1. The following are commonly used bases among organic chemists. Draw the conjugate acid for each one. For each one, the pKa of the conjugate acid is given in parentheses. Rank all of the bases from weakest to strongest base.

(a) \( \text{N}^+\text{N}^- \) (10.6)  
(b) \( \text{H}_3\text{C}=\text{O}^-\text{Na}^+ \) (15.54)  
(c) \( \text{C}_6\text{H}_4\text{N}^- \) (5.21)  
(d) \( \text{NaH} \) (36)  
(e) \( \text{O}^-\text{K}^+ \) (17)  
(f) \( \text{NaNH}_2 \) (38)  
(g) \( \text{N}^+\text{N}^- \) (36)  
(h) \( \text{Li}^+\text{Li^-} \) (50)

2. Choose an appropriate base from those in question 1 to deprotonate the most acidic proton in each of the following compounds (you probably will need to consult a pKa table). For each one, draw the mechanism of the reaction and the product.

(a) \( \text{C}_7\text{H}_{12}\text{OH} \)  
(b) \( \text{C}_5\text{H}_{10}\text{O} \)  
(c) \( \text{C}_7\text{H}_{12}\text{O} \)  
(d) \( \text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2 \)  
(e) \( \text{C}_10\text{H}_{12} \)  
(f) \( \text{C}_2\text{H}_4 \)  
(g) \( \text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{OH} \)  
(h) \( \text{C}_5\text{H}_{10}\text{O}_2\text{H} \)  
(i) \( \text{C}_6\text{H}_{11}\text{F}_2\text{O}_2\text{H} \)
3. Amines can be EITHER bases or acids. Draw a reaction in which methyl amine (CH$_3$NH$_2$) acts as a base, and a second reaction in which it acts as an acid. Which is a stronger acid, a protonated amine or a neutral amine? Which is a stronger base, a deprotonated amine or a neutral amine?

4. Follow the curved arrows to give the product(s) of the following reactions. For parts a-c, label the species on the left of the arrow as Brønsted-Lowry acid or base, nucleophile, or electrophile.

5. Propose a mechanism for each step of the following reactions:

(a) 

(b) 

(c) 

(d) 

(e) 

(f)