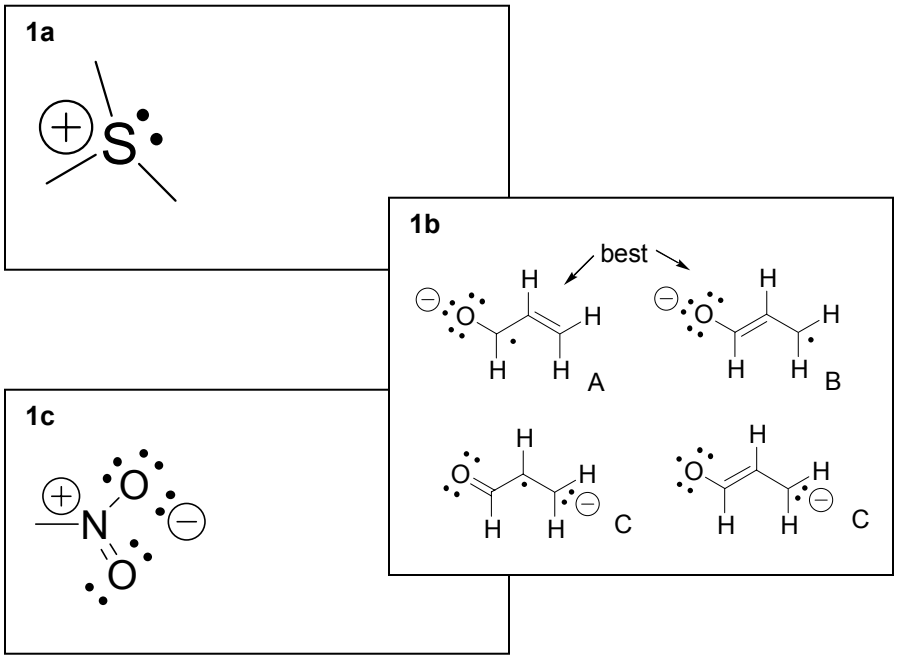
1. (*15 pts*) Draw line structures (as the lowest-energy resonance structures) for the following compounds. **Include all lone pairs and indicate all formal charges** (unless the formal charge is zero). Indication regarding how to connect the atoms is present in the molecular formulas given below at left.

1a. $S(CH_3)_3$+

1b. $OCHCHCH_2$(-)

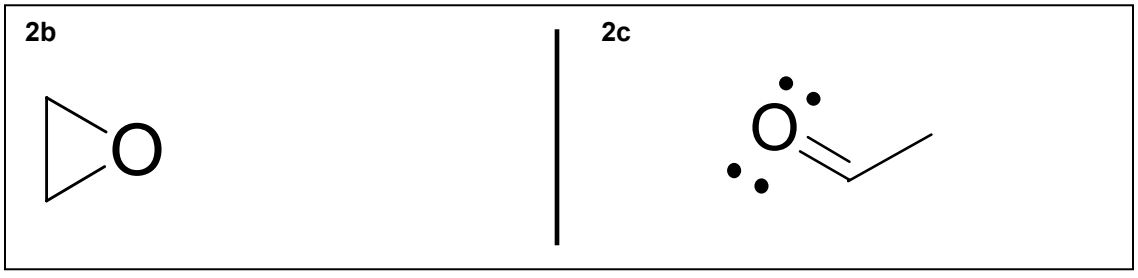
1c. CH_3NO_2



2a. (5 pts) Compute the degrees of unsaturation in C_2H_4O; show you work.

My answer for 2c: __DU = 2-4/2+1 _____

2bc (10 pts) Draw two isomers possessing molecular formula C_2H_4O.



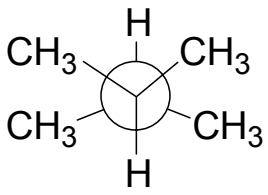
3. (10 pts) Think about the electron-based mechanism of molecular absorption of light. Question: Which should absorb light of lowest energy, saturated or unsaturated hydrocarbons and why? My answer: **One or two sentences**! **No credit** without an explanation. _____

__Unsaturated hydrocarbons absorb lower energy light because the filled bonding and the empty antibonding orbitals are closer in energy than in saturated molecules because pi bonds overlap less efficiently than sigma.

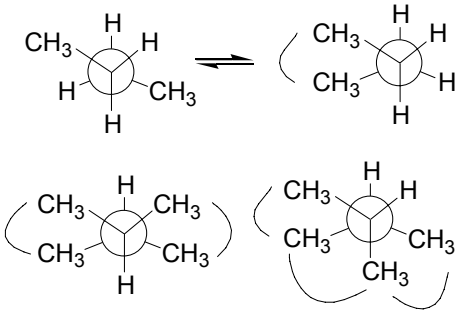
_____

4a. (10 *pts*) Draw the Newman projection of 2,3-dimethylbutane in its most stable conformation.

4a



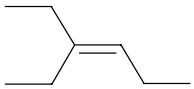
4b work space



4b. (*5 pts*) The lowest-energy conformer of n-butane is 0.9 kcal/mol less in energy than the second lowest conformer. With this information you should be able to estimate the difference in energy between the structure you drew in **4a** and the second lowest conformer of 2,3-dimethylbutane.

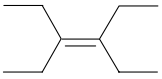
There are 3 gauche interactions in the next highest conformer whereas there are two in the lowest energy conformer of 2,3-dimethylbutane. Each is worth 0.9 kcal/mol so the answer is 0.9 kcal/mol.

5a. (10 *pts*) Name the following structure.



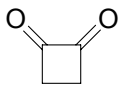
7a: _____3-ethyl-3-hexene_____

5b. (10 *pts*) How many signals in the ^{13}C NMR spectrum will the structure in 5a have?

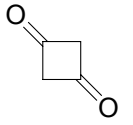
Answer: 5a_8___ How many signals in **5b?__3__**  **(5b)**

6. *(10 pts)* In molecular formula $C_4H_4O_2$ Each carbon atom is connected to at least two and only two carbon atoms by single bonds. Draw a structure that maximizes the dipole moment and draw a structure that minimizes the dipole moment of the molecule.

Maximum Dipole

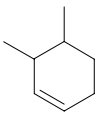


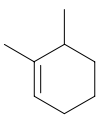
Minimum Dipole



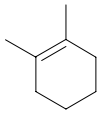
7 *(15 pts) (5 pts)* Rank the molecules according to stability. (10 pts.) Explain your answer for the most stable structure and the least stable structure (one or two words will be enough for each).

Most stable _D_, _B_, _A_, least stable _C_.


A


B


C


D

7. Most stable: **__Most substituted__**

Least stable_**trans-double bond in a six-membered ring is strained. Poor orbital overlap. _**