synthetic Transformations 13.1-3: Halogenation of an Alcohol

Synthetic Transformations 13.4a-d: Examples of Synthetic Uses of S_N2 Reactions

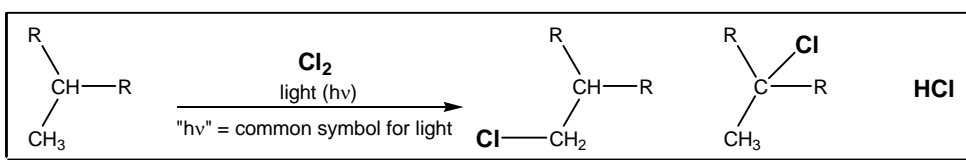
Synthetic Transformation 14.1: Alkyl Halide (R—X) or Tosylate (R—OTs) to Alkene (via E1)



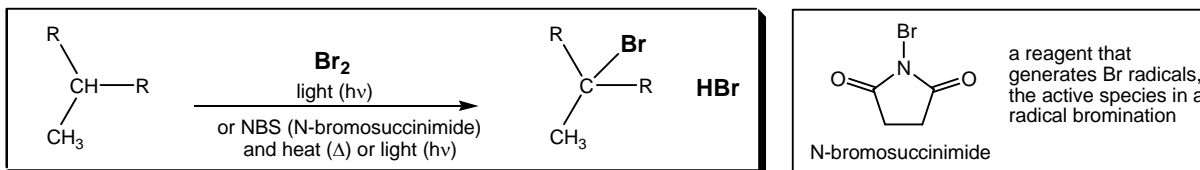
Synthetic Transformation 14.2: 2° or 3°, Allylic or Benzylic Alcohol to Alkene (via E1)



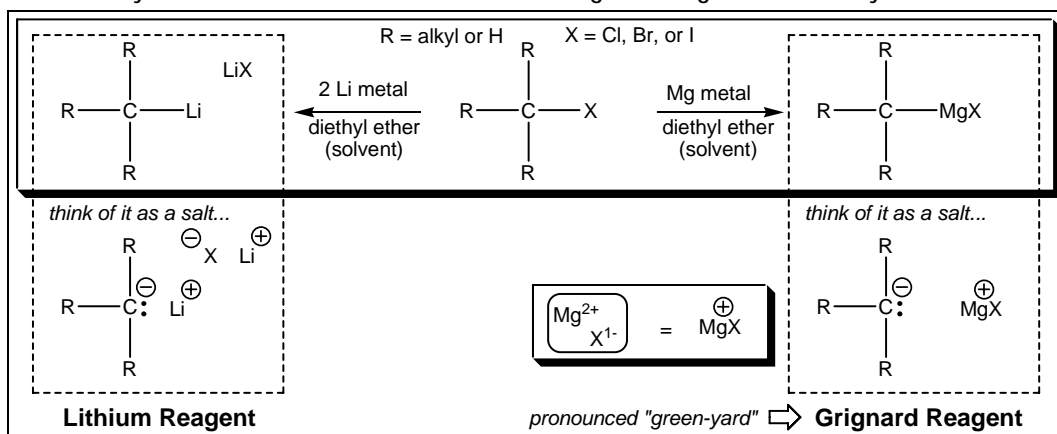
Synthetic Transformation 15.1: Radical Chlorination of an Alkane



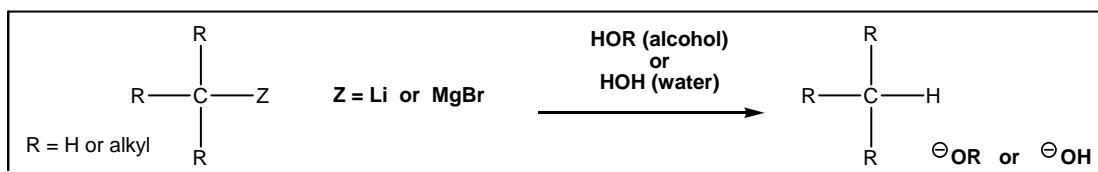
Synthetic Transformation 15.2: Radical Bromination of an Alkane



Synthetic Transformation 16.1: Lithium or Grignard Reagent from an Alkyl Halide



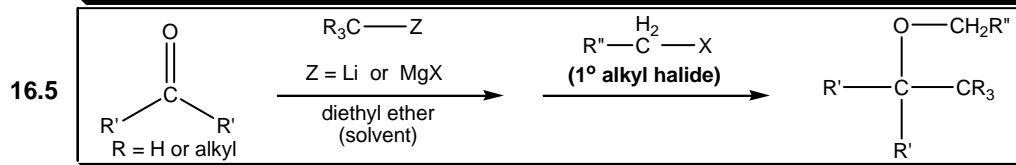
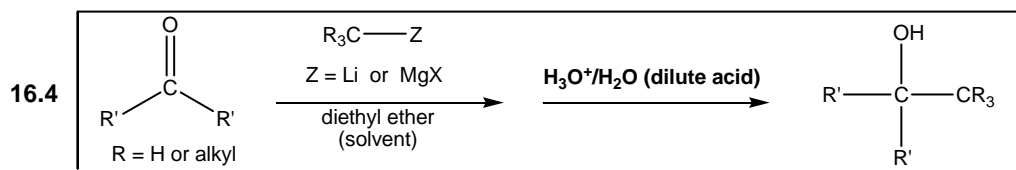
Synthetic Transformation 16.2: Reaction of a Lithium or Grignard Reagent as a Base



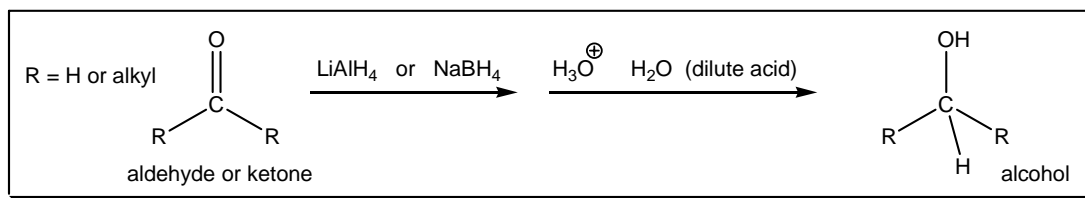
Synthetic Transformation 16.3: Replacement of a Halogen with a Deuterium



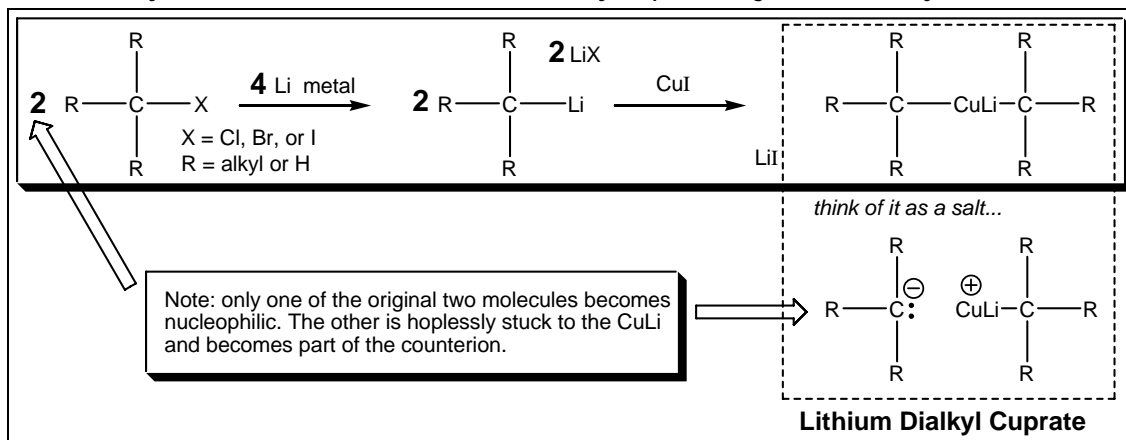
Synthetic Transformations 16.4 and 16.5: Alcohol or Ether from an Aldehyde or Ketone



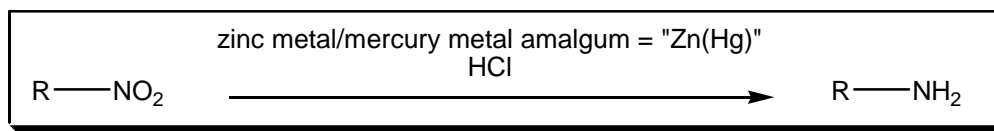
Synthetic Transformation 16.6: Reduction of an Aldehyde or Ketone to an Alcohol




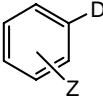
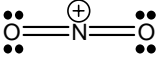

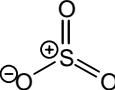
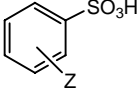

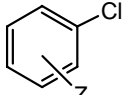



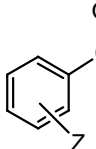
Synthetic Transformation 16.7: Lithium Dialkyl Cuprate Reagent from an Alkyl Halide



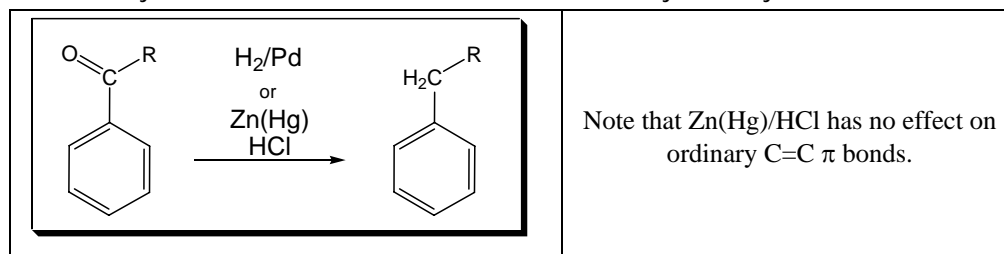
Synthetic Transformation 16.8: Reduction of a Nitro Group to an Amine



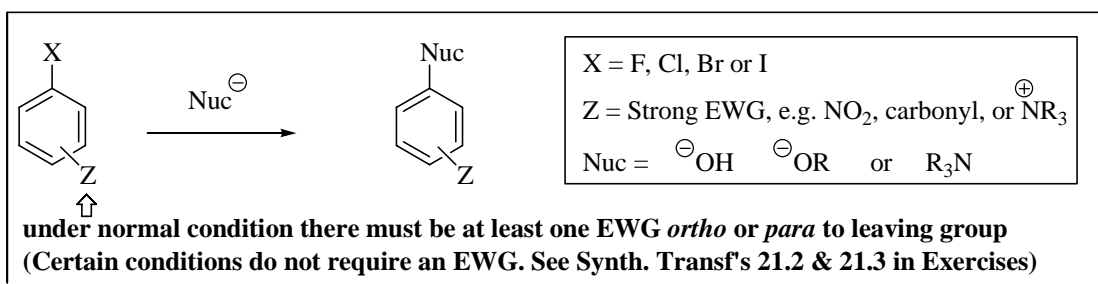
Synthetic Transformations 19.1-19.6: Reagents for EAS

Reactant	Synth. Transf.	Electrophile (E ⁺)	Reagents	Product(s)
 benzene when Z = H	19.1	D ⁺	Any deuterated strong acid	
	19.2		H ₂ SO ₄ and HNO ₃	
	19.3		anhydrous sulfuric acid (H ₂ SO ₄ with no water)	
	19.4	Br ⁺ or Cl ⁺	Br ₂ and FeBr ₃ or Cl ₂ and FeCl ₃	 or 
	19.5	R ⁺	R-X, AlX ₃ (X = Cl or Br)	 R = alkyl group
	19.6		 AlX ₃ (X = Cl or Br)	 R = alkyl group

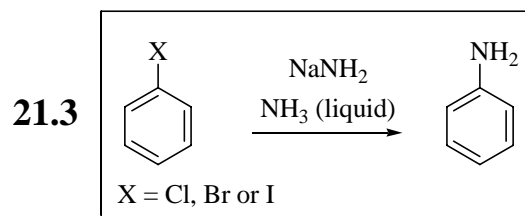
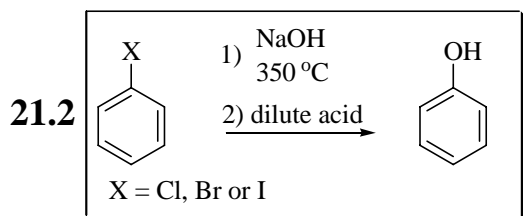
Synthetic Transformation 19.7: Reduction of a Benzyl Carbonyl



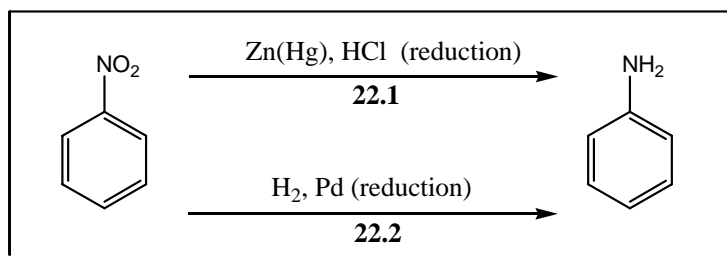
Synthetic Transformation 21.1: NAS (Nucleophilic Aromatic Substitution)



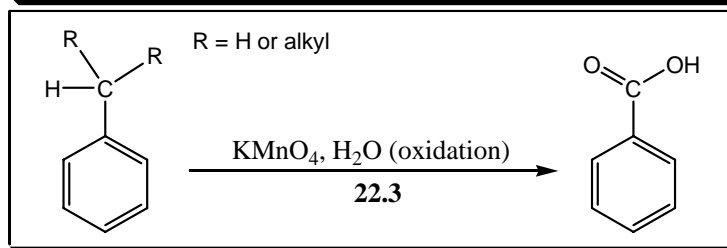
Synthetic Transformations 21.2 and 21.3: Benzyne Reactions

Synthetic Transformations 22.1-22.3: Changing an *o/p* to a *m* Director, or Vice Versa

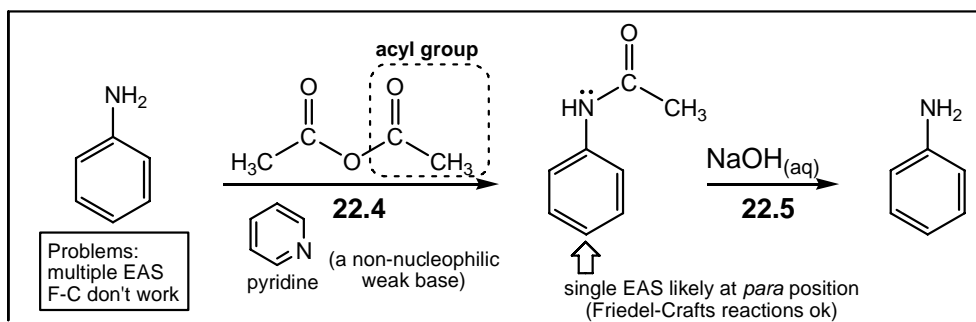
Synthetic
Transformations
22.1-22.2



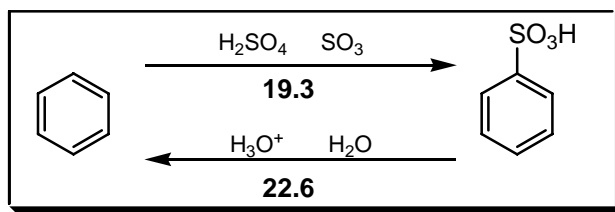
Synthetic
Transformation
22.3



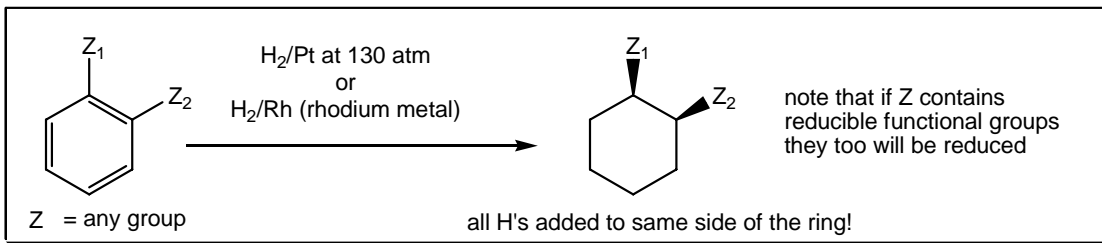
Synthetic Transformations 22.4 and 22.5: Acylation and de-Acylation of Anilines



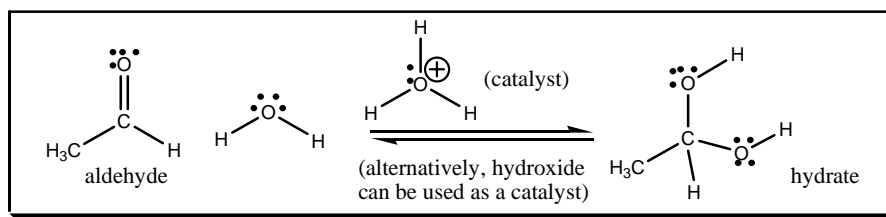
Synthetic Transformations 22.6 (and 19.3): Sulfonation and de-Sulfonation of Aromatic Rings



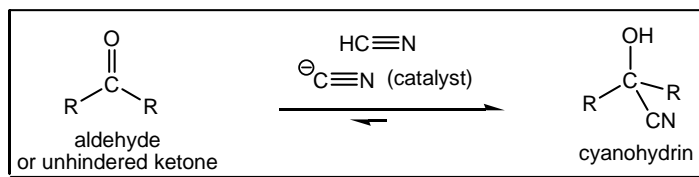
Synthetic Transformation 22.7: Complete Reduction of Benzene



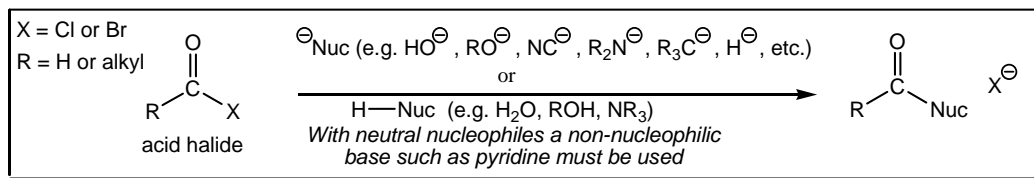
Synthetic Transformation 23.1: Hydrate Formation



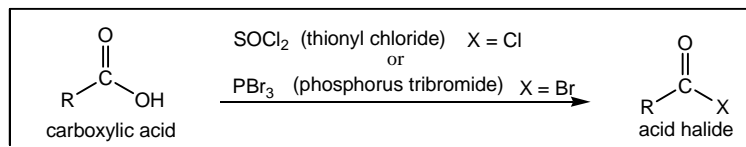
Synthetic Transformation 23.2: Cyanohydrin Formation



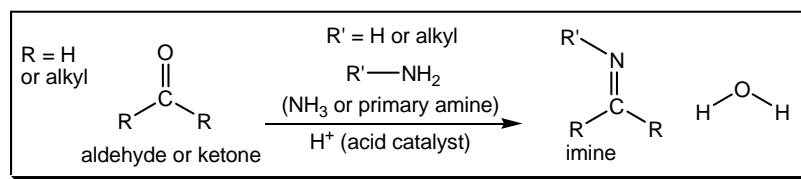
Synthetic Transformation 23.3: Acid Halide Reaction (Nucleophilic Acyl Substitution)



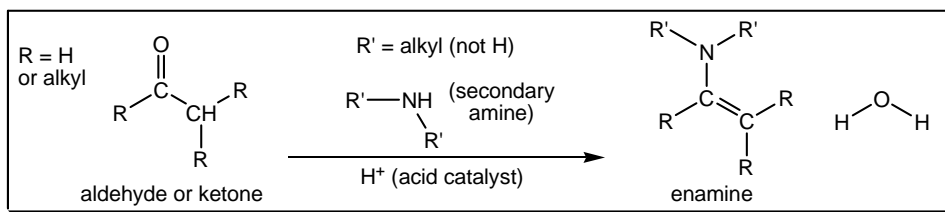
Synthetic Transformation 23.4: Preparation of Acid Halides from Carboxylic Acids



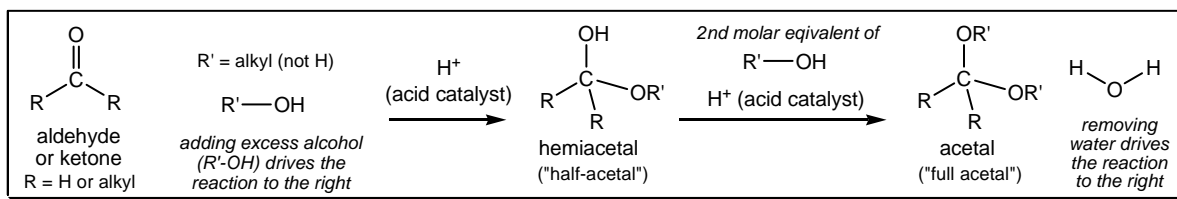
Synthetic Transformation 23.5: Imine Formation



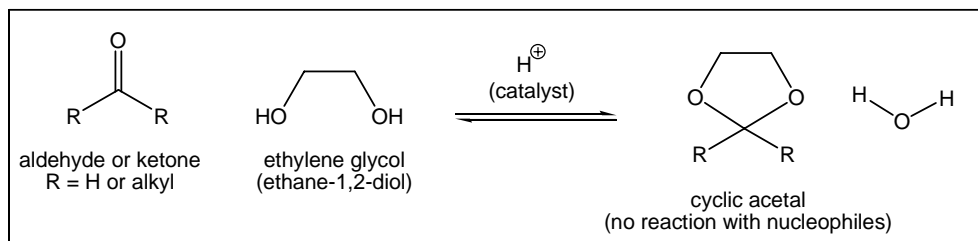
Synthetic Transformation 23.6: Enamine Formation



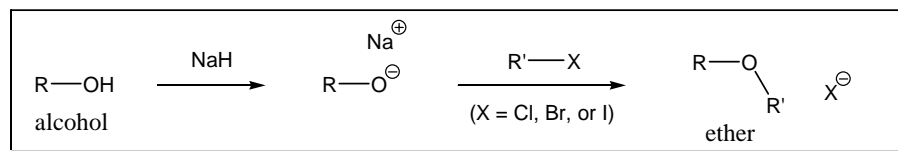
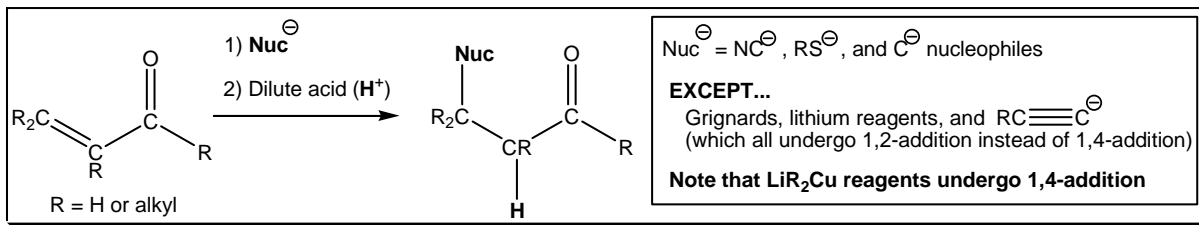
Synthetic Transformation 23.7: Hemiacetal and Acetal Formation

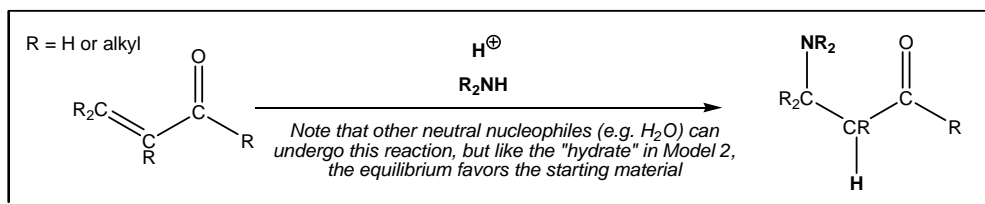


Synthetic Transformation 23.8: Protection of a Carbonyl Against Nucleophiles

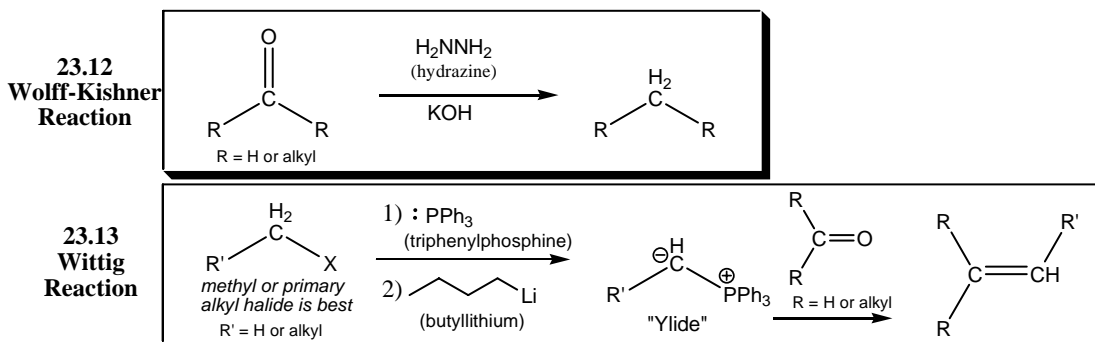


Synthetic Transformation 23.9: Williamson Ether Synthesis

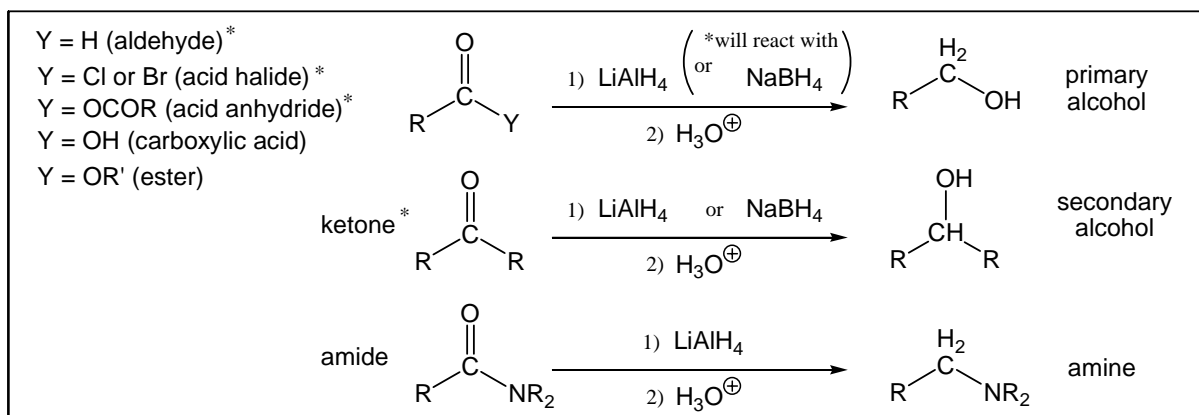
Synthetic Transformation 23.10: 1,4-Addition to an α,β -Unsaturated Carbonyl

Synthetic Transformation 23.11: 1,4-Addition of an Amine to an α,β -Unsaturated Carbonyl

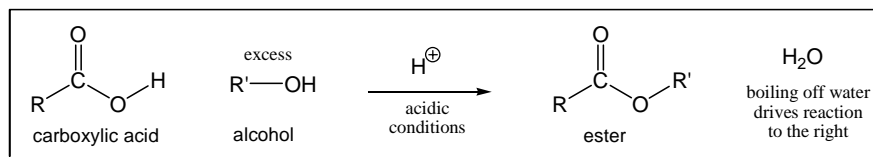
Synthetic Transformations 23.12 and 23.13: Wolff-Kishner and Wittig Reactions



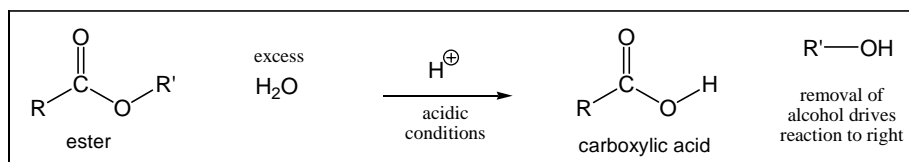
Synthetic Transformation 24.1: Reduction of Carboxylic Acid Derivatives with Hydride



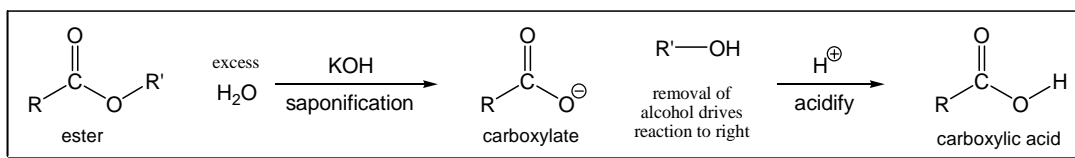
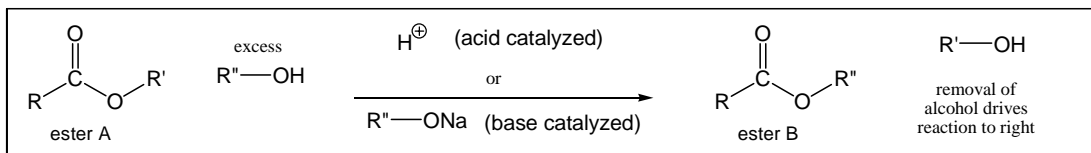
Synthetic Transformation 24.2: Acid-Catalyzed Ester Synthesis



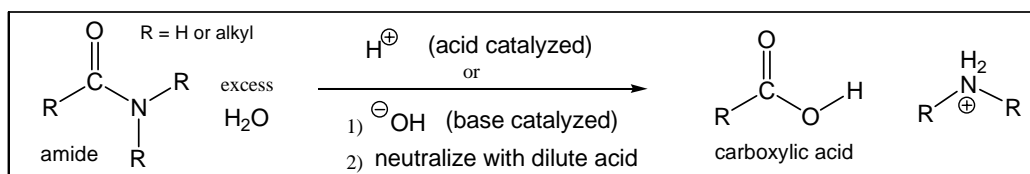
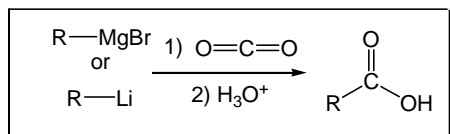
Synthetic Transformation 24.3: Acid-Catalyzed Synthesis of a CA from an Ester



Synthetic Transformation 24.4: Ester Saponification (Base-Catalyzed CA Synthesis)

Synthetic Transformation 24.5: *Trans*-Esterification

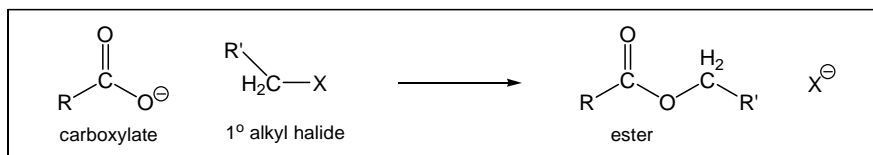
Synthetic Transformation 24.6: Acid- or Base-Catalyzed Hydrolysis of an Amide

Synth. Transf. 24.7: Grignard/Lithium Rgnt + CO₂

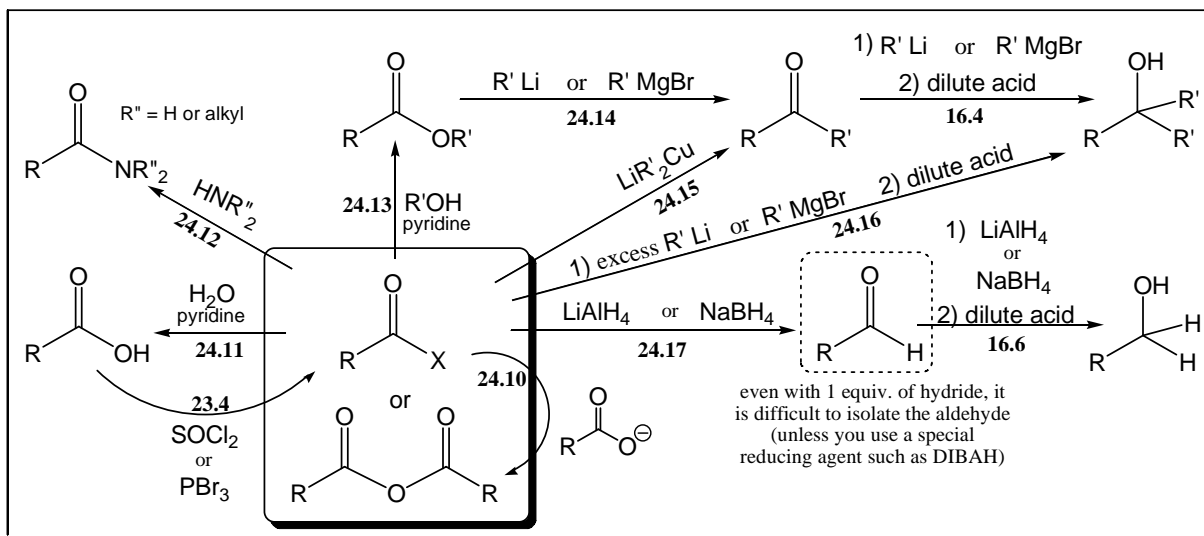
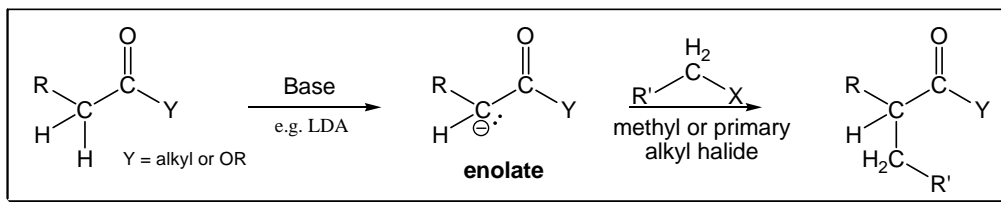
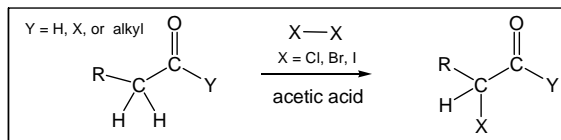
Synth. Transf. 24.8: Grignard/Lithium Rgnt + Nitrile



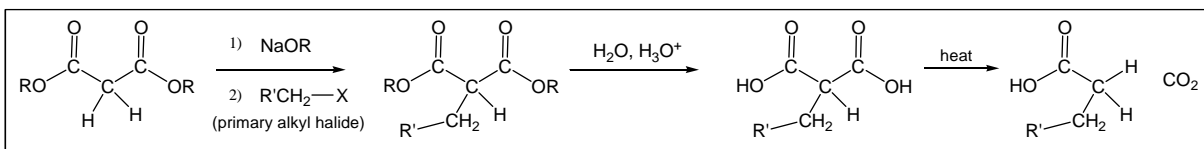
Synthetic Transformation 24.9: Formation of an Ester from a 1° Alkyl Halide



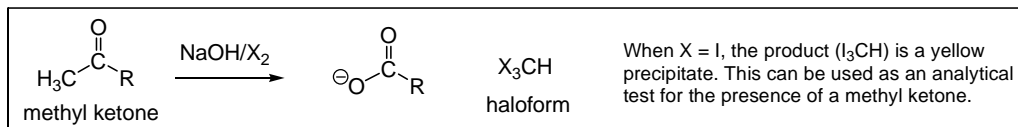
Synthetic Transformations 24.10-24.17: Reactions of Acid Halides and Anhydrides

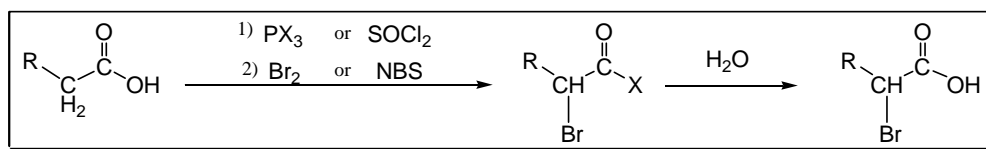

 Synthetic Transformation 25.1: Base-Promoted α -Alkylation of Carbonyl Compounds

 Synthetic Transformation 25.2: Acid-Catalyzed α -Halogenation of Carbonyl Compounds


Synthetic Transformation 25.3: Malonic Ester Synthesis of Carboxylic Acids

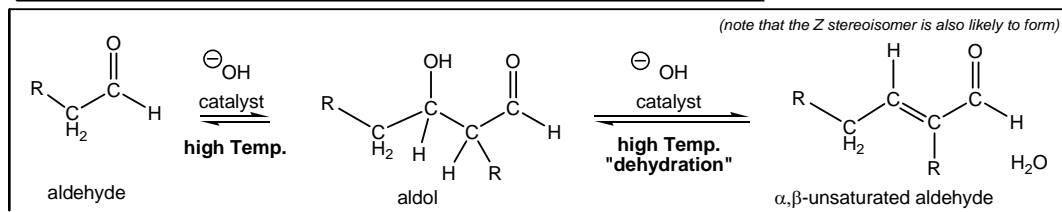
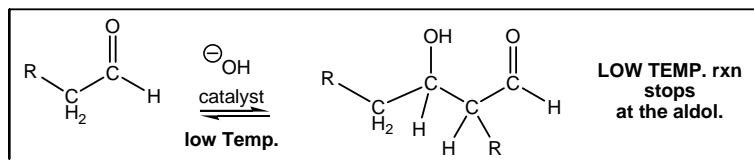


Synthetic Transformation 25.4: Haloform Reaction (and Iodoform Test for Methyl Ketones)

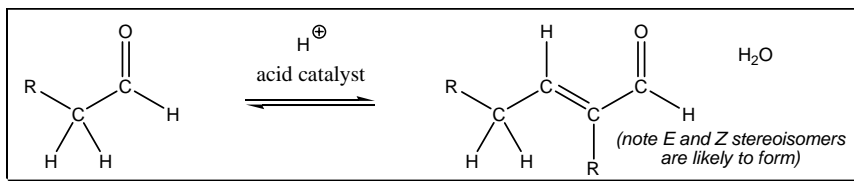


Synthetic Transformation 25.5: α -Bromination of Carboxylic Acids (Hell-Vollhard-Zelinsky)

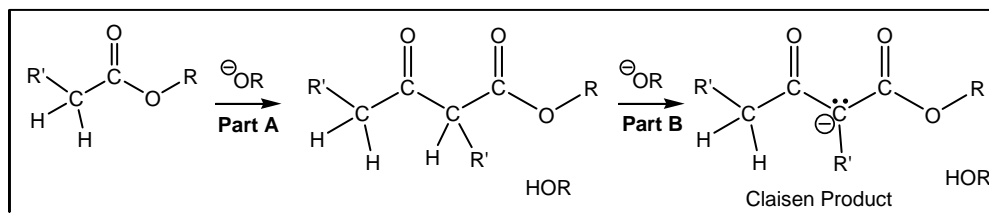
Synthetic Transformations 26.1 and 26.2: Base-Catalyzed Aldol Reactions



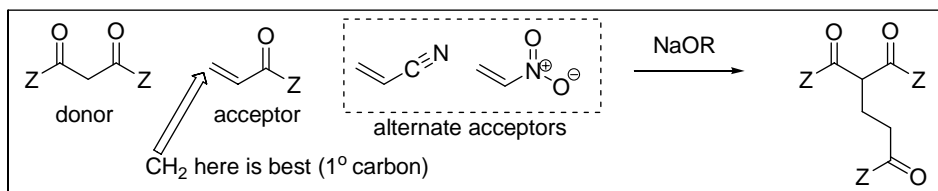
Synthetic Transformations 26.3: Acid-Catalyzed Aldol Reaction



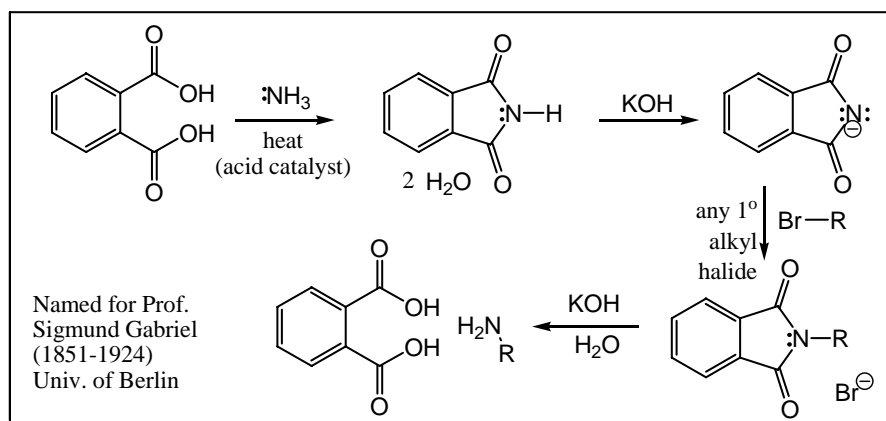
Synthetic Transformation 26.4: Claisen Reaction



Synthetic Transformation 26.5: Michael Reaction



Synthetic Transformation 27.1: Gabriel Synthesis of Primary (1°) Amines



Synthetic Transformations 27.2-27.4: Synthesis of Amines via Reduction of Amides, Aldehydes, Ketones or Nitriles

