CHEM 232 Worksheet
Acid Base

1. Define a Brønsted acid.
   Proton donor

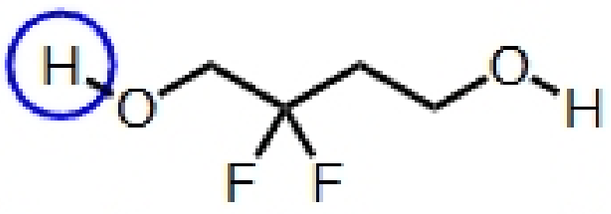
2. Define a Brønsted base.
   Proton acceptor

3. Rank the following molecules from most basic to least basic.

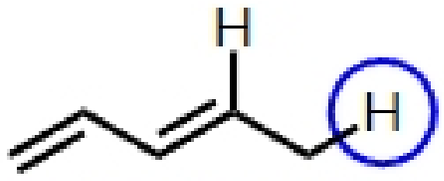
most basic ⊖NH_2 ⊖OH NH_3 H_2O least basic

4. For the following molecules, consider the hydrogen atoms (protons) explicitly shown. Circle the more acidic hydrogen atom, and state the effect responsible for making that proton more acidic: atom effect (electronegativity, size, bond strength), resonance, inductive effect, or orbital effect.

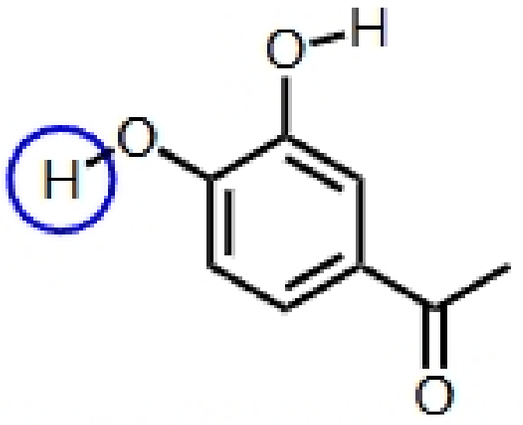
atom effect: sulfur is larger than oxygen and the H-S bond will be weaker than the H-O bond.



inductive effect: the OH group on the left is closer to the two F atoms.

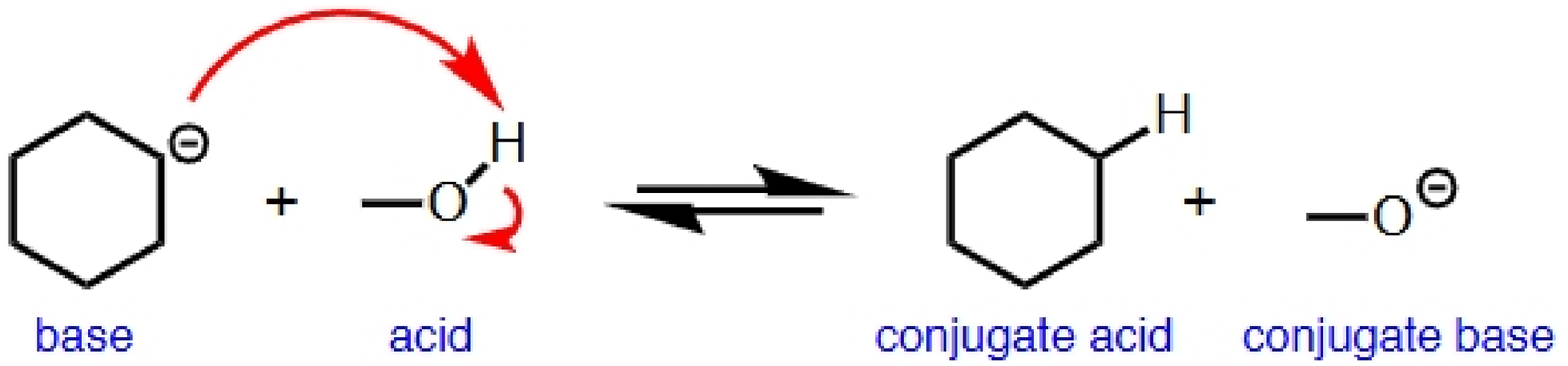


resonance: after the circled proton is removed, the negative charge will be delocalized over the whole molecule. The other proton will not result in a delocalized negative charge since the sp^2 orbital the lone pair sits in is perpendicular to the pi system.

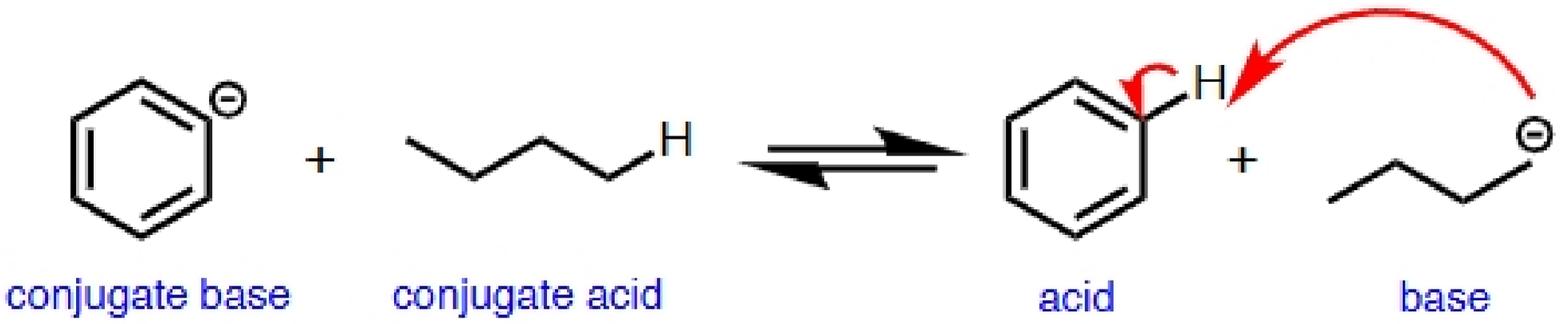


resonance: when the circled hydrogen atom is removed, the negative charge is delocalized over the ring and the C=O bond. The negative charge generated when the other hydrogen atom is removed is restricted to the ring.

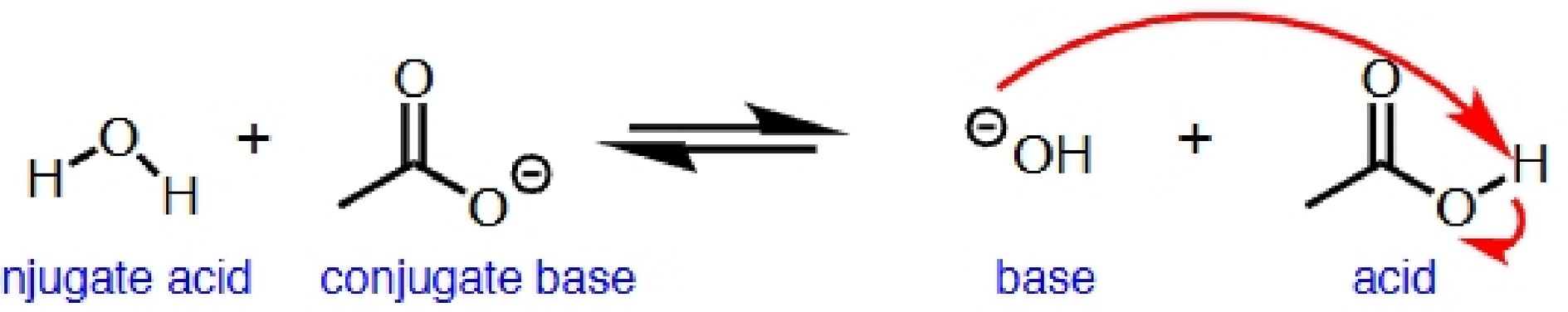
5. For the reactions shown below.
    a. Identify the strongest acid. Label it "acid."
    b. Based on your answer to part a, label the other molecules in the scheme "base," "conjugate acid," or "conjugate base."
    c. Which side of the reaction (right or left) is favored?
    d. Draw the arrow-pushing mechanism for the transfer of the proton from the "acid" to the "base."
    e. State the effect you used to decide which molecule is most acidic: atom effect (electronegativity, size, bond strength), resonance, inductive effect, or orbital effect.



Right side is favored.
Atom effect: Oxygen is more electronegative than carbon and will better stabilize the negative charge. Therefore the negative charge on oxygen will give the more stable conjugate base.



Left side is favored.
Orbital effect: An sp^2 orbital is lower in energy than an sp^3 orbital. Therefore having the negative charge in an sp^2 orbital will generate the more stable conjugate base.



Left side is favored.
Resonance: In both cases, the negative charge sits on an oxygen atom. However, resonance with the C=O bond will generate a mores stable conjugate base.