

Midterm 1

You may **not** use model sets or other aids, including electronic devices, notes, etc.

Answer clearly with neat figures, which are necessary to ascertain whether you know the correct answer. You can use the reverse side of the page as scratch, but specify the answer you would like to have graded.

For mechanism problems, show all elementary steps including proton transfers.

Time allowed: 50 minutes.

Please make sure you have all **4** pages of this midterm including the coverpage. *Good luck!*

Problem	Score
1	
2	
3	
4	
5	
Bonus	
Total	KEY


Your signature below indicates that you agree to abide by all U.C. Irvine regulations concerning academic honesty. Your exam will not be graded unless this section is completed. A substantial point penalty will be assessed for a late-signature regrade.

Signature: _____

Seat Number: KEY _____

1. (14 pts) Please fill-in the following blanks with the correct word or phrase.

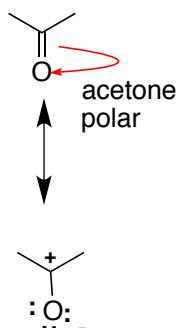
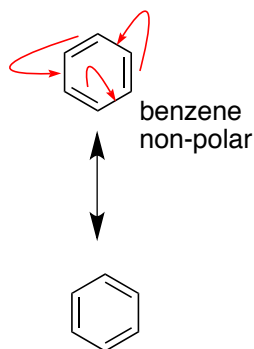
The boiling points of organic compound depend on strengths of non-covalent interactions (between molecules = optional).

An example of an arrow used to indicate chemical equilibrium:  _____.

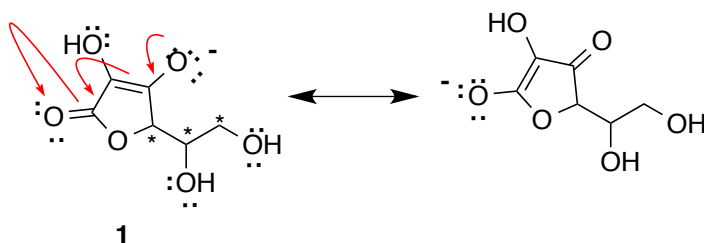
The net dipole _____ indicates the polarity of an organic compound.

Double-head, curved mechanistic arrows must begin on a lone pair _____ or bond _____, and end on an atom _____ or bond _____.

2. (15 pts.) Label each of the following molecules with their common names (not IUPAC nomenclature). Draw a major resonance structure for each, and label each as polar or non-polar.



3. (31 pts) Please answer the following questions about the conjugate base of vitamin C, molecule (1), shown below.



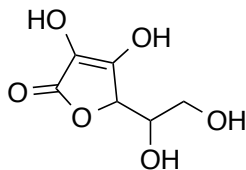
3A. Add lone pairs, and label all formal charges to the molecule above.

3B. To the right of the molecule above, draw a resonance arrow and then a major resonance structure. Use curly arrows to show the movement of electrons to your resonance structures from left to right. Label formal charge in the resonance structure.

3C. What is the **molecular formula** of molecule 1? C₆H₇O₆

3D. Put a star next to all sp³ hybridized carbons in the left resonance structure for molecule 1.

3E. Draw the structure of product after compound 1 is treated with a strong acid.



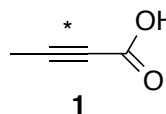
3F. According to the rules of solubility presented in lecture and the textbook, will molecule 1 **dissolve in water** (circle one)?

YES NO

3G. Which **functional group(s)** are present in molecule 1 (circle one) ?

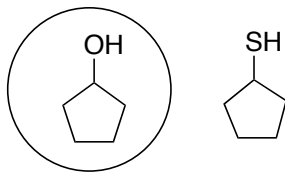
a. carboxylic acid b. ketone c. ester d. ether e. ketone and ether f. ketone, ester, and ether

3H. Put a star next to the shortest bond in the following molecule 1.



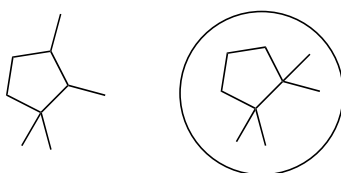
4. (30 pts)

4A. Circle compound with the higher boiling point, and concisely explain your answer with one complete sentence.



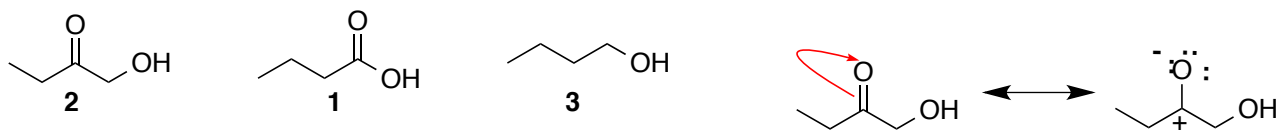
The alcohol (compound on the left) forms stronger hydrogen bonds than the thiol (compound on the right).

4B. Circle the molecule with the higher melting point, and concisely explain your answer with one complete sentence.



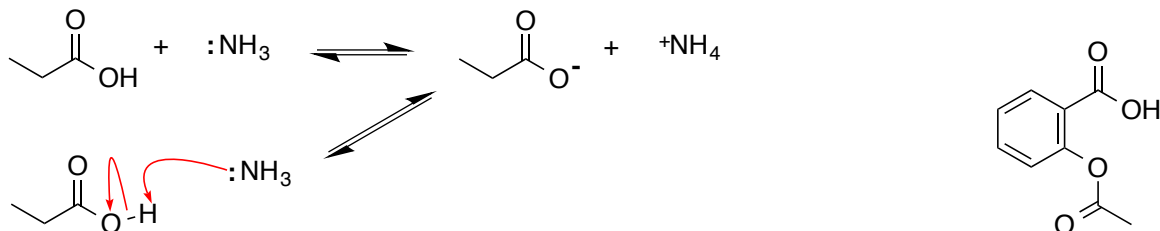
The molecule on the right is more symmetrical and compact; thus, the right molecule forms stronger packing interactions with other identical molecules, resulting in a higher melting temperature.

4C. Rank the following compounds from the lowest pK_a (1) to the highest pK_a (3), and concisely explain your answer, including a relevant resonance structure and complete sentence.



Compound ranked 1 has a conjugate base stabilized by resonance; compound 2 has an electron withdrawing ketone with a resonance structure shown that can inductively pull electrons away from the conjugate base; compound ranked 3 lacks both of these things.

5. (12 pts). Predict the product of the following reaction, and draw an arrow-pushing mechanism to justify its formation.



Bonus (2 pts, no partial credit): What is the structure of aspirin? (above)