Chem 343
Reich Exam 1
October 10, 2011

Name: First ________ Last: _____________
ID Number ________________________

General Instructions:
Use scratch paper at the back of the exam to work out answers. Final answers must be recorded at the proper place on the exam itself for credit.
Print your name and ID # on each page.
Please keep your paper covered and your eyes on your own work.
Academic misconduct will lead to failure in the course.

1. (12 pts.)
   a) Draw the two best resonance structures of dinitrogen oxide. Circle the most stable one of the two.
   \[ \text{N}_2\text{O} \rightarrow \text{N} = \text{N} : \text{O} \quad \text{Circle} \quad \text{N} = \text{N} - \text{O} : \]

   b) Draw two more good resonance structures of the anion shown. Show electron-pushing arrows for the conversion of the first to the second and the second to the third.

2. (8 pts) Answer the following questions about the pencillin derivative below.

   a) Circle the aldehyde functional group.

   b) The hybridization at the amine N is \( \text{SP}^3 \)

   c) The Cl-C-C angle is \( 120^0 \)

   d) The unsaturation number is \( 10 \)
3. (6 pts.)

(a) Draw trans-4,5-dimethylcyclohexene

(b) Name including E/Z.

(2)-4- isopropyl-2,3,5-trimethyl-2,4-heptadiene

4. (6 pts.) The structure of allene is shown below in 3-D. Write the hybridization under each carbon. Explain the 3-D structure of allene on the basis of the orbitals used to form the double bonds. It may be helpful to draw the orbitals. Be brief.

The H's on the end carbons are in perpendicular planes because the central carbon uses both p orbitals which are perpendicular to each other and p orbitals are perpendicular to the sp² orbital plane.
7. (9 points) **Circle** the strongest base.

   a) NaOCH₃  \hspace{1cm} NH₂CH₃  \hspace{1cm} NaNHCH₂CH₃  \hspace{1cm} NaOCCCH₃

   b) CH₃CH₂Li  \hspace{1cm} NaNHCH₂CH₃  \hspace{1cm} NaOCH₂CH₃  \hspace{1cm} NaOH

   c) I⁻  \hspace{1cm} Cl⁻  \hspace{1cm} F⁻  \hspace{1cm} OH⁻

8. (9 points) Complete the following acid-base reactions. It might be helpful to put in the lone pairs.

   a) \[
   \begin{array}{c}
   \text{Cl} \quad \text{Al} \quad \text{Cl} \\
   \end{array}
   \quad + \quad \begin{array}{c}
   \text{O} \quad \text{O} \\
   \end{array}
   \quad \rightarrow \quad \begin{array}{c}
   \text{AlCl₃} \\
   \end{array}
   \]

   b) \[
   \begin{array}{c}
   \text{H} \quad \text{O} \\
   \end{array}
   \quad + \quad \begin{array}{c}
   \text{N} \quad \text{H} \\
   \end{array}
   \quad \rightarrow \quad \begin{array}{c}
   \text{NH₃} \\
   \end{array}
   \]

   c) \[
   \begin{array}{c}
   \text{Li} \\
   \end{array}
   \quad + \quad \begin{array}{c}
   \text{CH₃CH₂OH} \\
   \end{array}
   \quad \rightarrow \quad \begin{array}{c}
   \text{C₆H₆} \\
   \end{array}
   \quad + \quad \begin{array}{c}
   \text{CH₃CH₂O}⁻ \\
   \end{array}
   \]

9. (6 pts.) Write complete Lewis structures for the following **showing all lone pairs**.

   a) THF

   \[
   \begin{array}{c}
   \text{O} \\
   \end{array}
   \]

   b) a bromonium ion

   \[
   \begin{array}{c}
   \text{Br} \quad + \\
   \end{array}
   \]
9. (12 pts)

(a) **Circle** the highest priority group and put a **box** around the lowest priority group according to the rules for assigning E or Z configurations.

(b) When an alkane is treated with Br\(_2\) in the presence of light, one hydrogen is replaced by a Br. **Circle** the compound which would produce the **smallest** number of different monobrominated isomers. Put a **box** around the compound which would produce the **greatest** number.

(c) **Circle** the most stable free radical. Put a **box** around the least stable radical.

(d) **Circle** the most stable alkene. Put a **box** around the least stable one.
10. (15 pts) Draw the product(s) of the following reactions.

(a) 

\[ \text{1. O}_3, \text{excess} \]

\[ \begin{array}{c}
\text{1. O}_3, \text{excess} \\
\text{2. } \cdot \cdot \cdot \\
\end{array} \]

(b) 

\[ \begin{array}{c}
\text{H}_3\text{O}^+ \\
\text{H}_2\text{O} \end{array} \]

(c) 

\[ \begin{array}{c}
\text{I-Cl} \end{array} \]

11. (6 pts) Show how you would accomplish the following synthesis. Two steps are required. Write the product of the first step in the box and reagents over the two arrows on either side of the box.

\[ \begin{array}{c}
\text{OH} \\
\text{H}_2\text{SO}_4 \end{array} \]

\[ \begin{array}{c}
\text{HBr} \\
\text{peroxides} \end{array} \]
12. (7 pts) Write the mechanism for the following reaction showing all intermediates and electron-pushing arrows.

13. (4 pts) Draw a chain propagation step for the reaction of propene with HBr and peroxides. Show electron-pushing arrows.