Name:_____Key_____

CHEMISTRY 3311, Fall 1998
Professor Walba
First Hour Exam
September 24, 1998

scores:

1)

2)

3)

4)

5)

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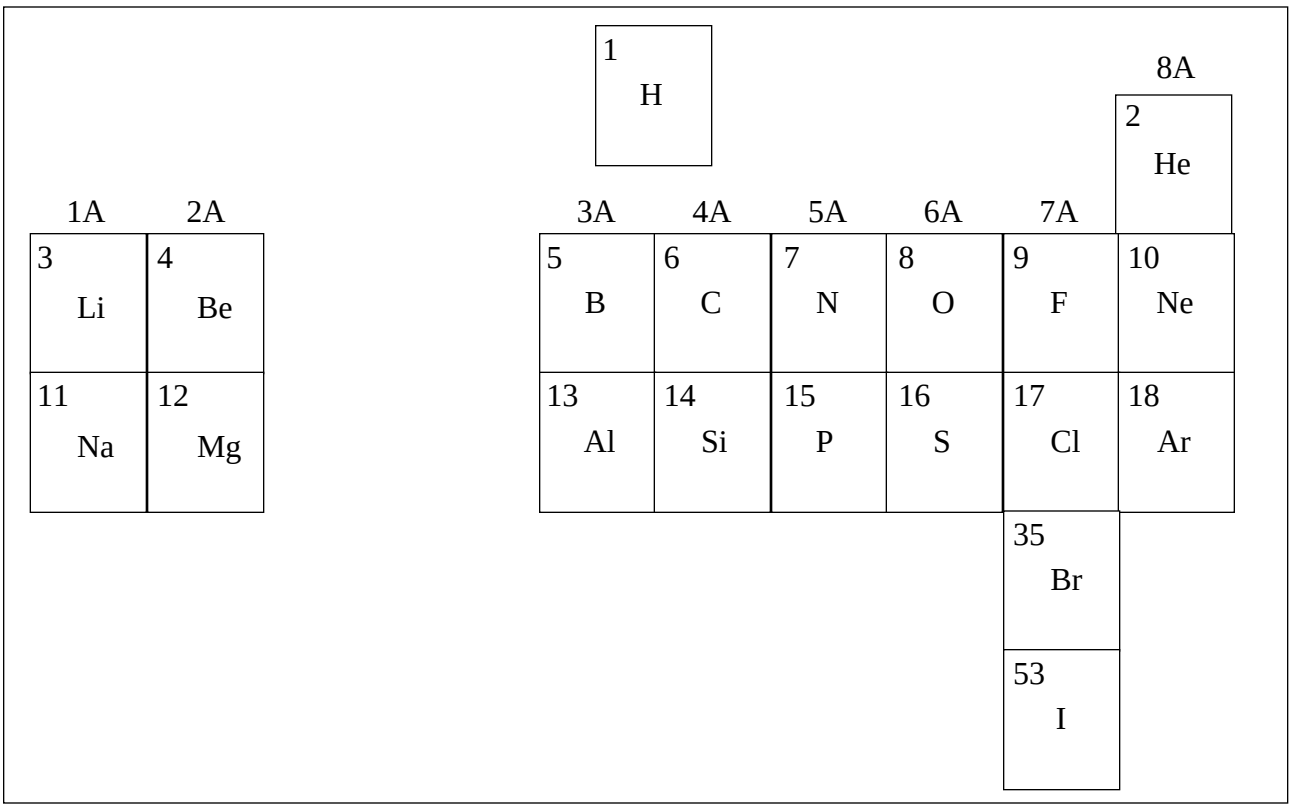
This is a closed-book "open model" exam. You may use models, but no notes or books. Please put all your answers on the test. Use the backs of the pages for scratch.

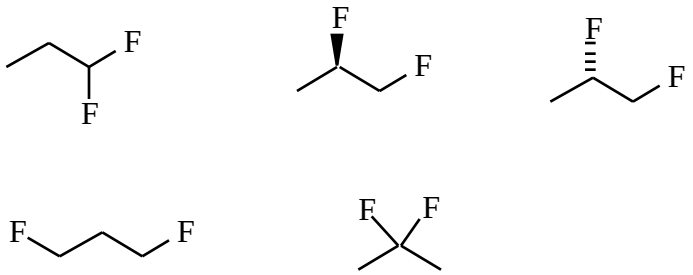
PLEASE read the questions carefully!

Partial Periodic Table

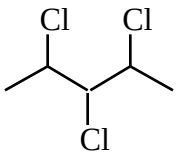


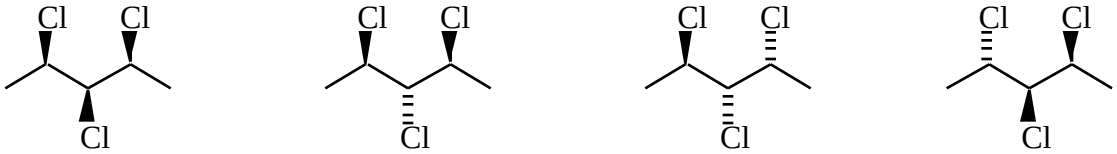
Name:_____Key_____

1) (18 pts) a) Draw structural formulas (molecular graphs) for all possible isomers (including stereoisomers and constitutional isomers, but NOT conformations) with the molecular formula $C_3H_6F_2$. Use wedges and dashes to show stereochemistry if necessary; you need not show H atoms. Draw each isomer ONLY ONCE.



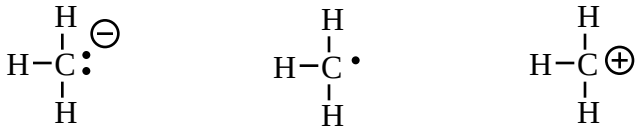
b) Using wedges and dashes, draw structural formulas for all the different stereoisomers (NOT conformations) of 2,3,4-trichloropentane (constitution shown below). You need not show H atoms. Draw each isomer ONLY ONCE.



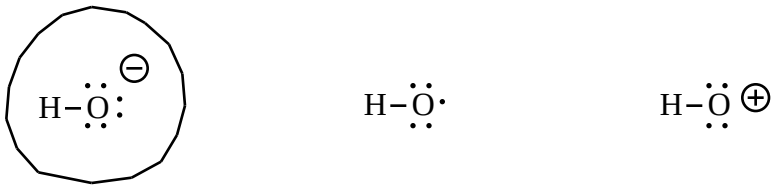


Name:_____Key_____

2) (20 pts) a) Draw valid valence bond structures (no geometry required) for $(CH_3)^-$, (CH_3), and $(CH_3)^+$. In these structures include all of the H atoms, and be sure to show unshared electrons (as dots) and correct formal charges for each of your structures. Use lines to represent covalent bonds (not pairs of dots).

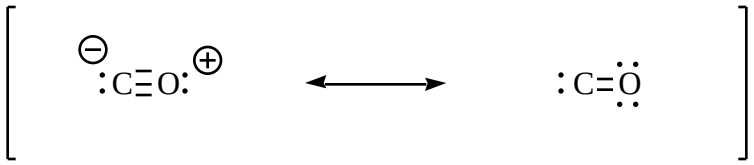


b) Draw valid valence bond structures for $(OH)^-$, (OH), and $(OH)^+$. In these structures include the H atom, and be sure to show unshared electrons and correct formal charges. In solution one of these molecules is more stable than the others. **Circle the more stable molecule and give a one word explanation** for your answer.

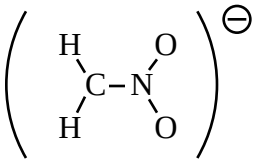


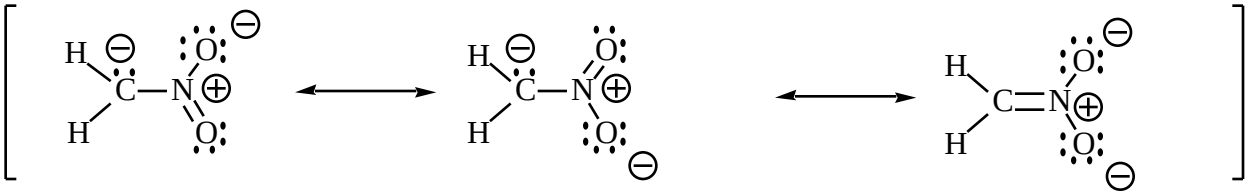
OCTETS

c) Draw the two most important resonance contributors to the structure of carbon monoxide (CO). The molecule is uncharged. Be sure to show all unshared electrons and formal charges in your structures. Use lines to represent covalent bonds.



d) Draw the three most important resonance contributors to the structure of the nitromethane anion $(CH_2NO_2)^-$. The connectivity of the atoms and net charge is shown in the <u>incomplete</u> structure below. Use the same rules as for part a.





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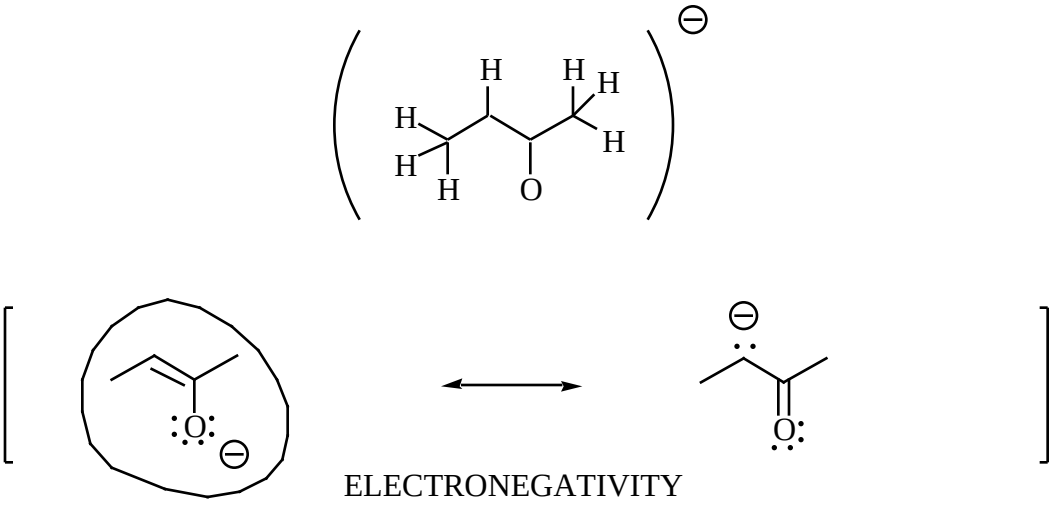
2 -continued-

e) Draw the two most important contributors to the structure of the methyl ethyl ketone enolate anion. The connectivity of the atoms and net charge is shown below.



ELECTRONEGATIVITY

f) For part e above, circle the single most important contributor to the structure and give a one word explanation for your answer.

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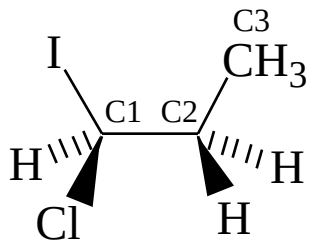
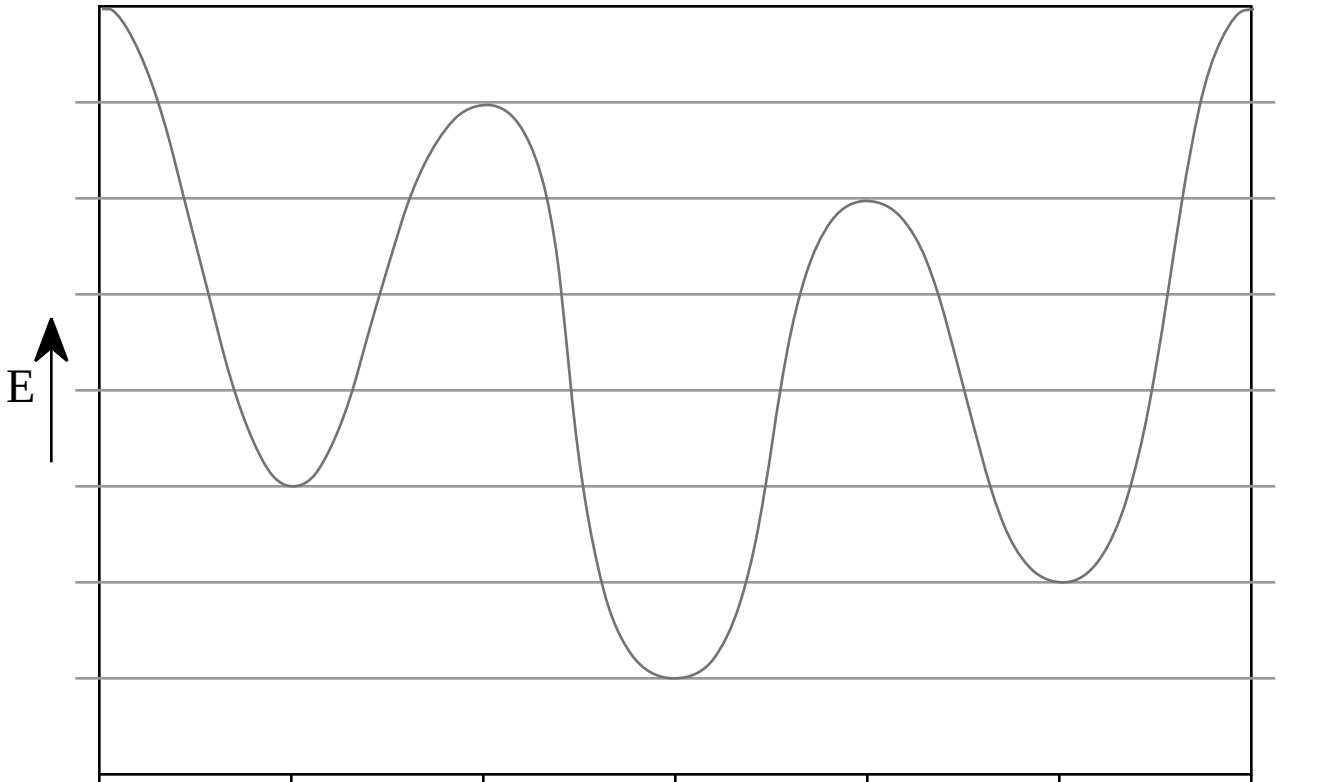
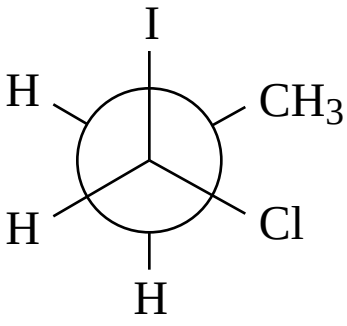
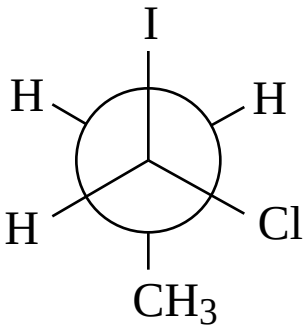
3) (18 pts) An eclipsed conformation of (S)-1-Chloro-1-iodopropane is given at right. The I-C1-C2-C3 dihedral angle for this conformation is 0°. Complete the energy diagram showing relative energies of all the conformations generated by rotating C2 clockwise about the C1-C2 bond. Complete the Newman projections for the three staggered conformations, with C1 in front. NOTE!!! The iodine atom is much larger than CH_3, and chlorine is smaller than CH_3 but much larger than H. Please be sure to show the relative energies of all the wells and barriers on the energy diagram in a way that is easy to read.

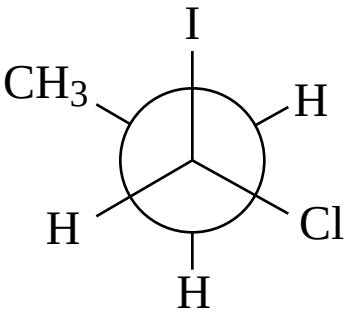




I-C1-C2-C3
Dihedral Angle







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4) (24 pts) Label each of the following pairs of structures as homomers, conformations, enantiomers, diastereomers or constitutional isomers (also known as structural isomers). In our class, conformations are NOT enantiomers or diastereomers, they are conformations. This question relates to the description of chemical compounds at room temperature on a long time scale. For example, enantiomeric structures represent molecules which, when present in a large ensemble of molecules comprising a macroscopic samples of material, can be purified into isomers with equal magnitude but opposite sign of rotation of plane polarized light.

<table>
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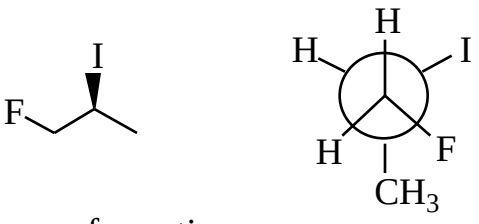
enantiomers</td>
<td> 

conformations</td>
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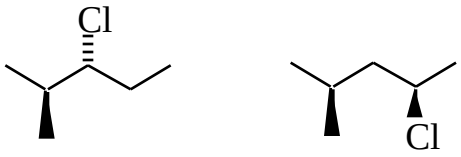
<td> 

constitutional isomers</td>
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enantiomers</td>
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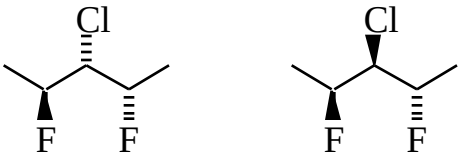
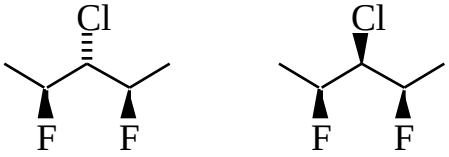
<td> 

homomers</td>
<td> 

diastereomers</td>
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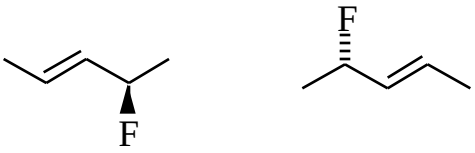
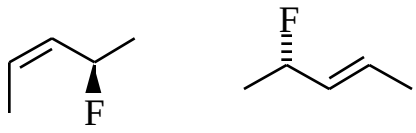
<td> 

enantiomers</td>
<td> 

diastereomers</td>
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Name:_____Key_____

5) (20 pts) Label each tetrahedral stereogenic center in the following structures using the CIP (R/S) system. Be sure to show which label goes with which stereogenic center.