

# Welcome everyone!

## Today's Experiment Alkyl Halide Substitutions

We will begin at 12:10pm.

Please add your group number to the beginning of your name.

*Use this time to ask questions  
and chat!*

### Nucleophilic Substitution and Elimination Comparisons

CHEM 12A Section 311 Laboratory  
October 7<sup>th</sup>, 2020

#### Definitions

**Bimolecular Nucleophilic Substitution ( $S_N2$ ):** a good nucleophile approaches an electrophile and forms a bond with the electrophilic carbon as the good leaving group bond is breaking

**Unimolecular Nucleophilic Substitution ( $S_N1$ ):** a poor electrophile leaving group bond breaks to form a semi-stable carbocation intermediate that is then attacked by a weak nucleophile to form a new bond

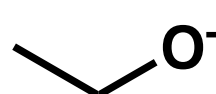
**Bimolecular Elimination ( $E2$ ):** a strong base removes a proton anti-periplanar to a good leaving group as its bond breaks to install a double bond

**Unimolecular Elimination ( $E1$ ):** a weak base removes a proton adjacent to a carbocation carbon after a poor leaving group has left to install a double bond

#### What makes a good nucleophile?

Polarizable, sterically-unhindered, negatively charged species are good nucleophiles.  
Sterically-hindered, neutral species are poor nucleophiles.

Good

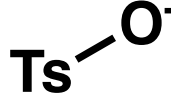
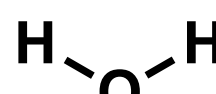


Poor

#### What makes a good leaving group?

Large, polarizable, moderately-electronegative species that can stabilize charge with resonance are good leaving groups.  
Small, highly-electronegative or non-electronegative species that cannot resonate are weak leaving groups.

Good

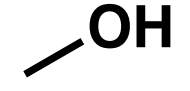
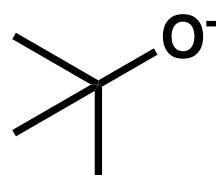


Poor

#### What makes a strong base?

Negatively-charged, moderately electronegative species are good bases.  
Note that all good nucleophiles are strong bases, but not all strong bases are good nucleophiles.

Strong

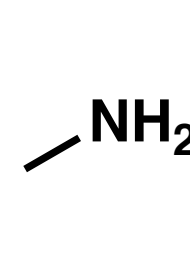
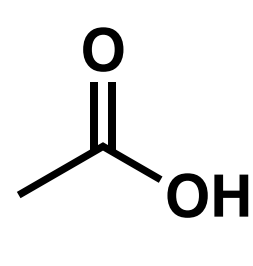
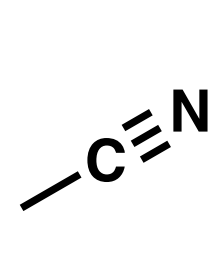
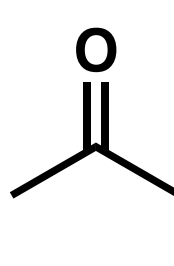
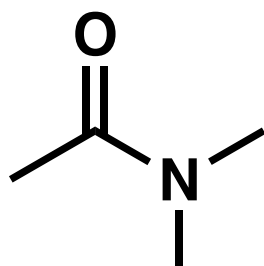


Weak

#### What solvents encourage each reaction?

Polar, aprotic solvents encourage bimolecular reactions by not interfering with the nucleophile.  
Polar, protic solvents encourage unimolecular reactions by stabilizing the leaving group via H-bonding.

Bimolecular



Unimolecular

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