

Substitution/Elimination Determination Table

Reference: Dr. Mark Arant (University of Louisiana at Monroe) uses a table very similar to this one for determining whether a reaction goes SN_2 , E_2 or SN_1/E_1 .

pKa of conjugate acid of nucleophile	Primary Halides	Secondary Halides	Tertiary Halides
<10	SN_2	SN_2 – polar aprotic solvent SN_1/E_1 – polar protic solvent	SN_1/E_1
10-25	SN_2	E_2	E_2
>25	E_2	E_2	E_2

How to read the chart: 1) Determine whether the carbon that has the leaving group is primary, secondary, or tertiary. 2) Next, draw the conjugate acid of the nucleophile and determine its pKa.

Exceptions: a) This table determines the reaction most likely to take place. SN_1 and SN_2 are limiting reactions with most reactions taking place by a combination of mechanisms instead of by just one mechanism. b) If the base is bulky like tert-butoxide, elimination will dominate via E_2 even though the pKa of tert-butyl alcohol is less than 25. c) If the primary carbocation is stabilized (i.e. allyl or benzyl) the SN_1 reaction may dominate.