



CHE 2060: Guide to strength of Nu:, E+ and LG

As you read each statement consider these two questions:

1. Why? What is the reason or explanation for each statement?
2. How does the factor help determine whether the mechanism is SN1 or SN2?

How do you know whether a reactant is acting as a Nu: or a base?

- By its actions: bases remove a H atom while Nu:s do more.

Common Nu:

Many Nu: use **N**, **O** and **S** atoms to hold lone pairs.

- Water
- Alcohols
- Phenols
- Amines
- Thiols
- Carbohydrates (aldehydes and ketones)

Factors that affect Nu: strength:

- Negatively charged > neutral >>> positively charged (deprotonated > protonated)
- Within rows Nu: strength decreases going left to right.
- In protic solvents, Nu: strength increases from top to bottom of columns (α -base).
- In polar aprotic solvents, Nu: strength increases bottom to top of columns (as base).
- Resonance stabilization weakens Nu:s.
- Steric hindrance weakens Nu:s.

Factors that affect E+ strength or speed or reaction:

- Steric hindrance weakens E+ for SN2 but not SN1.
- SN2 speed and likelihood of reaction: methyl > 1° > 2° > 3°.
- SN1 speed and likelihood of reaction: 3° > 2° > 1° > methyl.
- Electron withdrawing groups decrease E+ stability (\downarrow SN1, \uparrow SN2).
- Resonance that stabilizes carbocation charge increases stability (\uparrow SN1, \downarrow SN2).
- Electron donating groups in resonance with carbocation stabilize it (\uparrow SN1, \downarrow SN2).
- Vinyl carbocations destabilize the carbocation (\downarrow SN1, \uparrow SN2).
- E+ must be sp³ for either SN1 or SN2.

Factors that affect LGs:

- Weaker bases make the best LGs.