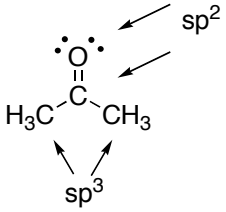
CHE 171
Fall, 2005
Exam 1 Answer Key

Name_____

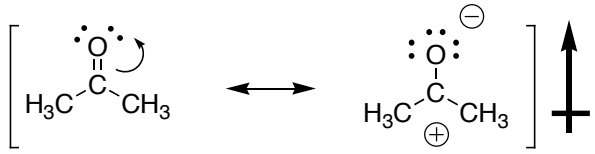
Section: **101** **102** **103**
M W F
(circle one)

1. Acetone is a polar organic compound with molecular formula C_3H_6O and a **KETONE** functional group. (35 pts total)

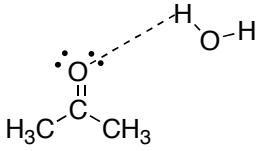
   (a) Draw a Lewis structure for this molecule. (5 pts)



   (b) Show a resonance structure that accounts for acetone's polarity. (5 pts)

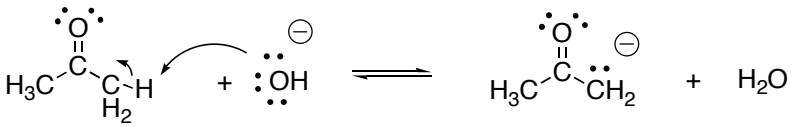


   (c) Would you predict that acetone is soluble in water? Explain. (5 pts)
   Acetone is a polar organic compound with one electronegative heteroatom to three carbon atoms; it is also capable of forming H-bonds with water. Both of these factors make acetone water soluble.

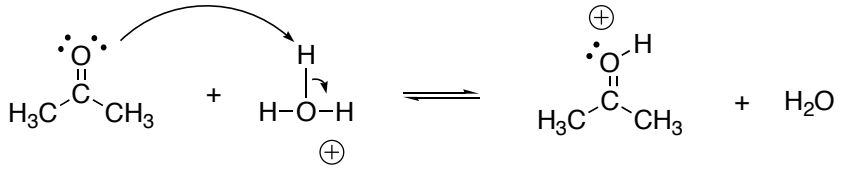


   (d) What is the hybridization of each of acetone's carbon atoms and oxygen atom? Label these in your original Lewis structure above. (4 pts)

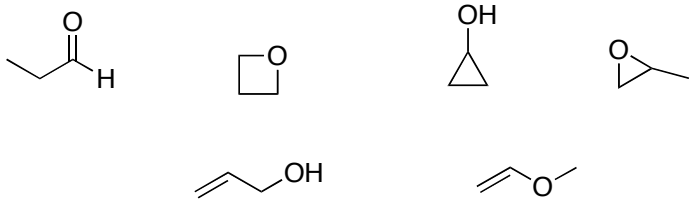
   (e) Write an equation for the equilibrium reaction of acetone with hydroxide ion (HO^-, a strong base). Use curved arrows to show electron flow. (5 pts)



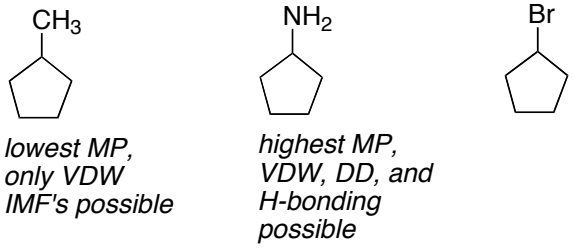
(f) Write an equation for the equilibrium reaction of acetone with hydronium ion (H_3O^+, a strong acid). Use curved arrows to show electron flow. (5 pts)



(g) Draw three additional structures (constitutional isomers) with molecular formula C_3H_6O. (6 pts) *Here are a few:*

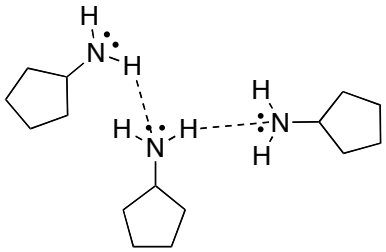


2. Which of the compounds shown below has the highest melting point? Which has the lowest melting point? Explain or illustrate. (10 pts) *(See Smith 3.23 c)*

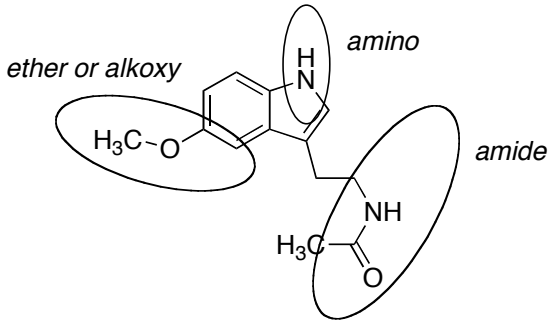


lowest MP, only VDW IMF's possible

highest MP, VDW, DD, and H-bonding possible

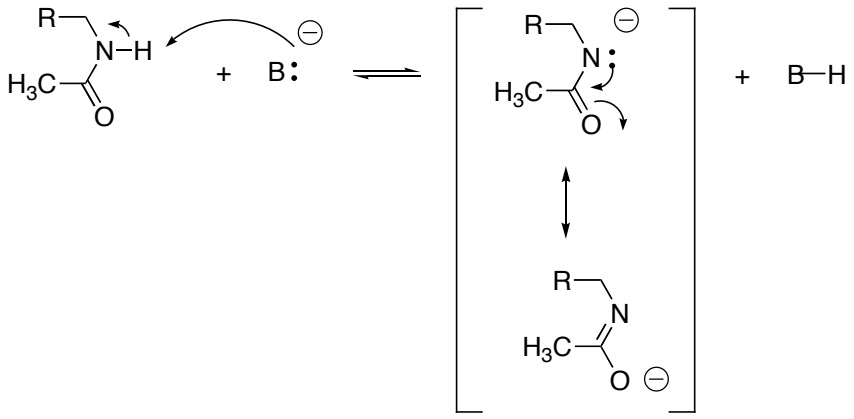


3. Melatonin, shown below, is a hormone thought to induce sleep. *(See Smith 3.14b)*



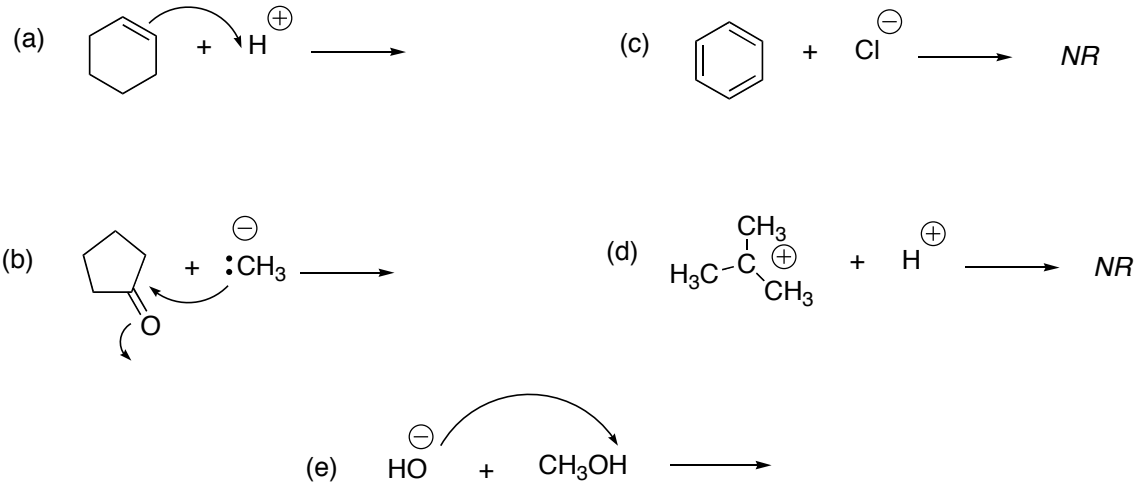
(a) Identify the functional groups present in melatonin by circling and labeling them in the structure above. (6 pts)

(b) Which is the most acidic proton in melatonin? Explain. (4 pts)
The amide proton is most acidic. The corresponding conjugate base is resonance stabilized:

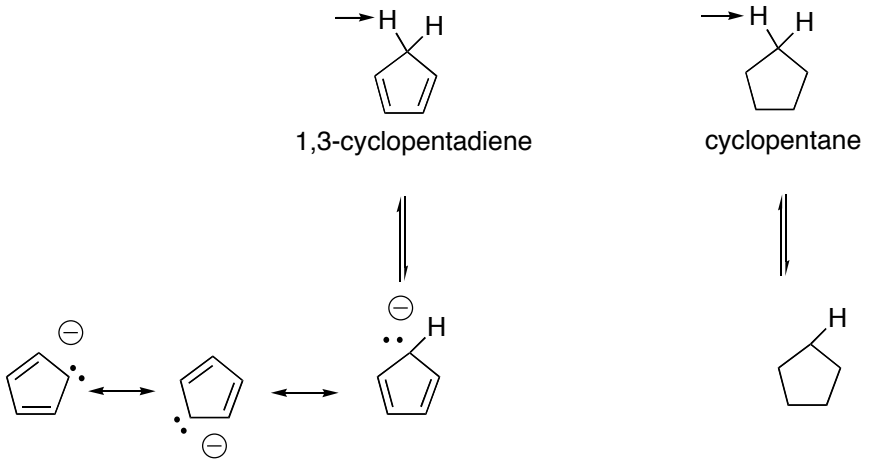


(c) Would you expect melatonin to be soluble in water? Why or why not? (5 pts) *Yes, melatonin should be water-soluble. It's a polar organic compound with 4 electronegative atoms to 13 carbon atoms. Plus, there are many sites for H-bonding.*

4. By using electron density arguments, determine whether the following reactions will occur. If yes, show electron flow using curved arrows. If no, write "NR" for no reaction. You do not need to show product(s). (15 pts)

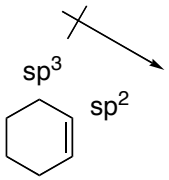


5. The indicated hydrogen in 1,3-cyclopentadiene is more acidic than the indicated hydrogen in cyclopentane. Show the conjugate bases for each of these compounds and explain the relative difference in acidity. (10 pts)



1,3-cyclopentadiene is much more acidic because its conjugate base is much more stable due to resonance delocalization.

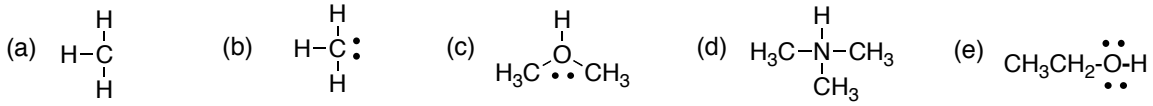
6. When two carbons having different hybridization are bonded together, the C-C bond contains a slight dipole. What is the direction of the dipole for the indicated bond in the molecule shown below? Explain. (5 pts)



7. Which is the stronger base, iodide ion (I^-) or fluoride ion (F^-)? Explain. (5 pts)

HF is a weaker acid than HI, so F^- is a stronger base. Basicity increases going down a column in the periodic table.

8. Calculate the formal charge on the atoms indicated in the Lewis structures shown below. (5 pts)



C = +1 C = -1 O = +1 N = +1 O = 0