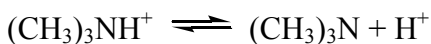


Chem 141 Problem Set 3

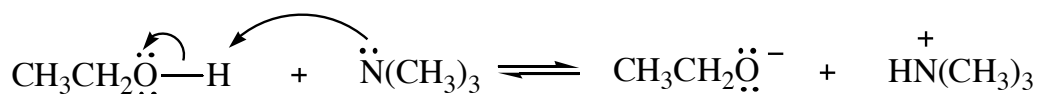
Friday 26th September 2008

This problem set covers material to the end of Chapter 2 in McMurry.

- 1a. Write acid dissociation reactions of the form $\text{HA} \rightleftharpoons \text{H}^+ + \text{A}^-$ for $\text{CH}_3\text{CH}_2\text{OH}$ (ethanol) and for $(\text{CH}_3)_3\text{NH}^+$ (trimethylammonium ion)



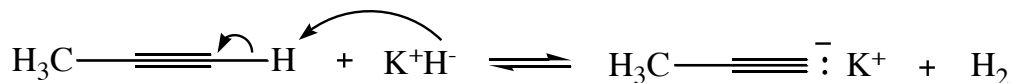
- b. Draw curved arrows to show the chemical reaction and predict the products for the reaction of ethanol with trimethylamine $(\text{CH}_3)_3\text{N}$:



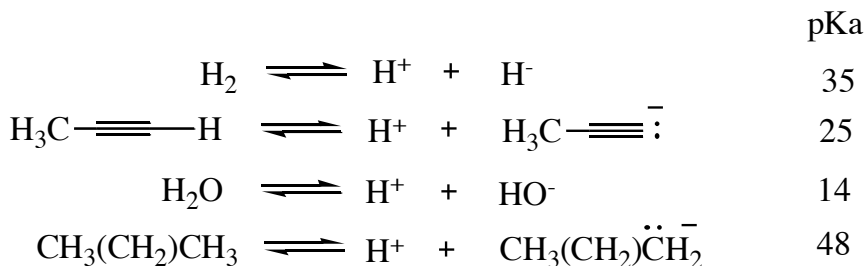
- c. If the pKa of ethanol is 15, and the pKa of trimethylammonium ion is 11, which side of the reaction is favored and by how much?

The proton will favor the stronger base (ethoxide), so the left hand side is favored by a factor of 10,000.

- 2a. Use curved arrows to predict the products of the following reaction:

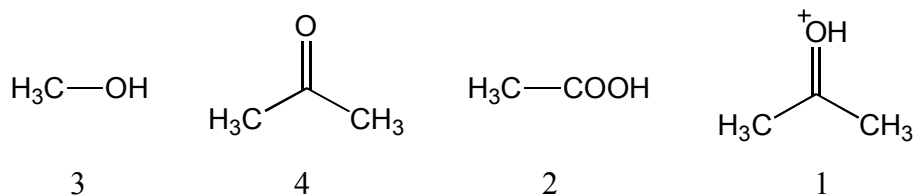


- b. The pKa's for propyne and hydrogen are 25 and 35 respectively. Predict the favored products of the reaction (i) in hexane, and (ii) in water.

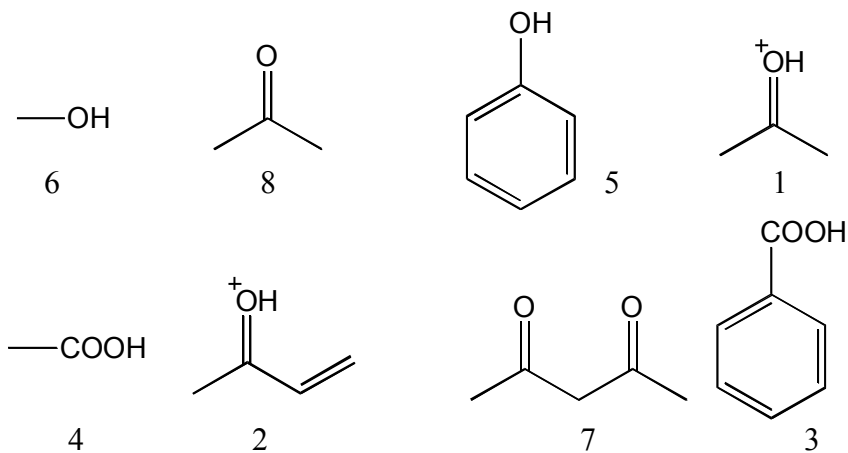


- (i) in hexane the reaction will give the products shown in 2a.
(ii) in water the KH will react with H_2O to give KOH and H_2 .

3. Rank the following acids strongest to weakest



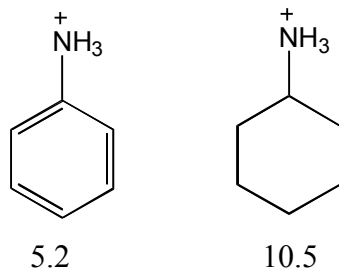
4. Rank the following acids strongest to weakest



5. Which of the acids in Q. 4 will react with sodium hydrogen carbonate, NaHCO_3 ?
The pK_a of carbonic acid, H_2CO_3 , is 6.4.

1, 2, 3 and 4

6. Consider these conjugate acids and their pK_a 's:



Which is the stronger base, $\text{C}_6\text{H}_5\text{NH}_2$, or $\text{C}_6\text{H}_{11}\text{NH}_2$, and why?

You can draw 4 resonance forms for $\text{C}_6\text{H}_5\text{NH}_2$ and none for $\text{C}_6\text{H}_{11}\text{NH}_2$. $\text{C}_6\text{H}_5\text{NH}_2$ is therefore the weaker base. Resonance forms delocalize the negative charge, so the bond to H^+ is weaker and the conjugate acid is stronger.