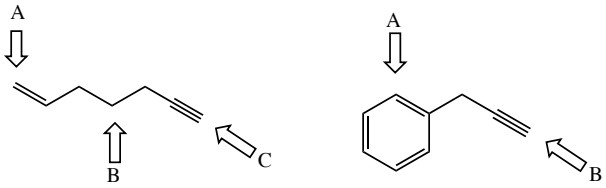
Organometallic Practice Problems

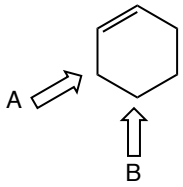
1. For each of the following compounds, draw in all missing hydrogen atoms. At each of the indicated positions, rank the acidities of the hydrogen atoms based on the Orbital part of the ARIO acidity scheme.



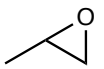
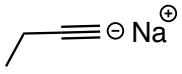
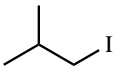
2. According to the ARIO scheme, resonance interactions can greatly stabilize conjugate bases and therefore make protons more acidic. Resonance stabilization of a negative charge on carbon is illustrated below:

A. Complete the structures above by adding in all missing hydrogen atoms and lone pairs. Use curved arrows to interconvert the two resonance forms.

B. Use resonance to explain why the pKa of the protons marked A in the structure below are 35 while those marked B are 60:

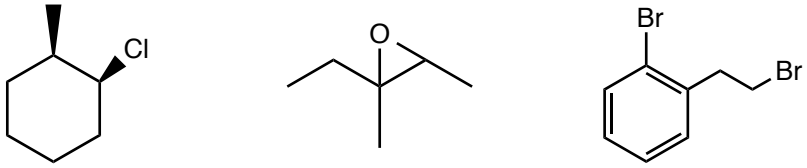


3. Match each of the organometallic compounds below with each of the provided electrophiles (e.g. organometallic 1 with electrophiles A, B, C, D). If a substitution reaction is unlikely between any pair, indicate so. If a substitution reaction is likely, draw the expected major product (assume a neutralization step at the end of the reaction if necessary, and include stereochemistry where required):

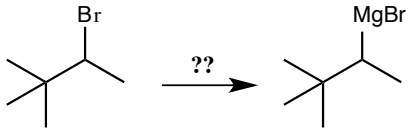
	organometallics		**electrophiles**
1	PhMgBr	**A**	
2		**B**	
3		**C**	MeOTs
4	$(Et)_2CuLi$	**D**	

4. The cyanide ion (CN^{-1}) is a very potent nucleophile. Answer the following questions:

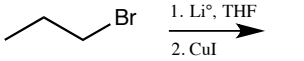
A. Draw the Lewis dot structure for cyanide ion
B. Both the C and the N atoms are potentially nucleophilic since they both have a lone pair of electrons. When cyanide acts as a nucleophile, however, reaction always occurs at the C atom. Explain this observation.
C. Cyanide, therefore, provides yet another nucleophile capable of forming a C–C bond. Provide the product from each of the following electrophiles reacting with cyanide ion in an S_N2 reaction (consider stereochemistry for the first electrophile, and assume neutralization if necessary):

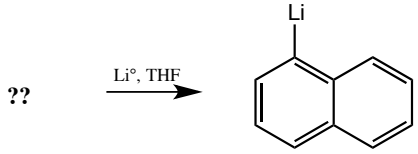


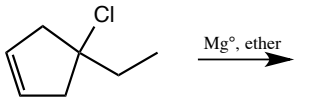
5. Provide the missing component as required for each of the organometallic reactions below:

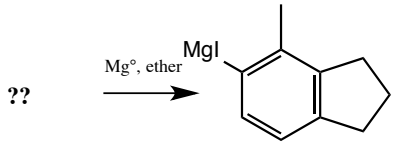
A. 

B. 

C. 

D. 

E. 

F. 

6. For each of the organometallic compounds formed in Question 5, draw the product that would result upon treatment with CH_3OTs.

7. For each of the organometallic compounds formed in Question 5, draw the product that would result upon treatment with ethylene oxide, followed by neutralization with H_3O^+.

ethylene oxide