

Chapter 9 (Klein) Summary: Reactions of Alkynes

- I. Structure, Properties and Nomenclature of Alkynes (9.1, 9.2) **SkillBuilder 9.1**
- II. Alkyne preparation by E2/dehydrohalogenation
 - i) – HX twice w/strong base (9.4)
- III. Reductions of alkynes (9.5)
 - i) H₂/catalyst (Pd, Ni, Pt, RhCl[PR₃]₃) adds 2 equiv. to give alkane
 - ii) H₂/poisoned cat. (Lindlar's catalyst) adds 1 equiv. to give cis alkene
 - iii) Na/NH₃ (dissolving metal reduction) converts internal alkyne to a trans alkene
- IV. Addition reactions
 - i) Br₂ (adds 2 equivalents) (9.8)
 - ii) HBr (adds 2 equivalents, both Markovnikov) (9.6)
 - iii) Hydration of alkynes (9.7) **SkillBuilders 9.3, 9.4**
 - A) Markovnikov addition of H-OH (1 equiv.) to give enol
 - B) tautomerization of enol to ketone/aldehyde (1st step protonate; 2nd step deprotonate)
- V. Ozonolysis of alkynes (9.9)
 - i) cleave C≡C triple bond to give 2 carboxylic acids
- VI. Alkyne synthesis by alkylation reaction (9.10)
 - i) deprotonation of alkynes (9.3)
 - A) acidity of alkynes ($\text{RC}\equiv\text{CH} + \text{NaNH}_2 \rightarrow \text{RC}\equiv\text{CNa}$) **SkillBuilder 9.2**
 - B) $\text{RC}\equiv\text{CNa}$ can be a nucleophile (S_N2 on MeI or primary R'X) **SkillBuilder 9.5**
- VII. Synthesis strategies (9.11) **SkillBuilder 9.6**
 - i) Are there any changes to the carbon skeleton? (use $\text{RC}\equiv\text{CNa}$ nucleophile + R'X)
 - ii) Are there any changes to the identity/position of functional group?
 - iii) Make logical disconnections to develop a retrosynthetic plan.