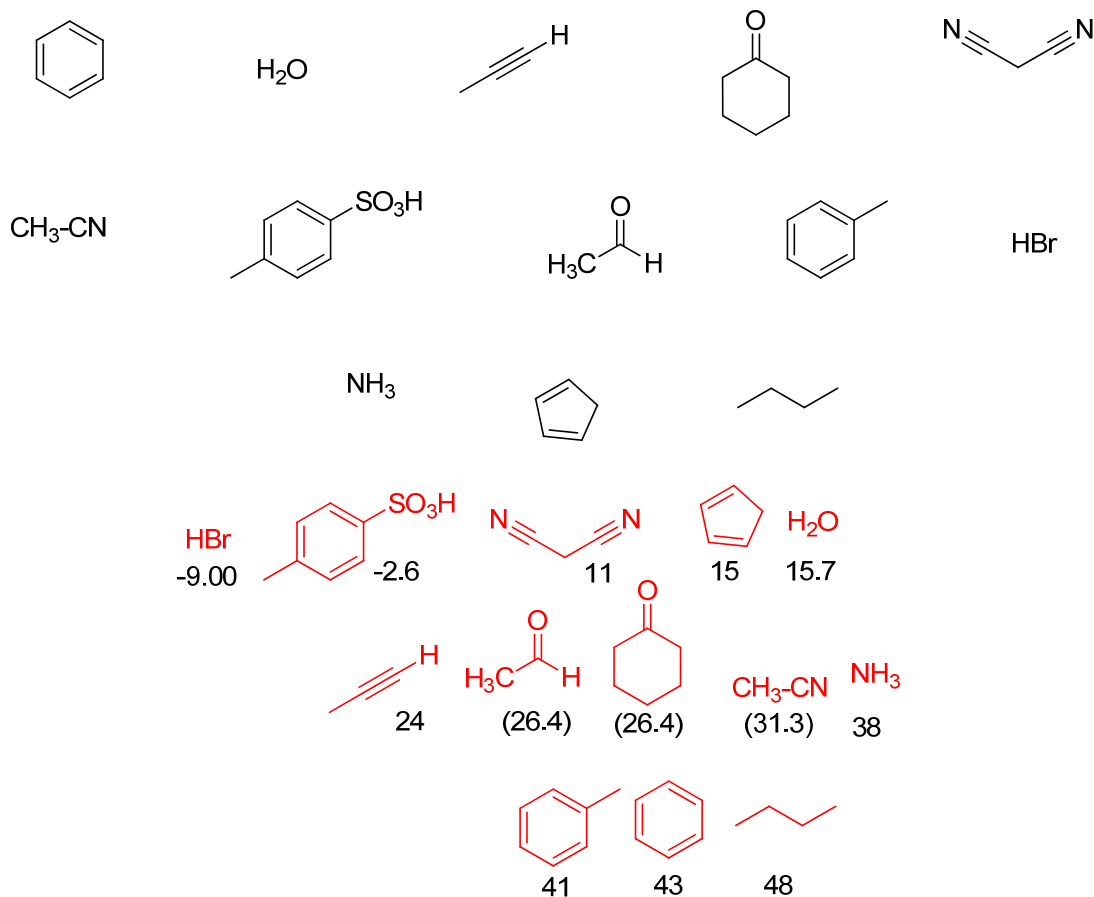


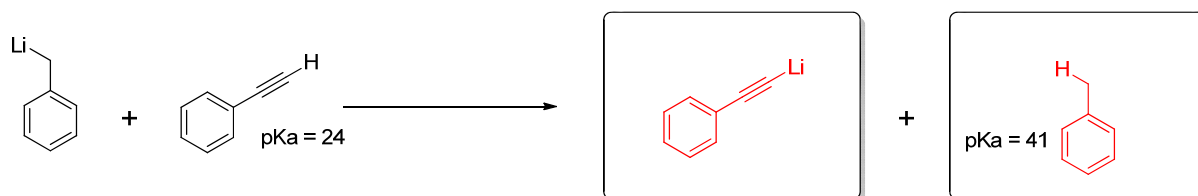


## Problem Set No. 1

1. Sort the following compounds according to their pKa-values:



2. Provide the products and calculate the  $K_{eq}$  for the following reaction and determine the free energy. Indicate whether the reaction is reversible or not. (see [https://webspace.utexas.edu/cc1524/CH318N/pKa\\_Keq.pdf](https://webspace.utexas.edu/cc1524/CH318N/pKa_Keq.pdf)) and (remember  $\Delta G = -RT \ln K_{eq}$ ).



$$K_{eq} = 10^{-(pK_a \text{ starting} - pK_a \text{ product})} = 10^{-(24-41)} = 10^{17} \quad \Delta G = -RT \ln K_{eq} = -8.314 \cdot 298 \ln 10^{17} = 97 \text{ kJ/mol}$$

3. a) Give a mechanistic description of the formation of an organolithium species from lithium metal and provide the term used to describe this process.

**Direct Approach or Direct Synthesis**



- b) What figure of merit can be used to predict if a solvent will be compatible with *n*-BuLi. Give examples of solvents compatible and incompatible.

pKa of most acidic proton on the solvent or whether or not the solvent is electrophilic.

Compatible solvents: diethyl ether, hydrocarbons (pentane, hexane, cyclohexane, heptane).

Stability at low temperature: THF, Toluene

Incompatible: DMF, CH<sub>3</sub>CN, CHCl<sub>3</sub>, CH<sub>2</sub>Cl<sub>2</sub>, EtOAc, EtOH, MeOH, Acetone, DMSO.

The students only need to give two examples of compatible and incompatible

- c) Above -20°C *n*-BuLi reacts with THF (tetrahydrofuran) provide a detailed reaction mechanism and draw all products after hydrolysis.

