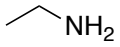
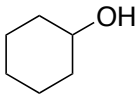
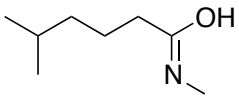
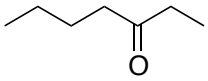
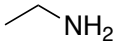
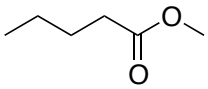
ACID/BASE CHEMISTRY

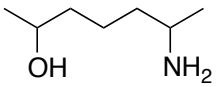
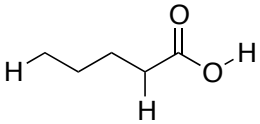
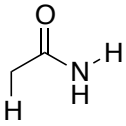
Learning Objective-Based Activities

You should be able to:

1) Deprotonate a given molecule.
   a. 
   b. 
   c. 

2) Protonate a given molecule.
   a. 
   b. 
   c. 

3) Given a molecule:
   a. Identify the most acidic proton.
   b. Identify the most basic atom.
   c. Draw its conjugate acid and conjugate base (as appropriate).

   i. 
   ii. 
   iii. 

4) Given two bases, determine the stronger of the two using pK_as or relative base stabilities (as appropriate or as stated in the question).

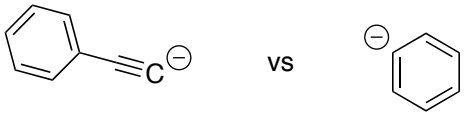
a.

b.

c.

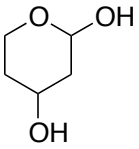
$CF_3CO_2^-$ versus $C_6H_5CO_2^-$

d.

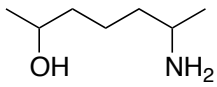


5) Given two acids, determine the stronger of the two using pK_as or relative base stabilities (as appropriate or as stated in the question).

a.



b.

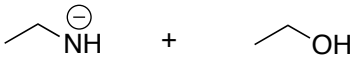


c.

6) Given the starting materials:

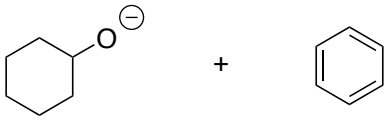
a. Draw the mechanism and products of an acid/base reaction.
b. Identify the acid, base, conjugate acid, conjugate base.
c. Predict the direction of an acid/base equilibrium using pK_as or relative base stabilities (as appropriate or as stated in the question).

i.



ii.

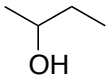
iii.



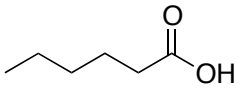
7) Given a molecule:
    a. Draw (or select from a list) a base that could quantitatively deprotonate the acid (i.e., identify a base that could drive the equilibrium towards products).
    b. Draw (or select from a list) an acid that could quantitatively protonate the base (i.e., identify an acid that could drive the equilibrium towards products).
    c. Identify the predominant form of the compound at a given pH (acid/conjugate base form).

i.

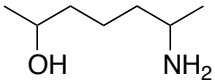
ii.



iii.



iv.



Note: memorizing periodic trends and citing them is not sufficient (nor is citing a key factor/word, such as resonance, without an explanation of *how* that factor affects the stability of a species).

How to do this:

Acid/base chemistry always comes back to a few basic principles.

1. You can **compare pK_as of acidic protons**

2. You can **compare the stabilities of bases** using one of the following factors:
   - Electronegativity (two basic atoms in the same row)
   - Atom size (two basic atoms in the same column)
   - Inductive effects
   - Resonance
   - Hybridization
   - Degree of substitution (alkyl groups are electron-donating and therefore destabilize anions).
   - Solvent effects (e.g., protic solvents can stabilize anions and cations through hydrogen-bonding and dipole/ion-dipole interactions, while aprotic solvents can only stabilize cations).

Note: the last two effects were not covered (read: you are not responsible for these in 1321).

Sometimes both methods will work; other times you can only use one of the two methods. See class notes for more details.