Question 1. Provide the product, reactant, or reagent for four of the following five reactions. Specify stereochemistry wherever appropriate. If you attempt all five, be sure to cross out the one you don’t want me to mark. Otherwise, I will go in order.

A. ![Diagram of a reaction with mCPBA as the reagent]

B. ![Diagram of a reaction with LiHMDS 18-crown-6 as the reagent]

C. ![Diagram of a reaction with LiHMDS 18-crown-6 as the reagent]

D. ![Diagram of a reaction with LDA/Tf₂O, PhB(OH)₂/Pd(PPh₃)₄, Cs₂CO₃/wet DMF as the reagents]

E. ![Diagram of a reaction with PhO-P-N₃ as the reagent]

**Note: Believe it or not, this is not a course on acronyms. If I’ve used an acronym or other abbreviation you don’t know, please ask me and I’ll write it up on the board.**
Question 2. Provide a reasonable mechanism for one out of the following two transformations. If you attempt both, be sure to cross out the one you don’t want me to mark. Otherwise, I will go in order.

A. Organic chemists love named reactions. In fact, some people make a career out of stringing sequences of named reactions together in tandem approaches to complex molecules. Provide a mechanism for this reaction reported by Martin Hiersemann in 2001. You don’t need to include the names of the reactions. You also needn’t worry about stereochemistry.
B. An enantioselective synthesis of tricyclic compounds like 3 was reported this week in the Journal of Organic Chemistry. The synthesis begins from simple starting materials (1 and 2) and proceeds through two metal-mediated transformations, plus a third step that is not metal-catalyzed. (i) Suggest likely metals for steps A and B. (ii) Sketch out a mechanism for the complete transformation. (iii) If the product is produced as a single enantiomer, which step must involve a chiral ligand?
Question 3. Propose a synthesis for one out of the following two compounds. If you attempt both, be sure to cross out the one you don’t want me to mark. Otherwise, I will go in order. Your approach should begin with commercially available reagents. You can assume that you have access to:

(a) simple alkyl, alkenyl or alkynyl reagents with up to 4 carbon atoms, for example:

(b) aryl or heteroaryl molecules with a maximum of 2 substituents, for example:

(c) simple penta- or hexacycles, for example:

(d) other reagents or catalysts that we’ve seen in class.

You will not have access to organotin or organoborane compounds, so you’ll have to make those yourself. Your syntheses can be racemic, but please explain how you will control relative stereochemistry.

A. \[
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\text{N} & \quad \text{N}
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