NAME ________________________

ID # ________________________

ORGANIC CHEMISTRY I (2301)

9:30 – 10:20 am, June 25, 2012

Exam 1

If you want to pick this exam up on Tuesday in class (in public), please check the box on the right: ☐

If you do not check the box, I will not bring your exam to class on Tuesday, and you will need to pick up your exam in private from Chemistry department staff in 115 Smith beginning Wednesday, June 27th. Exams that are not picked up within two weeks will be disposed of.

A periodic table is attached to the back of this exam as an aid. Otherwise, you are not permitted to use any other materials (including notes, books, or electronic devices of any kind).

Right now, write your name and student ID number at the top of this page. When the exam begins, please write your name at the top of the next page.

You may use pen or pencil. However, re-grades will be considered only for exams completed in pen.

Please write your answers in the boxes/spaces provided. If your answer is not in the appropriate space (say, for example, it's on the back of the page), draw us an arrow and/or note telling us where to look.

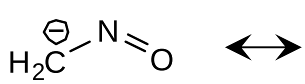
NAME ________________________

Scoring:		
	1. _________ / 6	5. _________ / 18
	2. _________ / 20	6. _________ / 20
	3. _________ / 12	7. _________ / 6
	4. _________ / 18	

Total Score: _________ / 100

1. (6 pts) **Draw Lewis dash-bond structures** for two constitutional isomers that have molecular formula **CH_4N_2**, and that have **no formal charges** on any atom. Draw all atoms and lone pairs of electrons.

2. (20 pts) For each of the molecules on the left, draw as many of the best Lewis dash-bond resonance structures as there are boxes to put them in. (Feel free to omit lone pairs and C-H's, or draw them—your choice.) Then, below each resonance structure, describe whether each would be a major or minor contributor. Finally, draw a resonance hybrid that illustrates partial charges and multiple bonds.



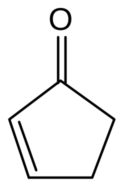
resonance structure

resonance hybrid

contribution:

(major/minor?)

contribution:



↔ *resonance structure* ↔ *resonance structure*

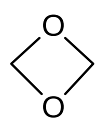
contribution: (*major/minor?*)

contribution:

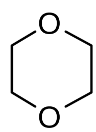
contribution:

resonance hybrid

3. (12 pts) This problem compares 1,3-dioxetane and 1,4-dioxane (shown at right).



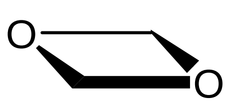
1,3-dioxetane



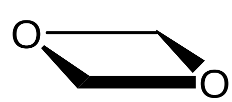
1,4-dioxane

a. *Angle strain* and *torsional strain* are both repulsive forces between pairs of electrons that make some cyclic molecules less stable than others. **Does 1,3-dioxetane show angle strain and/or torsional strain?** Circle your answers in the boxes below. Then, if you circled "YES" in either box, **illustrate the electron-pair repulsion** (the strain) on my skeleton structure **with a double-headed arrow**. You may have to add to my drawing in order to show the repelling electrons. (If you circled "NO", leave the rest of that box blank.)

Angle strain: **YES** *or* **NO** *?*

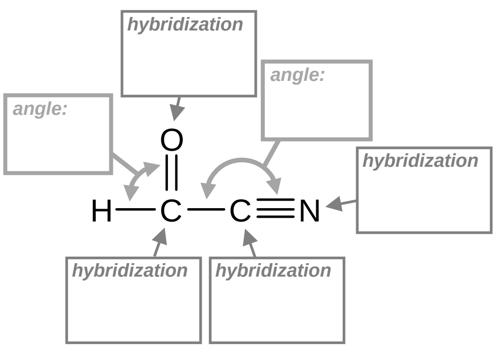


Torsional strain: **YES** *or* **NO** *?*

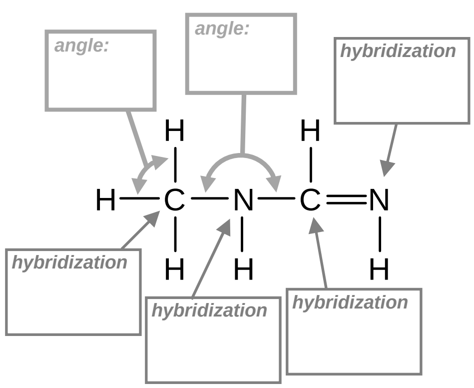


b. 1,4-Dioxane puckers from planarity in order to avoid angle and torsional strain. In the box on the right, draw the most stable conformation of 1,4-dioxane. In your drawing, **include all H atoms**, but feel free to omit lone pairs.

4. (18 pts) For each of the Lewis structures drawn below, in the boxes provided:
   - Draw Lewis wedge/dashed-bond structures that illustrate the most stable three-dimensional structure of the molecule. Draw all atoms, but feel free to omit lone pairs.
   - In the boxes provided, write the hybridization state for any atom heavier than hydrogen.
   - In the boxes provided, give any bond angle indicated by curved arrows in the original Lewis structure.

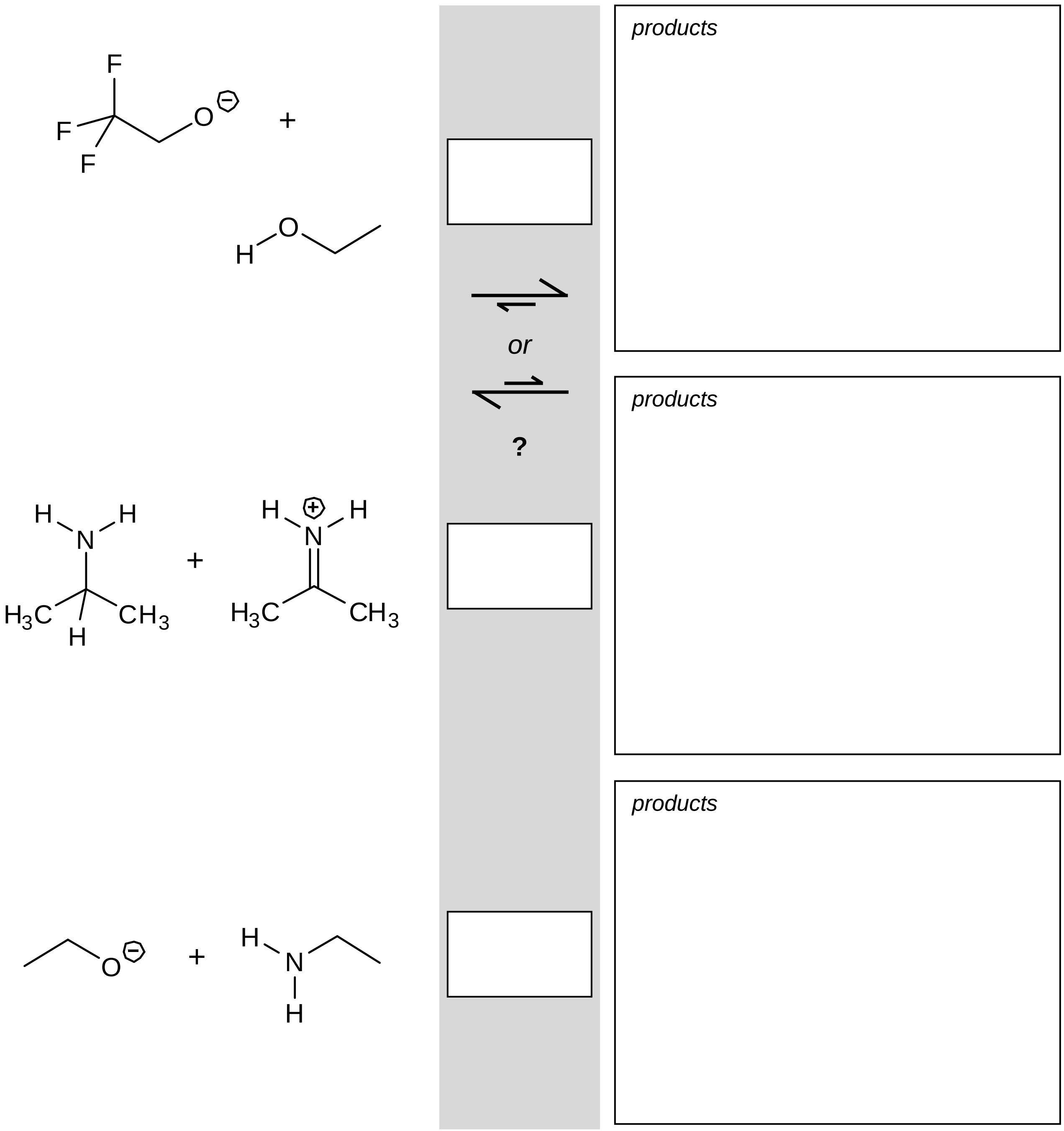


wedge/dashed-bond (3D) structure



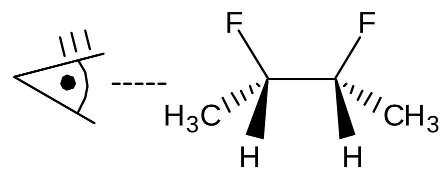
wedge/dashed-bond (3D) structure

5. (18 pts) For each of the sets of molecules below:
   - Using “electron pushing” (with double-barbed arrows), show how the molecules on the left would react in an acid-base reaction to transfer a proton from one to the other.
   - In the box on the right, draw the conjugate acid and base products of each reaction.
   - In the middle, draw an equilibrium arrow that shows whether you feel the acid-base equilibrium would lie on the left or the right.



6. (20 pts)

   a. For the difluorobutane shown at right, in the boxes below, draw Newman projections that show the most stable, second-most stable, least stable, and second-least stable conformations of the molecule. Draw your projections looking down the central C-C bond, using the perspective I've shown in the drawing.

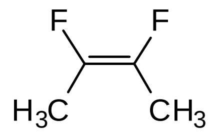


   b. Different conformations can contribute different polarities to the overall, average polarity of a molecule. For each of the two most stable conformations of the molecule above, circle whether the molecule is polar or non-polar when it is in that conformation. If you circle "POLAR", also draw <u>one</u> dipole arrow (+→) that shows the total dipole moment for that conformer.

Newman projection for ***most stable*** *conformation*	*Newman projection for* ***second-most stable*** *conformation*
POLAR *or* **NON-POLAR** *?* *(circle one)*	**POLAR** *or* **NON-POLAR** *?* *(circle one)*

Newman projection for ***least stable*** *conformation*	*Newman projection for* ***second-least stable*** *conformation*

c. Would you call the 2,3-difluorobutene shown at right a

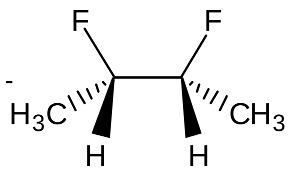
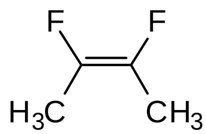


CONFIGURATIONAL ISOMER,

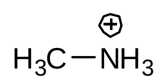
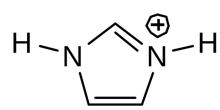
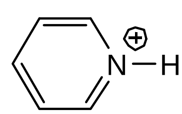
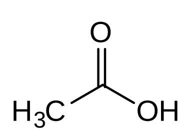
STEREOISOMER, *or* **NEITHER**

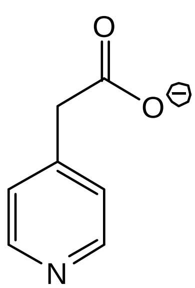
compared to the 2,3-difluorobutane on the previous page? (*Circle one answer*.)

d. Which is more polar:

		***or are they equally polar?***
this difluorobutane?	***this difluorobutene?***	*(Circle one answer.)*

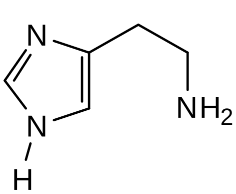
7. (6 pts) Each of the basic molecules below has multiple potential protonation sites. Given the pKa values in the chart on the right, draw the organic product you would expect if each molecule was combined with just <u>one</u> molecule of H_3O^+.

	<u>pK_a</u>
	10.6
	7.0
	5.3
	4.7



+ H_3O^+ →

+ H_2O



+ H_3O^+ →

+ H_2O