CHEM221 Section 02 Dr. C. Rogers **NAME:**

# INTRODUCTORY ORGANIC CHEMISTRY I --- **PROBLEM SET #2**

**INSTRUCTIONS:** HAND IN STAPLED, COMPLETED ASSIGNMENT (no extra pages please) **AT THE BEGINNING OF CLASS on Thursday Feb.17th**. LATE SUBMISSIONS WILL **NOT** BE ACCEPTED (EARLY IS OK). ANSWER ALL QUESTIONS, BUT ONLY 3 WILL BE MARKED. ALL MATERIAL WILL BE COVERED BEFORE THE DUE DATE.

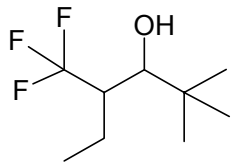
*NOTE: In many questions, I have told you to draw relevant interactions/structures/etc. to support your explanations. This should be standard practice any time you are asked to EXPLAIN anything. Next time, I won't explicitly ask for it...*

**# 1.** Complete the following table about common organic compounds.

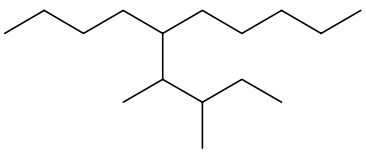
| Common name | IUPAC name | Condensed formula | Skeletal (line) structure | More soluble in ethanol *or* hexane? |
|---|---|---|---|---|
| *t*-butyl methyl ether | | | | |
| diisopropyl amine | | | | |
| neopentane | | | | |
| cyclohexyl bromide | | | | |

**# 2.a)** Provide systematic (IUPAC) names for the following molecules:

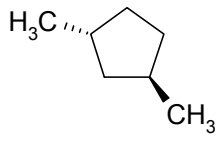
**i)**




**ii)**



**iii)**




**# 2.b)** Draw skeletal (line) structures of the following molecules:

**i)** 4-ethyl-*N*,*N*-dimethyl-3-heptanamine

**ii)** *cis*-1-chloro-2-methylcyclobutane

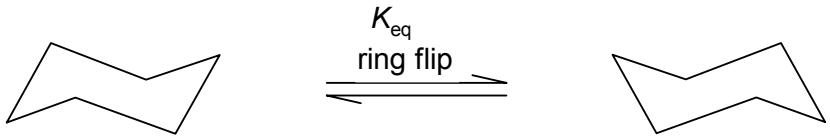
**# 3.** Draw condensed Lewis structures for all the constitutional isomers with the formula $C_4H_{11}N$. There are 8 isomers in total. Give their common names, and label them as 1°, 2° or 3° amines.
NOTE: you may draw condensed $CH_n$ groups, but please clearly show all C-N bonds and all Hs.

**# 4.a)** Draw the requested representations of the two extreme conformations of 2-fluoroethanol.

| | STAGGERED CONFORMATION | ECLIPSED CONFORMATION |
|---|---|---|
| Perspective formula | | |
| Newman projection | | |

**b)** Staggered conformations are normally preferred because they minimize torsional strain. Explain why a 2-fluoroethanol molecule might spend an unusually large proportion of its time in the eclipsed conformation. Include drawings of relevant interactions.

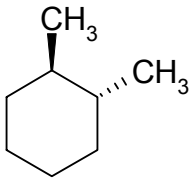
**# 5.a)** Draw the necessary substituents on the rings to complete the "ring-flipping" equilibrium for ethylcyclohexane. On each conformer, label the substituent as "axial" or "equatorial". Justify your assignment of the chair conformers' relative stabilities *(notice the labels underneath the chairs)* by identifying (drawing *and* naming) the relevant intramolecular interactions.

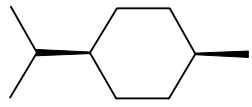


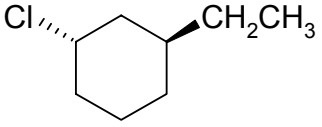

less stable conformer more stable conformer

**b)** The ring-flipping equilibrium constant, $K_{eq}$, is 21 for ethylcyclohexane at room temperature. Calculate the proportion of molecules (as a %) that have the more stable conformation in a sample of this liquid.

**# 6.** Draw the interconversion of chair conformations (ring-flipping) for the following disubstituted cyclohexanes, and circle the more stable conformer.
[Table 2.10 of Bruice may be helpful for predicting the relative bulkiness of substituents.]

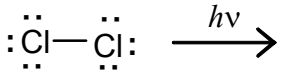
**a)** 


**b)** 

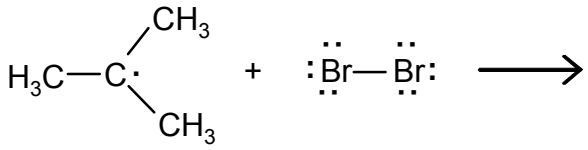
**c)** 

**# 7.** Curved "half-arrows" ( ⇀ ) are used to denote movement of single electrons, whereas full arrows (→) are used for describing the movement of electron pairs. Write appropriate curved arrow mechanisms for the following processes, and draw the expected radical products:

**a)** light-induced homolytic cleavage of a chlorine-chlorine bond




**b)** abstraction of a bromine atom from $Br_2$ by a *t*-butyl radical




**# 8.** If propane is treated with bromine in the presence of light, what will be the major monobrominated product: 2-bromopropane *or* 1-bromopropane? Explain your choice by discussing the mechanism of the reaction (hint: consider relative stabilities of intermediate species involved). Draw structures and/or write reactions to support your arguments.