

EXAM 1 PRACTICE PROBLEMS
CHEM 335
10/17/08

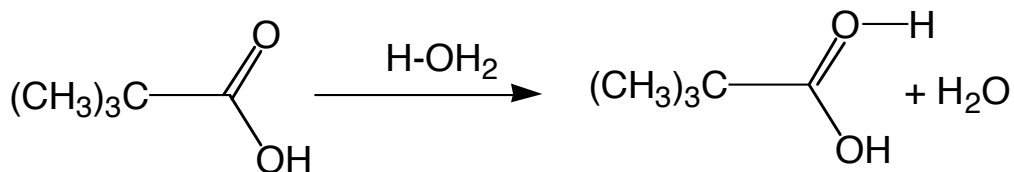
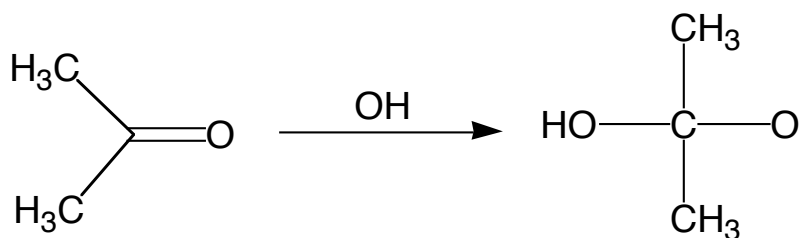
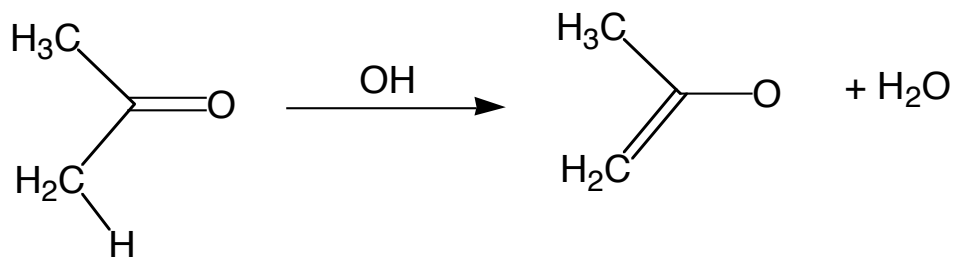
1. Finish the following sentence (Do not use a second sentence):

“An orbital is _____
_____.”

2. The two main criteria for determining whether a pair of orbitals will interact are _____ and _____.

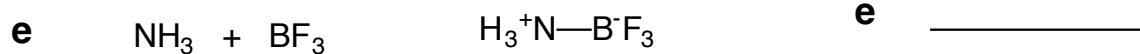
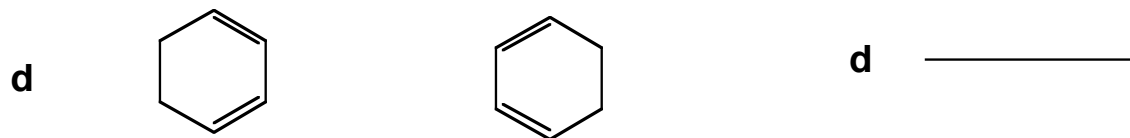
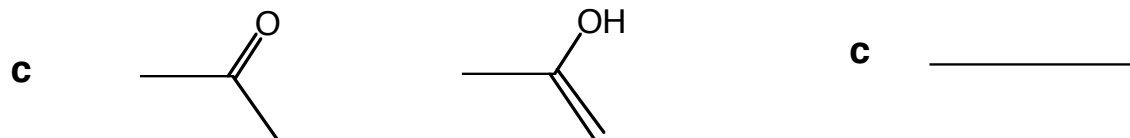
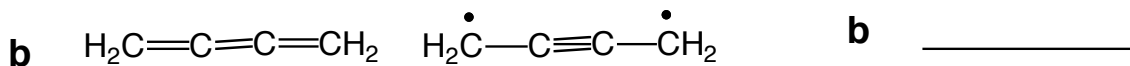
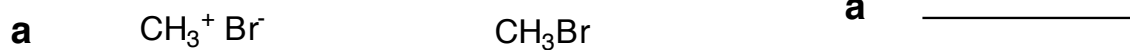
3. Draw clearly at least eight different structures that would fit the formula C_4H_7NO . You get two points for each correct structure and lose one point for each wrong structure.

4. Write curly arrow formalisms for the following reactions. Charges and electron dots are deliberately left out of the reagents and products so you must start by putting them in.



5. You may be surprised to learn that the molecule CH_2 with divalent carbon can exist. It is of course very reactive. We can conceive of two possible structures for this molecule with H-C-H bond angles of 180° or 120° . Draw the two structures. Draw the valence orbitals for each structure and indicate their occupancies?

6. Put an X next to pairs of compounds that could **in principle** (it might be hard) be separated and put into different bottles.



7. Write a valid Lewis structure for each of the following:

(a) bisulfate ion, HSO_4^-

(b) dinitrogen trioxide N_2O_3 (arranged ONONO)

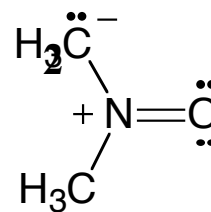
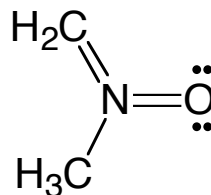
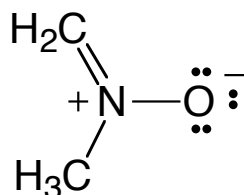
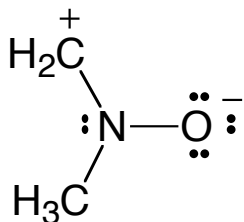
(c) hydrazoic acid, HN_3 (arranged HNNN)

(d) cyanic acid (OCNH)

(e) hydrogen cyanide (HCN)

8. One of the following four structural formulas is not a permissible resonance contributor.

Which one? _____



Rank the three remaining structures in order of their contribution to the resonance hybrid?

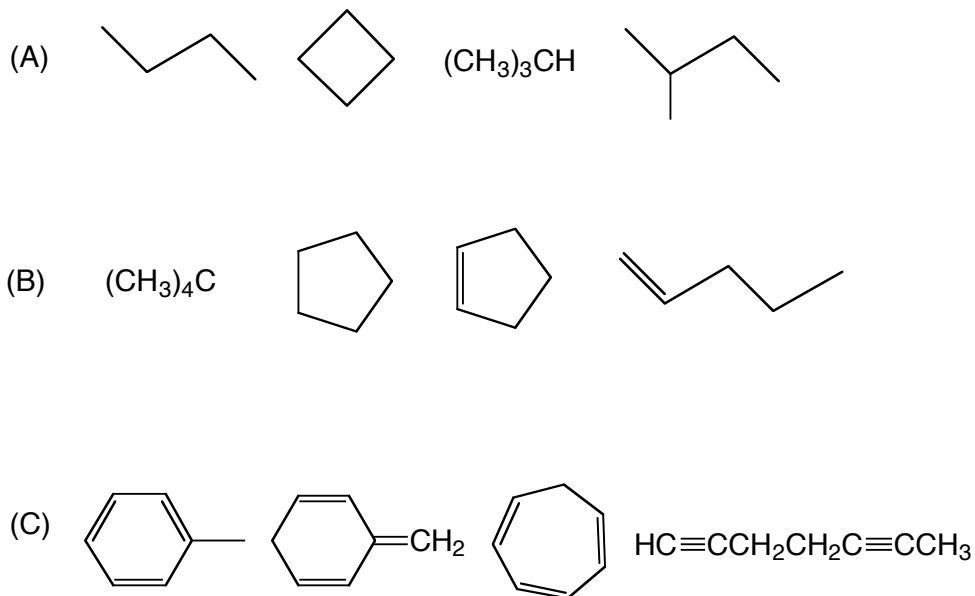
_____ > _____ > _____

most important

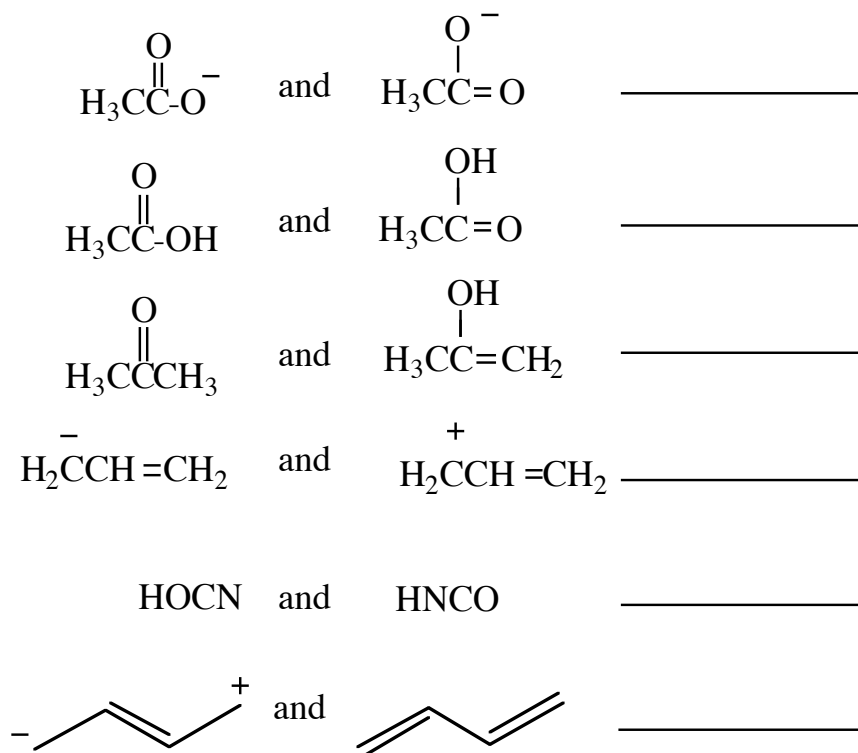
least important

(c.) Use curved arrows to show the electron movement that connects the three resonance contributors.

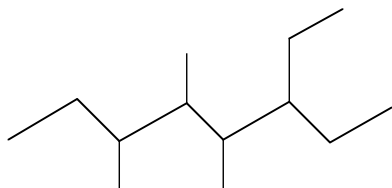
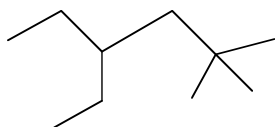
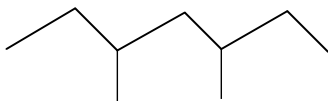
9. Circle the isomers in the following three sets.



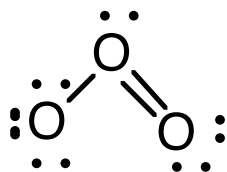
10. Indicate which of the following pairs **do not** constitute resonance structures by drawing an “X” in the space provided?



11. Give the IUPAC name of each of the following.



12. Ozone (O_3) is found in the upper atmosphere where it absorbs highly energetic ultraviolet radiation and thereby provides the surface of the earth with a protective screen. One possible resonance structure for ozone is the following:

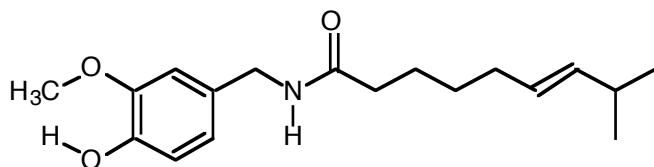


(a) Assign any necessary formal charges to the atoms in this structure.

(b) Write another equivalent resonance structure for ozone.

(c) What do these resonance structures predict about the relative lengths of the two distances between pairs of bonded oxygen atoms in ozone?

13. Capsaicin is the compound that makes chili peppers hot. Its line angle formula is shown below:



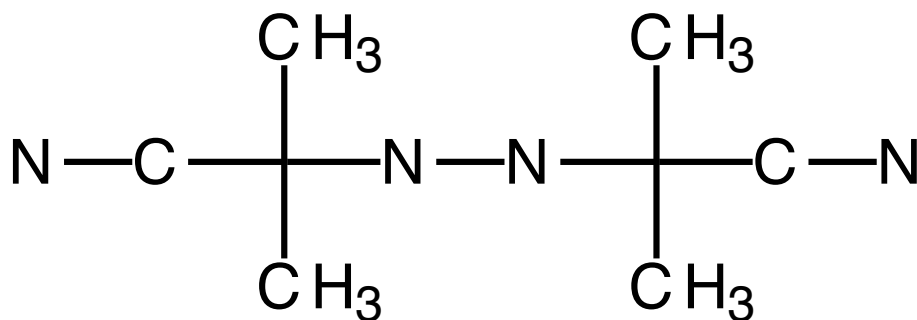
(a) What is the chemical formula for the caspsaicin? _____

(b) How many lone electron pairs are there? _____

(c) How many pi electrons are there? _____

14. The following structure is missing some multiple pi bonds.

Please draw them in. Indicate formal charges if and where necessary. Indicate lone electron pairs if and where necessary.



15a. Rank the following compounds left to right in order of increasing pKa?
The formulas represent ethane, ethene (ethylene), and ethyne (acetylene).



pKa _____ < _____ < _____

(b.) Justify your answer.