**Organic Chemistry I Lab**

**Week 5: Substitution & Elimination Reactions of Alkyl Halides**

1. For each of the following molecules, put a box around the **nucleophilic** atom(s).



1. For each of the following molecules, circle the **electrophilic** atom(s).



1. For the following molecule:



**a.** Draw both chair conformations and label substituents as axial or equatorial.

**b.** Indicate which conformation is more stable using equilibrium arrows.



**c.** Predict the major product of the reaction with sodium methoxide.



**d.** Predict the major product of the reaction with potassium *tert*-butoxide.



1. Predict the product(s) of the following reactions, including stereochemistry when necessary and identify the mechanism of each substitution reaction (SN1 vs SN2).



1. Predict the product(s) of the following reactions and identify the mechanism of each elimination reaction (E1 vs E2). If multiple products are possible, label each product as major, minor, or very minor.



1. In an organic chemistry lab, chemists were attempting to convert compound **I** into compound **III** via a substitution reaction. To their surprise, compound **II** was the only observed compound after treating compound **I** with cyanide.



**a.** Provide a detailed, stepwise mechanism for the transformation above that accounts for the formation of product **II**. Use the curved arrow formalism to show the flow of electrons. Show all lone pairs, intermediates, formal charges, and pertinent resonance structures.

**b.** Explain why product **II** is formed instead of product **III**. *Use drawings to support your answer*.

**c.** Would you expect compound **II** to be optically active? Briefly explain. Note: The reaction above was run on an enantiomerically pure sample of compound **I**.

