

Chemistry 125 Third Examination  
November 13, 2001

Name \_\_\_\_\_

1. Methylcyclohexane.

- A. (3 minutes) Draw **accurate** representations of the arrangement of the carbons atoms in two conformational isomers of methylcyclohexane and name them. Both isomers should have the chair conformation. [You may omit hydrogens.]

I. name \_\_\_\_\_

II. name \_\_\_\_\_

- B. (2 minutes) In each of the structures above circle a chain of four consecutive carbon atoms that includes the methyl group and give the name for the conformation of these two four-carbon chains as if they stood alone as **butane**.

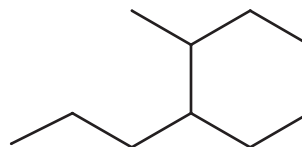
I. name \_\_\_\_\_

II. name \_\_\_\_\_

- C. (3 minutes) Estimate the energy difference between the two isomers of methyl cyclohexane (kcal/mole). Explain the basis for your estimate.

- D. (3 minutes) Estimate the equilibrium ratio of these isomers of methylcyclohexane (**I/II**) at **room temperature and at 30K**.

2. (5 min) Give the systematic (IUPAC) name of the compound to the right AND state at least **four principles** that you had to observe in composing the correct name.



3. (10 min) **Draw two** important resonance structures of an amide ( $\text{RCONH}_2$ ) **and two** of an acid chloride ( $\text{RCOCl}$ ) to **explain** why their carbonyl IR stretching frequencies differ from that of an aldehyde ( $\text{RCOH}$ ). Next to each charge-separated resonance structure **name the HOMO and the LUMO** whose mixing gave rise to the charge separation. [Hint: relevant generic frequencies, in no particular order, are 1800, 1725, and 1690  $\text{cm}^{-1}$ .]

4. (8 min) Sketch **ONE** of the following pieces of apparatus, and explain how it worked (labels would help) and what information it provided:

Lavoisier/Laplace calorimeter

Liebig combustion apparatus

Chupka/Inghram graphite oven.

5. (10 min) Choose **TWO** of the following three concepts. For **each** of these two provide **experimental** evidence **both for and against** its validity. [In all you should mention four experiments.]

Dualism is useful for understanding organic chemistry

Lavoisier's Acid/Base Theory

The proper model of cyclohexane has the carbons in a single plane

6. (6 min) The picture on the right shows a model used at the conclusion of a 19th century chemistry lecture. **Explain what the model was intended to show.** Give the **date** of the lecture within 10 years. Explain **how this type of model differed** from the type used by Paternó to explain isomerism in the dihaloethanes.

