Organic Chemistry CH 352-01 (Wilson)

Exam #3

April 1, 2003

Question 1 _______  (18)
Question 2 _______  (20)
Question 3 _______  (25)
Question 4 _______  (20)
Question 5 _______  (9)
Question 6 _______  (8)
BONUS _______  (3)

TOTAL _______ (100)

“Got my first chemistry set when I was seven, blew my eyebrows off, we never saw the cat again. I’ve been into it ever since.”

-Nicolas Cage from The Rock
1. Looking at the following two roadmaps, give structures for A, B, and C.

**A =**

**B =**

**C =**
2. Supply the missing products for five of the following six equations. Give answers for only five, and indicate which problems you would like graded.

a. 1-methyl-1,4-cycloheptanediol

\[
\begin{align*}
\text{1) O}_3 & \quad \text{2) Zn} \\
\text{3) NaBH}_4, \text{EtOH} \\
\end{align*}
\]

b. 2-hexanethiol

\[
\begin{align*}
\text{1) KOH} & \quad \text{2) Br} \quad \text{3) H}_3\text{O}^+ \\
\text{DMF} \\
\end{align*}
\]

c. m-chloroacetophenone

\[
\begin{align*}
\text{1) Ph}_2\text{CuLi} & \quad \text{2) OsO}_4, \text{NMO} \\
\text{3) } \text{IO}_4^- \\
\end{align*}
\]

d. styrene

\[
\begin{align*}
\text{1) mCPBA, CH}_2\text{Cl}_2 & \quad \text{2) H}_3\text{O}^+ \\
\text{3) PCC, CH}_2\text{Cl}_2 \\
\end{align*}
\]
3. Propose synthesis routes for TWO out of the following three compounds. Legal starting materials include mono-functional compounds of four carbons or less, benzene, 1,3-dithiane, bases for elimination and/or deprotonation, ethylene glycol (for protection only!), and any inorganic reagent or solvent required to carry out the transformation (CN, PPh\textsubscript{3}, NBS, etc. are all inorganic). Keep in mind there are many correct synthesis routes for each compound.

![Chemical structures](image)

All reasonable syntheses given credit. Really bad things are shown below. Don’t do this!

![Chemical reaction](image)

We know much better ways to put things on aromatic rings. You can only do S\textsubscript{N}2 reactions on sp\textsuperscript{3} hybridized carbons!

![Chemical reaction](image)

The Grignard reagent will deprotonate the alcohol first and not do the Grignard reaction. This goes for all organometallic nucleophiles!

4. Give complete arrow pushing mechanisms for two of the next three equations. Be sure to include all relevant resonance structures and account for at least one product. You may use the back of this page if you wish. (10 pts each)
5. Epichlorohydrin (1-chloro-2,3-epoxy propane) is a widely used “synthon” by organic chemists. Nucleophiles can add to multiple spots on this molecule, and this gives it a wide range of utility. Given the reaction below, the $^1$H NMR, and the FTIR spectra of the product, what do you think the product is? Support your answer with details from the spectroscopy.

![1H NMR spectrum](image1)

![FTIR spectrum](image2)

The key to this problem is seeing that there is no OH stretch in the IR spectrum. You have two choices (shown below) of nucleophilic addition, and clearly the addition takes place at the C-Cl bond. Comments about couplings and other IR stretches were given credit as well.

![Chemical structures](image3)
6. In Muppet Labs, the following molecule has been synthesized. It has been found to have anabolic and androgenic effects in male muppets, and works as a fertility drug for female muppets. Knowing what you know about other similar kinds of structures (they have a name that I am deliberately not using!), explain why this might be so. Use correct terminology, throw words around, impress me!

Key words I was looking for: steroid; hormone; testosterone; progesterone (or progestin); estrogen (or estrogens). I was also looking for correct discussion of androgenic and anabolic effects. Answers were accepted based on good arguments.

(3) **BONUS:** Name another Nic Cage movie. This is not an April fool's joke!

All correct answers accepted.