

## Recitation Week 4

2/6/13

1. What are the characteristic absorbances in the infrared spectra of the following types of compound? You should discuss the frequency, intensity and broadness of each absorbance.

(a) alkanes

(b) ketones

(c) terminal alkynes (compounds with a  $\text{=C-H}$  bond)

(d) alcohols

(e) carboxylic acids

2. What is the conjugate base of each of these?

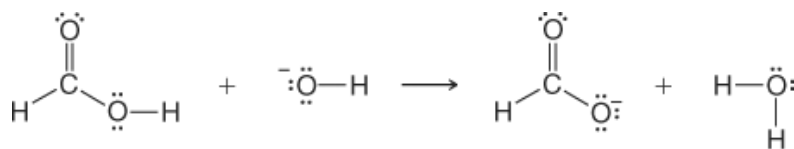
(a)  $\text{HNO}_3$ (b)  $\text{CH}_3\text{CH}_2\text{OH}$ (c)  $\text{CH}_3\text{CH}_2\text{COOH}$ 

3. What is the conjugate acid of each of these?

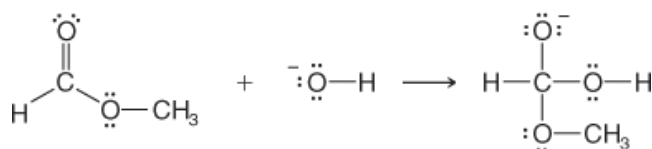
(a)  $\text{H}_2\text{PO}_4^-$ (b)  $(\text{CH}_3)_2\text{NH}$ (c)  $\text{CH}_3\text{C}\equiv\text{C}^-$ 

4. Draw curved arrows to show the electron flow in these reactions:

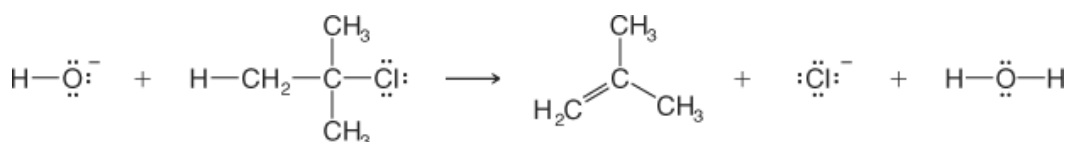
(a)



(b)

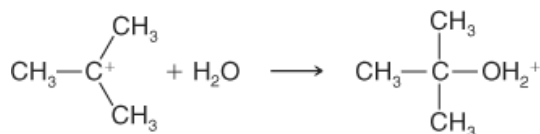


(c)

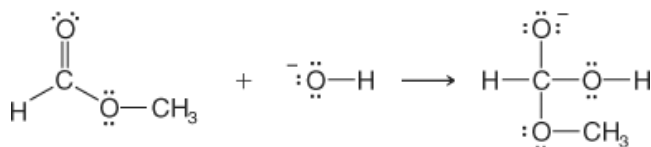


5. For these reactions, identify the electrophile and the nucleophile, and (if appropriate) the Lewis acid and base.

(a)



(b)



6. Rank each set of molecules by their acidity.

(a)  $\text{C}_6\text{H}_5\text{OH}$  ( $\text{p}K_{\text{a}} = 9.9$ ),  $\text{CH}_3\text{OCH}_3$  ( $\text{p}K_{\text{a}} = 19.2$ ),  $\text{H}_2\text{SO}_4$  ( $\text{p}K_{\text{a}} = -9$ )

(b)  $\text{CH}_3\text{OH}$ ,  $\text{CH}_3\text{SH}$

(c)  $\text{CH}_3\text{CH}_3$ ,  $\text{CH}_3\text{NH}_2$ ,  $\text{CH}_3\text{OH}$

(d)  $\text{CH}_3\text{CH}_3$ ,  $\text{CH}_2=\text{CH}_2$ ,  $\text{CH}\equiv\text{CH}$

(e)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$ ,  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ ,

(f)  $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{CHFOH}$ ,  $\text{CH}_2\text{BrCH}_2\text{OH}$ ,  $\text{CH}_3\text{CHBrOH}$ ,  $\text{CH}_3\text{CHClOH}$

7. For these equilibria, would the reactants or products be favored?

(a)  $\text{CH}_3\text{CH}_2\text{OH} + \text{CH}_3\text{CO}_2^- \rightleftharpoons \text{CH}_3\text{CH}_2\text{O}^- + \text{CH}_3\text{CO}_2\text{H}$

(b)  $\text{CF}_3\text{CO}_2\text{H} + \text{CH}_3\text{NH}_2 \rightleftharpoons \text{CF}_3\text{CO}_2^- + \text{CH}_3\text{NH}_3^+$   
 $\text{p}K_{\text{a}} = 0.18$   $\text{p}K_{\text{a}} = 10.6$

8. What would be the products of the following reaction if it was performed (a) in aqueous solution (b) in liquid ammonia.

