Predicting the most likely path(s) when SN1, SN2, E1 and E2 are possible...
Consider the questions of **focus** (α-carbon or β-proton) and **timing** in all cases

### Bimolecular

Rate = \( k, [\text{electrophile}][\text{nucleophile}] \)

- **Inversion**
- **Substitution**

---

**Note:**

- Inversion product only
- Nucleophile is part of final product

### Unimolecular

Rate = \( k_r, [\text{electrophile}] \)

- **Inversion**
- **Retention**

---

**Note:**

- Inversion and retention product nucleophile is part of final product(s)

---

And you also must consider both reactants to address the most likely outcome(s)

Note that this does not adequately address the idea of experimental design: choosing a skinny nucleophile/base or creating a specific nucleophile (i.e. by deprotonating an alcohol) means that the goal, or desired product(s), must come from substitution

**Nucleophiles**

- **Weak**
- **Weak bases**
- **Strong bases but skinny, small**
- **Big, strong**

<table>
<thead>
<tr>
<th>Electrophiles: α-C is</th>
<th>( ROH, H_2O )</th>
<th>( CH_3CN )</th>
<th>( N_3 )</th>
<th>( P, S, N )</th>
<th>( C=\text{C}-\text{R} )</th>
<th>( OH )</th>
<th>( N )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(^{st}), 0(^{th})</td>
<td>SN?</td>
<td>SN2</td>
<td>SN2</td>
<td>SN2</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2(^{nd})</td>
<td>SN1/E1</td>
<td>SN2</td>
<td>SN2/E2</td>
<td>E2/SN2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3(^{rd})</td>
<td>SN1/E1</td>
<td>SN1</td>
<td>E2/SN1</td>
<td>E2/SN1</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Resonance? how hindered is it?**

- E1 or E2: are there β-H+s to eliminate?

Note that this does not address conditions like solvent (protic solvents speed up unimolecular reaction paths; aprotic solvents speed up bimolecular paths) - weak nucleophiles and/or crowded electrophiles require a protic solvent so a carbocation can form

As the nucleophiles increase in basicity (pKa of conjugate acid \( > 15 \)) and/or size, elimination predominates

- Good
- Bad

Heat can be used to increase elimination products