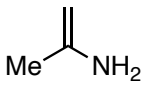
Name:_____

4 pts. **1a.** Mark an **X** in the box corresponding to the compound that is most likely to accept a proton.



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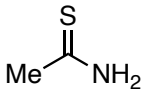

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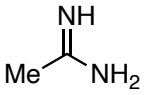

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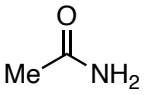

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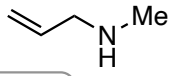
In the space below, provide an explanation for your selection. Include structures to aid your answer.

5 pts. **1b.** What is the hybridization of the nitrogen in each of the compounds below?

A



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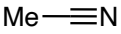
B



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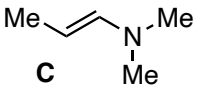
C

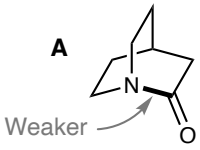


☐

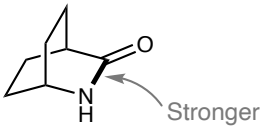
Compare compounds **A** and **C**. Which compound is more basic and why? Include structures to aid your answer.

5 pts. **1c.** Consider the structures below. The **C-N bond in bold** is much stronger in **B** than in **A.** Provide the most reasonable explanation. Include structures to aid your answer.

A



B



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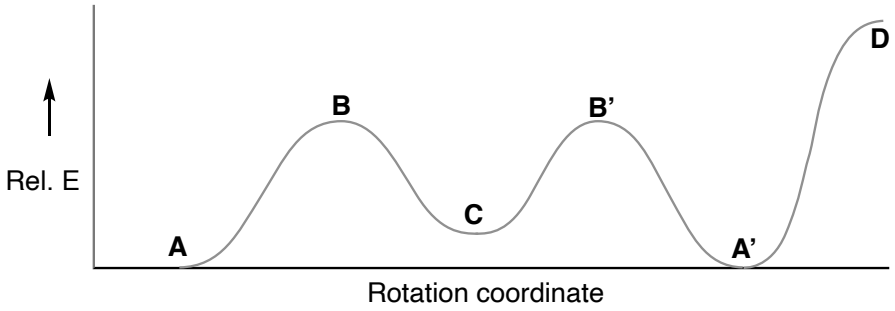
☐

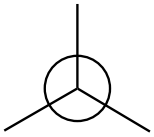
Name:_____

The compound 1,2-difluoroethane would appear to be a non-polar molecule. However, it has been found that it is indeed a polar molecule, which means that the **most stable rotamer is polar**.

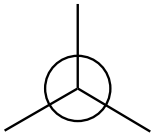
8 pts. **2a.** Draw the **Newman projections** of each conformational isomer of 1,2-difluoroethane, as viewed from carbon-1 (**C1**) toward **C2** in the back. The free-energy diagram shows each energy minima and maxima as the dihedral angle changes, rotating through the C-C bond. Each label represents a rotation of 30°. In the box provided **draw the structure that corresponds to each point**. You do not have to draw the structures for **A'** and **B'** since their energy is the same as **A** and **B**, respectively.



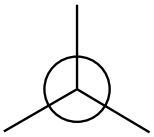
A.



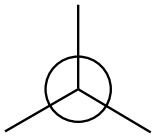
B.



C.



D.



4 pts. **2b.** Why is **A** lower in energy than **C**? Provide **the most reasonable explanation** below.

4 pts. **2c.** Why is **B** lower in energy than **D**? Provide **the most reasonable explanation** below.

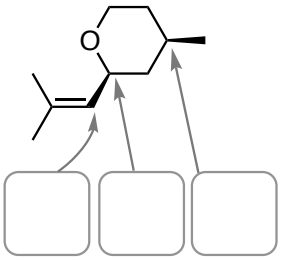
pts. this pg.

Name:_____

Valentine's day small talk: The natural product shown below is *rose oxide*. The stereoisomer **A** and its enantiomer **B** are responsible for the smell in roses. The other two stereoisomers are not as easily detectable by your nose.

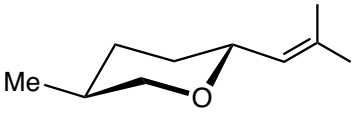
6 pts. **3a.** Label the **specific configuration** of each stereocenter. If **not a stereocenter**, write: **NS.** Then, draw the line/wedge structure of its enantiomer **B**.

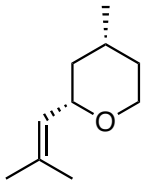
Rose Oxide (**A**)

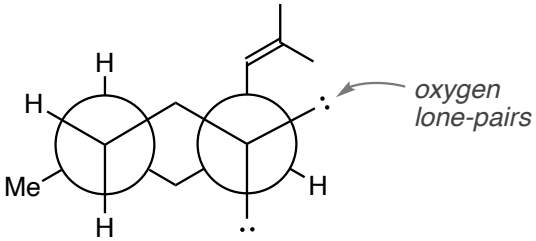


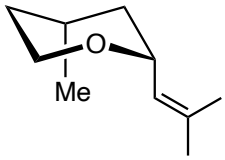
B

8 pts. **3b.** Indicate the ***relationship* between the rose oxide (A) structure above** & the molecules below as: **same molecule**, *diastereomer*, constitutional isomer, **enantiomer**, *meso compound,* or not isomers.









8 pts. **3c.** In **A** (below), draw the **line/wedge** structure of the ***R*-configuration** of the smallest **chiral alkylamine** and provide its name. In **B** (below), draw the ***S*-configuration** of the smallest **chiral cycloalkylamine.** (smallest = least number of atoms.)

A

R-configuration amine

B

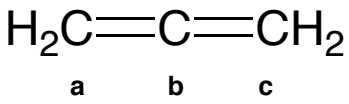
S-configuration cyclic amine

Name:

pts. this pg.

Name:_____

Consider the C_3H_4 isomer shown below (propa-1,2-diene), which is part of a hydrocarbon family called *allenes*. Note that the carbons contain a label, **a**, **b**, and **c**.



2 pts. **4a.** What is the hybridization of carbon **a**?

a ☐

2 pts. **4b.** What is the hybridization of carbon **b**?

b ☐

8 pts. **4c.** Draw the molecular orbital picture (the orbitals on the molecule, not the MO diagram) of propa-1,2-diene and label all molecular σ and π bonds, in addition to any non-bonding atomic orbitals (*s, p,* etc.), if any.

2 pts. **4d.** How many sp^2 orbitals are engaged in forming σ bonds?

☐

2 pts. **4e.** 2 pts. What is the dihedral angle between H-C(a)-C(c)-H in propa-1,2-diene?

☐

6 pts. **4f.** In the boxes below, **using line formula**, adopting **dashes** and **wedges**, draw the molecular representation that best describes the three-dimensional shape of each of the allenes below.

$H_2C{=}C{=}CH_2$

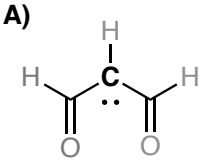
$H_2C{=}C{=}C{=}CH_2$

pts. this pg. ☐

Name:_____

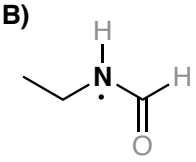
5 pts. **5a.** Gen Chem Flashback: For each of the **LINE-LEWIS DOT** structures below, provide the **FORMAL CHARGE of the atoms in bold**. The presence and absence of single electrons, lone-pair electrons and bonding electrons have been indicated with dots and lines about each atom.

A)



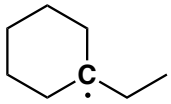
C = ☐

B)



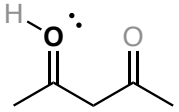
N = ☐

C)



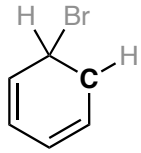
C = ☐

D)



O = ☐

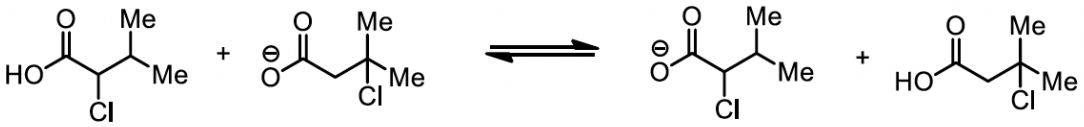
E)



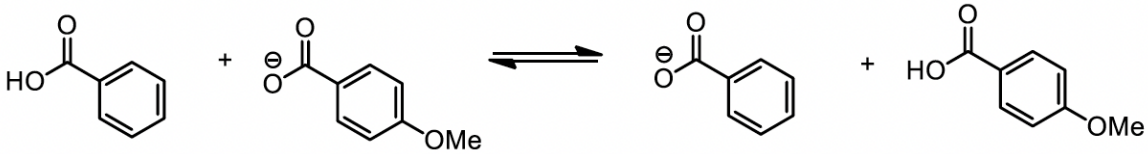
C = ☐

12 pts. **5b.** Circle the **side of the equilibrium** that is **FAVORED** in each reaction, *i.e.* the side with the weakest conjugate acid/base combination.

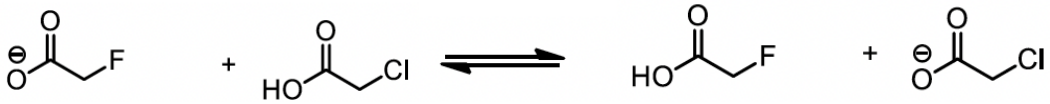
A)



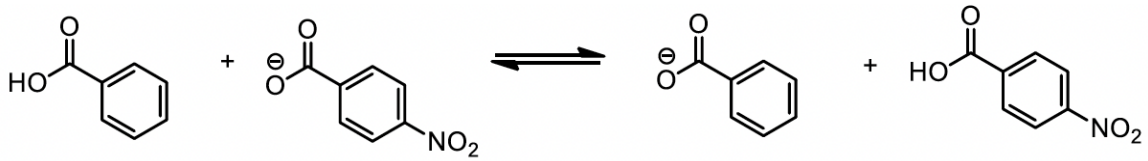
B)



C)



D)



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