

Elimination vs. Substitution?

Primary Alkyl Halides

1. Substitution via an S_N2 mechanism is favored by primary (1°) alkyl halides.
Primary alkyl halides will only eliminate via an E2 mechanism if both a very strong base and heat are present OR if a very, strong, bulky base like potassium t-butoxide ($\text{KOC}(\text{CH}_3)_3$) is present.

NOTE: Due to the instability of primary carbocations, primary alkyl halides do not undergo S_N1 or E1 mechanisms.

Tertiary Alkyl Halides

1. Elimination via an E2 mechanism is favored by tertiary (3°) alkyl halides when a strong base is present. In this case, heat is NOT necessary to cause the elimination.

NOTE: Due to steric hindrance, tertiary alkyl halides do not undergo S_N2 mechanisms.

2. Elimination via an E1 mechanism or substitution via an S_N1 mechanism is favored by tertiary (3°) alkyl halides when a weak base/weak nucleophile is present. However, the stronger the base and/or the higher the temperature, the more the elimination product is favored.

Secondary Alkyl Halides

1. Elimination via an E2 mechanism or substitution via an S_N2 mechanism is favored by secondary (2°) alkyl halides when a strong base/strong nucleophile is present. However, the stronger the base and/or the higher the temperature, the more the elimination product is favored. Elimination via an E2 mechanism is also favored in the presence of the strong, bulky base, potassium t-butoxide ($\text{KOC}(\text{CH}_3)_3$).
2. Elimination via an E1 mechanism or substitution via an S_N1 mechanism is favored by secondary (2°) alkyl halides when a weak base/weak nucleophile is present. However, the stronger the base and/or the higher the temperature, the more the elimination product is favored.

Strong Base/Strong Nucleophiles

CN^- , NH_2^- , OH^- , alkoxides (OR^- ; ex. OCH_3^- , $\text{OCH}_2\text{CH}_3^-$ etc.) alkoxides may be present as KOR or NaOR

Weak Base/Strong Nucleophiles

HS^- , SR^- (ex. SCH_3^- , $\text{SCH}_2\text{CH}_3^-$ etc.) may be present as KSR or NaSR, I^-

Weak Base/Weak Nucleophiles

H_2O , alcohols (ROH ; ex. CH_3OH , $\text{CH}_3\text{CH}_2\text{OH}$ etc.), NH_3 , RNH_2 , R_2NH , R_3N