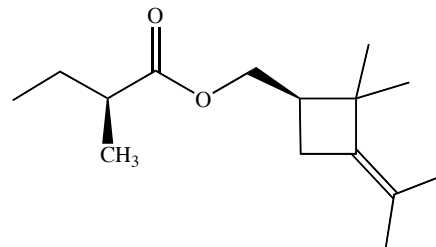
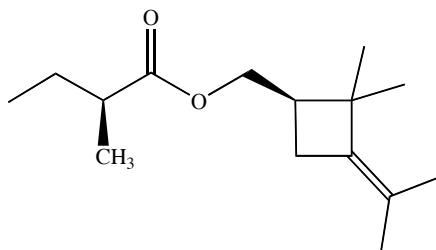


Behold molecule A, a constituent the sex pheromone of female pink hibiscus mealybugs (*Maconellicoccus hirsutus*). Native to the tropics, these sap-sucking insects are recent invaders of Florida and California, where they cause \$750 million per year in damage to avocados, citrus fruit, grapes and other crops. Pheromones could be the key to disrupting the mealybug's mating, and thus are of considerable economic interest.



Molecule A

- (2 points) Write the molecular formula of molecule A: _____
- (8 points) Molecule A has (supply numbers):
 - _____ atom(s) with open octets,
 - _____ lone pair(s),
 - _____ sp^2 carbon(s) and
 - _____ methyl group(s).
- (2 points) Circle and label the functional groups in molecule A.

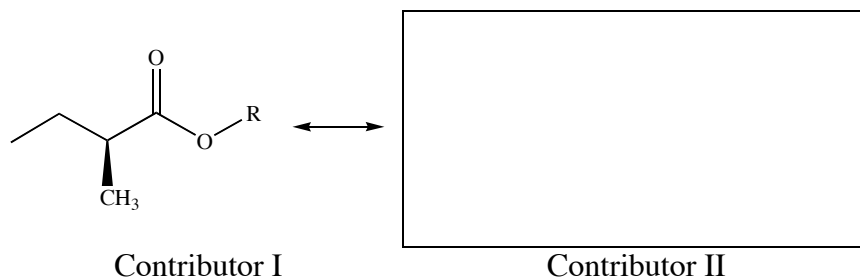


- (2 points) The best estimate for the C-O-C bond angle is (circle one):

$<109.5^\circ$
 109.5°
 $>109.5^\circ$
 $>109.5^\circ$ but $< 120^\circ$
 120°
 $>120^\circ$
- (1 point) Circle the correct electronegativity order:

$C > H > O$
 $C > O > H$
 $H > C > O$
 $H > O > C$
 $O > C > H$
 $O > H > C$
- (4 points) Fill in the blanks:
 - The C=O is called a(n) _____.
 - The atom of the C=O that bears the δ^+ charge is _____.
 - When hydroxide ion (HO^-) approaches the C=O, it approaches the _____ atom.

7. (6 points) In the box draw one additional, very significant resonance contributor for molecule A. Include all lone pairs and formal charges.



Which of the two resonance contributors makes the greatest contribution to the resonance hybrid (circle one): I II About equal

Which structure is the best representation of reality (circle one): I II The hybrid

8. (4 points) Short answers: Answer each in twenty words or less.

(a) What is the meaning of the wedge notation?

(b) What is the meaning of the abbreviation R?

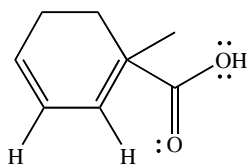
9. (12 points) Somewhat longer answers: Finish each brief discussion in two sentences or less.

(a) A molecule is said to have resonance when...

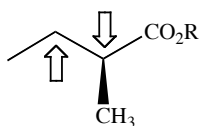
(b) Functional groups are important because...

(c) What is orbital hybridization?

10. (10 points) On a previous exam a Chem 30A student was asked to draw a molecule with exactly seven carbon atoms, one benzene ring and one alcohol. All lone pairs and formal charges were also required. The student's answer is shown below. List and label exactly five errors in the student's answer.



11. (4 points) Using a Newman projection, draw the most stable conformation of the bond indicated. Put the CH_2 carbon in the back of the Newman projection. Assume the CO_2R group is larger than the CH_3 group.



12. (8 points) Redraw the Newman projection of the previous question, but with the CH_3 groups eclipsed.

The CH_3/CH_3 dihedral angle is (give a number) _____°.

The CH_3 groups of this eclipsed conformation are (circle all that apply):

Periplanar Not periplanar Syn Anti Gauche

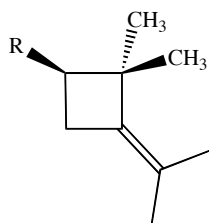
Compared to the conformation of the previous question, this eclipsed conformation is (circle one):

More stable Less stable About equal stability

13. (3 points) Define “strain.”

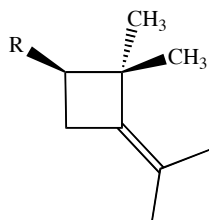
14. (3 points) Define “torsional strain.”

15. (2 points) Circle the two atoms and/or groups that cause the greatest torsional strain in the portion of molecule A shown below. An explanation can be included but is not necessary.

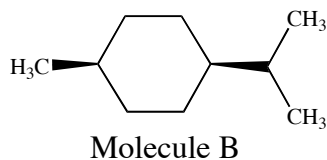


16. (3 points) Define “angle strain.”

17. (2 points) Circle the atom of the vertex (middle) of the bond angle that causes the greatest angle strain in the portion of molecule A shown below. An explanation can be included but is not necessary.



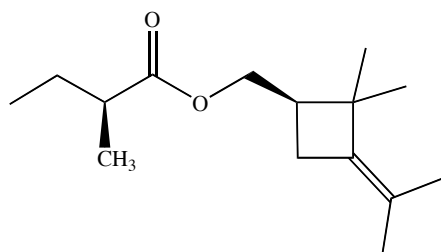
18. (6 points) Draw the two chair conformations of molecule B. Clearly label the most stable of the two chair conformations.



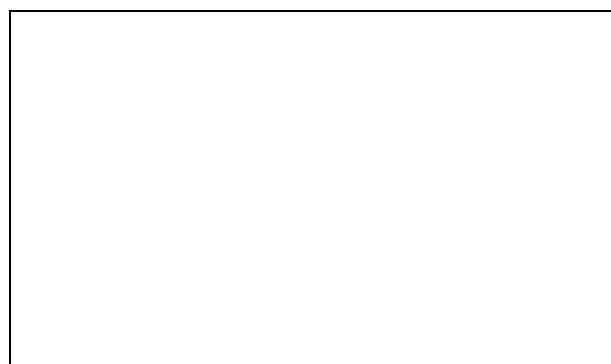
19. (2 points) By changing only the stereochemistry of the ring substituents, redraw molecule B so that it is essentially locked in a single conformation (i.e., the ring flip is strongly disfavored, or even prevented).

20. (3 points) Define “stereoisomers.”

21. (6 points) Consider once again molecule A:



Molecule A



Enantiomer

- (a) Molecule A has (give a number) _____ stereocenters.
- (b) On the molecule A structure above, label each stereocenters as R or S.
- (c) Draw an enantiomer of molecule A in the box.

22. (3 points) Molecule A is the (+) enantiomer, so its enantiomer is (circle all that apply):

Optically active Optically inactive Chiral Achiral

Meso Dextrorotatory Levorotatory

23. (2 points) Molecule A attracts male mealybugs, so its enantiomer (circle one):

Attracts males Repels males Has no activity Its activity cannot be guessed

24. (2 points) Draw a single molecule that has exactly three carbon atoms and one oxygen atom, and whose oxygen atom is a stereocenter.