

Please print:

Last name: Answer key

First name: _____

Chem 2061 Exam 1

Fall 2005

Andy Aspaas, Instructor

Wednesday, September 14, 2005

Instructions:

Time: You have 55 minutes to complete this exam.

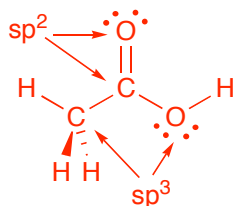
You may use a model kit for this exam.

I, _____ have read and understand the directions given above, and pledge that I will follow all regulations with regard to Academic Dishonesty as outlined by this college when taking this exam.

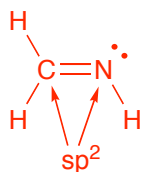
Signature _____ Date and Time _____

1. Draw 3-dimensional Lewis structures with the correct geometry and all lone pairs for the following neutral molecules, and indicate the hybridization of every atom that contains hybrid orbitals. (No need to draw σ or π bonds)

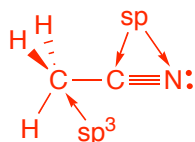
a. Acetic acid, CH_3COOH



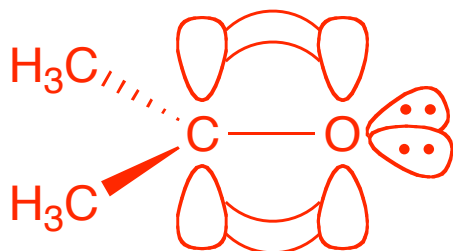
b. CH_2NH



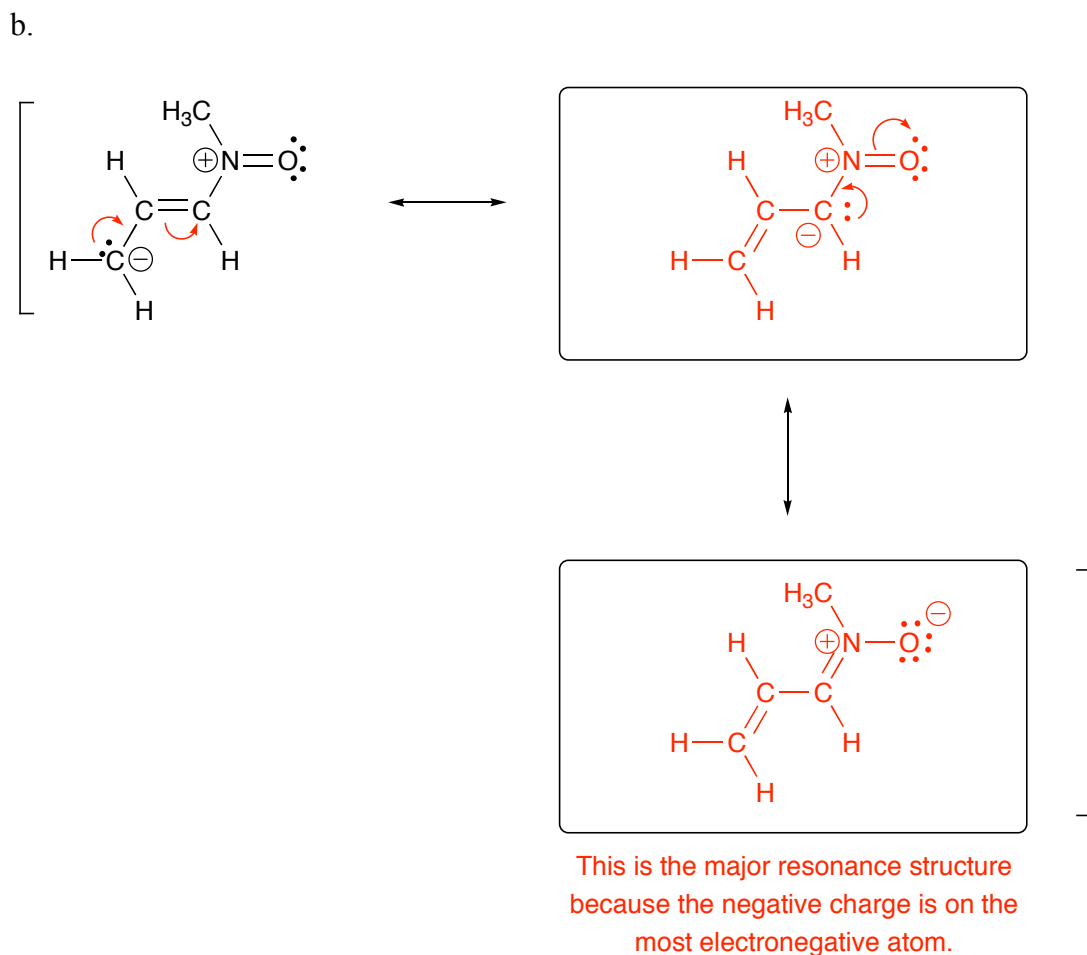
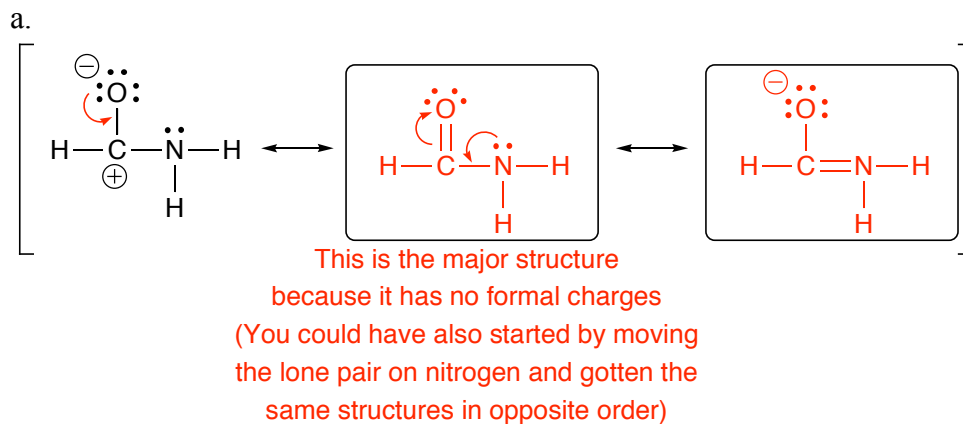
c. CH_3CN



2. Draw a 3-dimensional orbital diagram of acetone, $(\text{CH}_3)_2\text{CO}$, with the π bond in the plane of the paper. You may use lines, dashes, or wedges for the σ bonds but carefully draw the π bond and correctly show the geometry of the molecule. The methyl groups may simply be drawn as CH_3 .

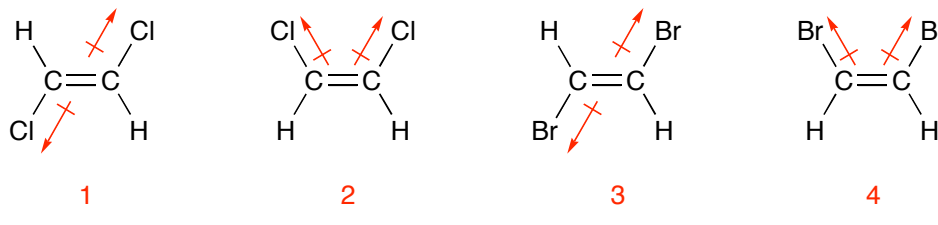


3. For each of the given structures, draw two other resonance structures, and use curved arrows to indicate the motion of the electrons from one structure to the next. Indicate the major contributor(s) and briefly explain why.



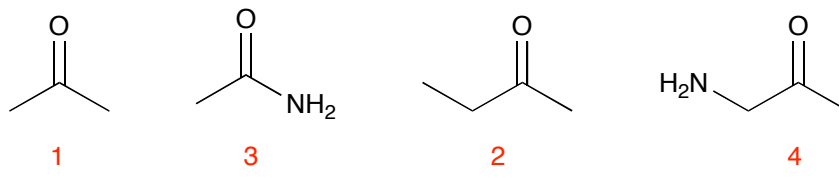
4. Rank the following in order of increasing boiling point, with 1 being the lowest and 4 being the highest, and briefly indicate how the intermolecular forces are influencing the ranks.

a.



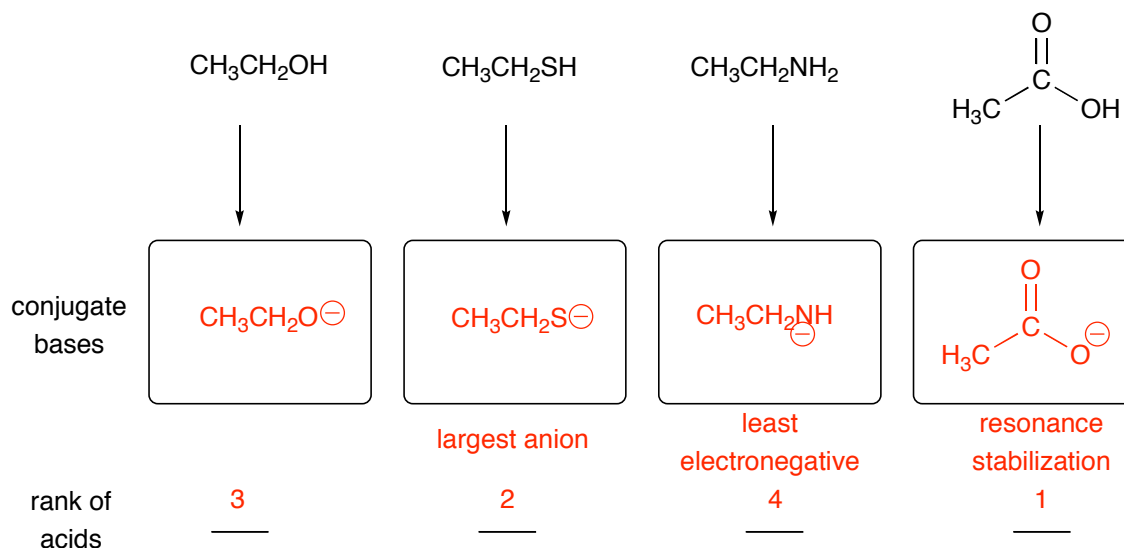
3 and 4 are more massive than 1 and 2 and thus they will have stronger London forces. When the halides are on opposite sides of the molecule as in 1 and 3, the dipoles will cancel; halides on the same side will give a net dipole moment and cause them to boil slightly higher. London forces are nearly always stronger than dipole-dipole forces so 3 boils higher than 2.

b.

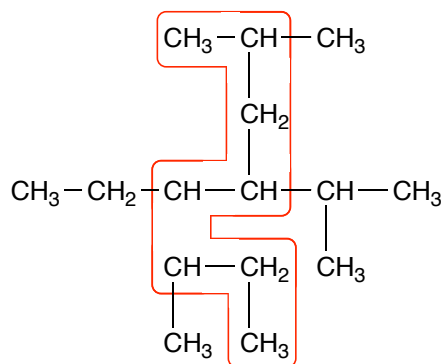


While 2 and 4 are heavier than 1 and 3, and will thus have stronger London forces, 3 boils higher than 2 due to the presence of two hydrogen bonding centers in the molecule.

5. Draw the conjugate bases for each of the following acids. Rank the acids in order of increasing acidity, where 1 is the most acidic and 4 is the least. Briefly indicate the rationale for your ranking.

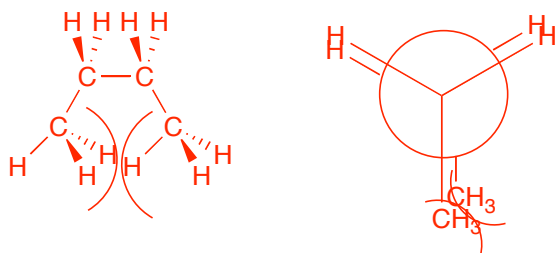


6. Name the following molecule, using common names for substituents.



Name: **5-ethyl-4-isopropyl-6-methyloctane**

7. Draw a 3-dimensional structure and a Newman projection for the totally-eclipsed conformation of butane. Indicate graphically in the 3-dimensional drawing and the Newman projection exactly why this conformation is so energetically unfavorable.



The steric hindrance between the two methyl groups eclipsed with each other causes this to be the most unfavorable conformation of butane.