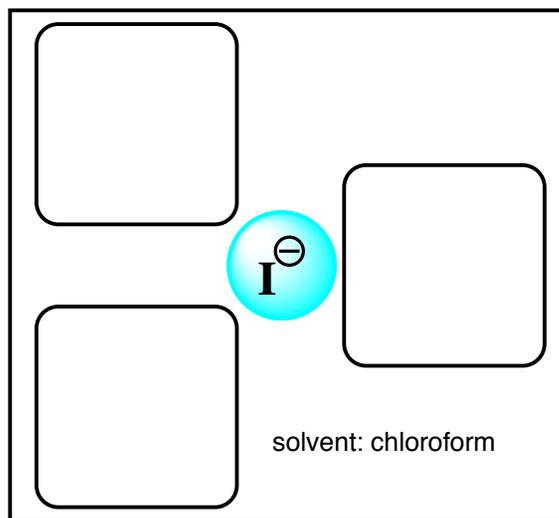
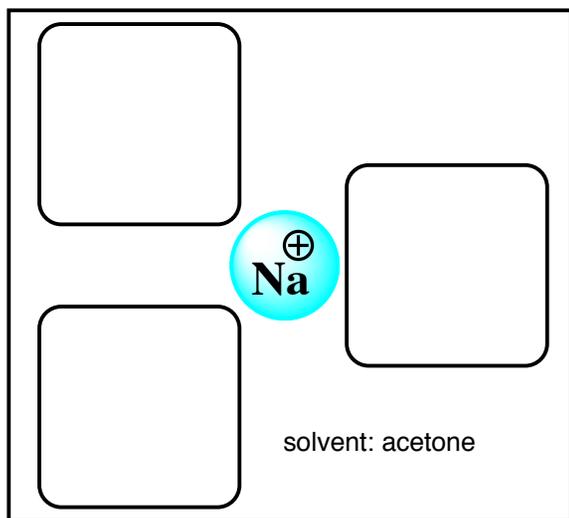


Discussion Problem: Solvation

The role of solvent was ignored in our considerations of charge stability. This is a huge oversimplification. **Solvation energy** contributes significantly to chemical potential, especially when charged species are involved. Let's begin by considering a molecular picture. For neutral solvent molecules and charged solutes, **ion-dipole interactions** are important. In each box, draw a solvent molecule oriented in a way that provides the most favorable ion-dipole interaction.

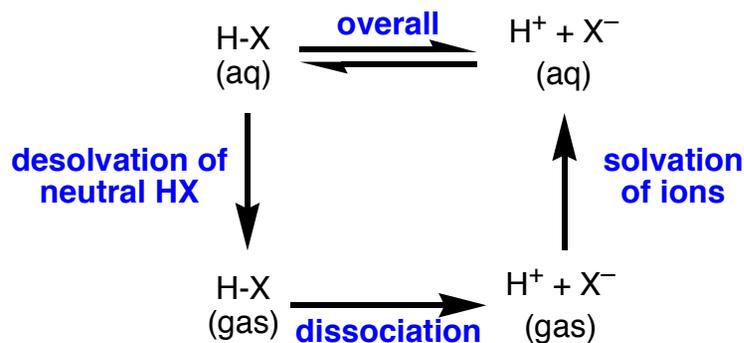


More about solvation: <http://www.cem.msu.edu/~reusch/VirtualText/enrgtop.htm#top4>

Common organic solvents: http://organicdivision.org/organic_solvents.html

The Contribution of Solvation to the Dissociation of HF vs. HI

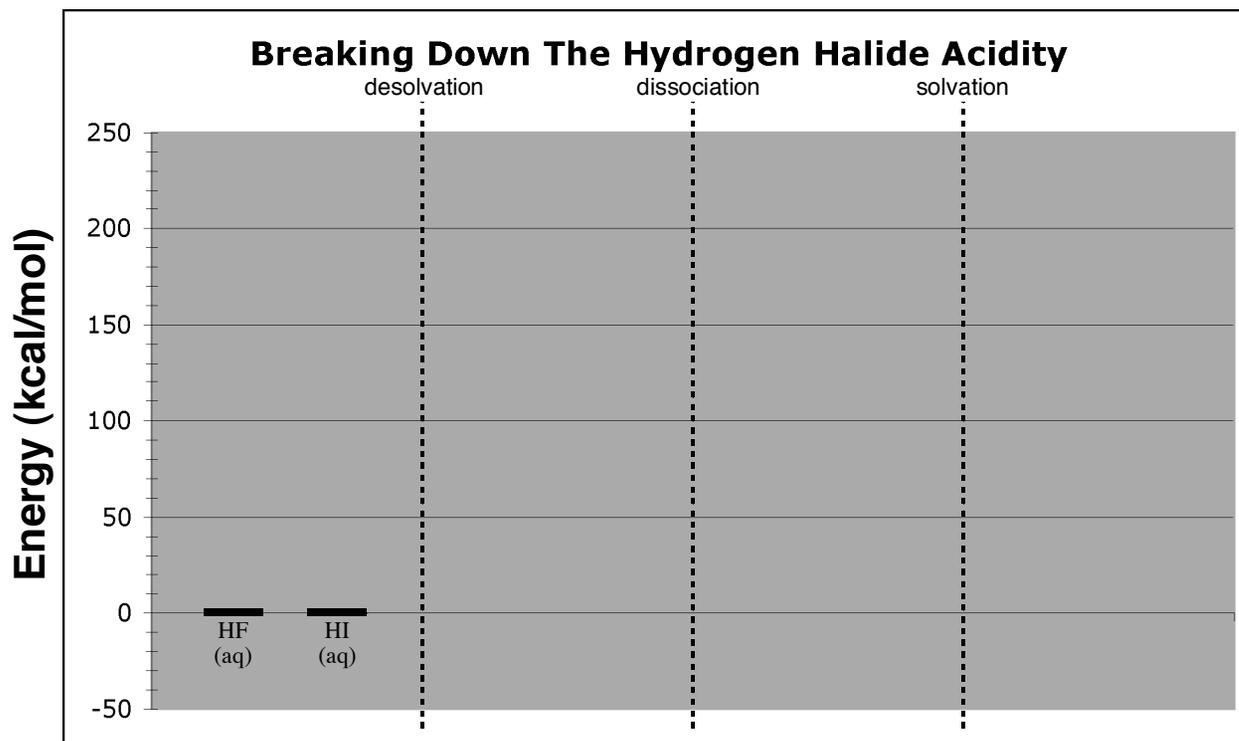
Now consider the behavior of HF and HI. The overall equilibrium can hypothetically be divided into three steps as illustrated in the diagram. Breaking the overall equilibrium into these steps reveals the energy change in solvating neutral molecules and dissociated ions. The table compares these energies for HF and HI.



process	Energy (kcal/mol)	
	H-F	H-I
desolvation	12	-2.5
dissociation	208.5	141.3
solvation	-212	-150.8
overall	8.5	-12

Ref: *J. Am. Chem. Soc.* **1999**, *121*, 3460

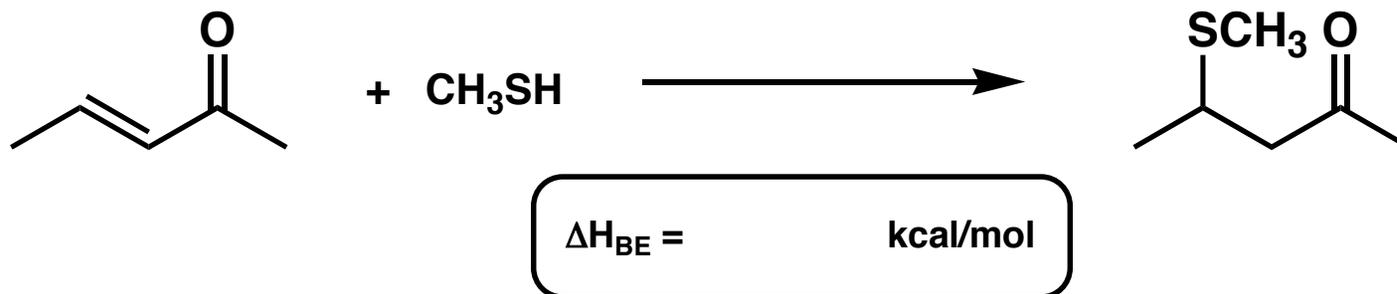
A line representing the state HF (aq) has already been drawn for you. It is initially positioned at zero on the energy scale (consider this a point of reference). Using the information from the table, add horizontal bold lines positioned at the appropriate energy to represent the remaining states: HF (gas), H⁺ + F⁻ (gas), and H⁺ + F⁻ (aq). Draw lines to connect the states and a dashed line to show the overall process: HF (aq) to H⁺ + F⁻ (aq). Repeat the process for HI.



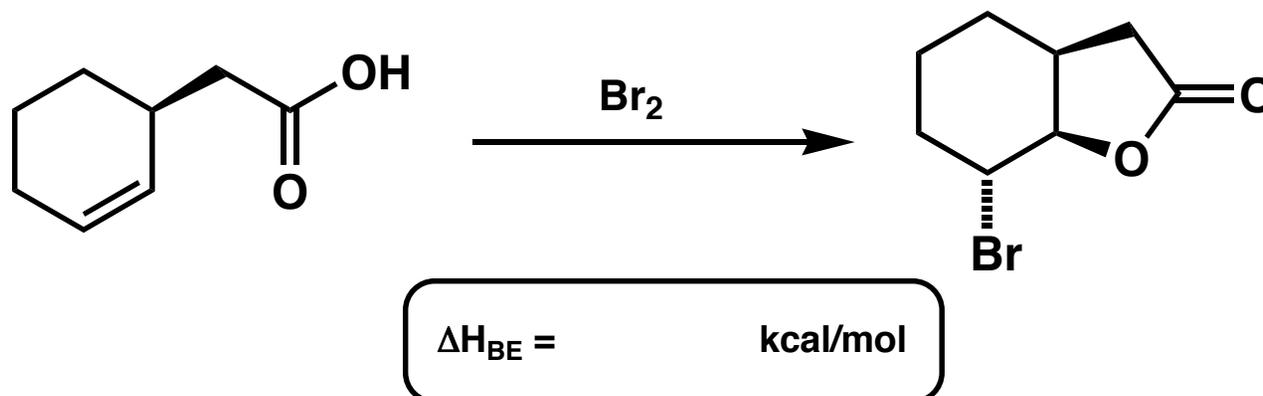
Discussion Problems

Calculate bond energy changes for these reactions (first make sure the stoichiometry is balanced). Determine if the reaction has a favorable enthalpy in the forward direction).

(a)

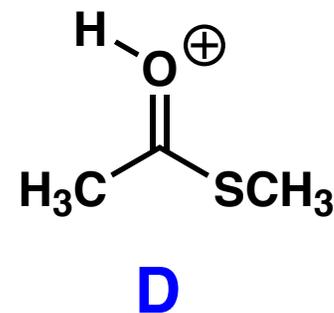
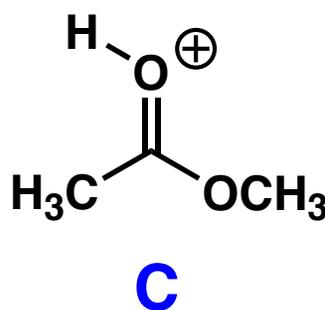
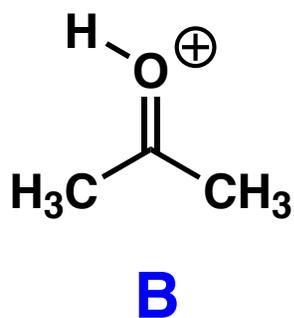
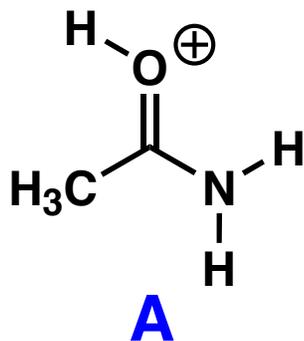


(b)



Discussion Problems

c) Rank these cations from most to least stable.



d) Rank these cations from most to least stable.

