Week 1 & 2 Worksheet

Topics Covered:

Chapter 1
- Structure and bonding
- Hybridization
- Resonance Structures
- Isomers
- Molecular Shape

Chapter 2
- Conjugate acids and bases
- pKa and acid strength
- Factors Influencing acid strength
- Predicting acid-base reactions

1. (6th edition, 1.75) Anacin is an over-the-counter pain reliever that contains aspirin and caffeine. Answer the following questions about each compound.

![Chemical structures of aspirin and caffeine](image)

a) What's the molecular formula?

b) How many lone pairs are present on heteroatoms?
c) Label the hybridization state of each carbon.


d) Draw three additional resonance structures.

2. (6th edition, 1.79)

Use the molecule below to answer parts a through f.

![Molecule Image]

a) What is the hybridization of each N atom?
b) What is the electron geometry around each N atom?

c) What is the molecular geometry around each N atom?

d) In what type of orbital does the lone pair on each N atom reside?

e) Draw a constitutional isomer of the molecule above.

f) Draw a resonance structure of the molecule above.

3. (6th edition, 2.58)
a) What is the conjugate acid of A?

b) What is the conjugate base of A?

4. (2.48)

Which of the following bases are strong enough to deprotonate C₆H₅OH (pKₐ = 10) so the equilibrium favors the products:
(a) H₂O ; (b) NaOH ; (c) NaNH₂ ; (d) CH₃NH₂ ; (e) NaHCO₃ ; (f) NaSH ; (g) NaH ?

5. (6th edition, 2.65)

Label the three most acidic hydrogen atoms in lactic acid, CH₃CH(OH)CO₂H, and rank them in order of decreasing acidity. Explain your reasoning.
Amino acids such as glycine are the building blocks of large molecules called proteins that give structure to muscle, tendon, hair, and nails.

a) Explain why glycine does not actually exist in the form with all atoms uncharged, but actually exists as a salt called a zwitterion.

b) What product is formed when glycine is treated with concentrated HCl?

c) What product is formed when glycine is treated with NaOH?