CHEM 8B Organic Chemistry II  
EXAM 1, Version A (300 points)

In each of the following problems, use your knowledge of organic chemistry conventions to answer the questions in the proper manner. **Be sure to read each question carefully.** You will have the entire class period to complete this exam (2 hours), but hopefully you won't need it! Draw a sombrero (hat) on the molecule of the problem you're skipping on page 6. You are welcome to use pre-built models.

Keep your eyes on your own paper. Electronic devices of any kind are not allowed, including cell phones and calculators. Any student found using any of said devices, examining another student's exam, cheat sheet, or outside resource, will be either moved to another seat or dismissed from the exam room and may receive a zero on this exam. Such an incident may also be reported to the UCSC Judiciary Affairs Committee.

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1. FUNdamentals

(a) (15 points) Classify each carbocation as 1°, 2°, or 3° and whether it is alkyl, allylic, or benzylic. Circle the classifications below each example.

\[ \begin{align*}
&\text{alkyl} / \text{allylic} / \text{benzylic} \\
&\text{alkyl} / \text{allylic} / \text{benzylic} \\
&\text{alkyl} / \text{allylic} / \text{benzylic}
\end{align*} \]

(b) (10 points) Use curved arrow notation and draw two resonance structures for the radical below.

\[
\begin{array}{c}
\text{move the radical}
\end{array}
\]

(c) (5 points) Add arrows to explain the transformation below.

\[
\begin{align*}
\text{CH}_3\text{CH}_2\text{CO} + \text{CH}_3\text{CH}_2\text{MgBr} & \rightarrow \text{CH}_3\text{CH}_2\text{COO}^- + \text{CH}_3\text{CH}_2\text{MgBr}
\end{align*}
\]

(d) (20 points) The arrow story – indicate the bond(s) broken and/or formed according to arrows (i) through (iv) in the mechanism below. Then draw the products.

(i) _________

(ii) _________

(iii) _________

(iv) _________
2. Acids & Basics

(a) (10 points) The following compounds are arranged from most (left) to least (right) acidic. Fill in the pKa values of each in the boxes provided.

(b) (15 points) Draw the products of the following acid-base reaction.

(c) (10 points) Rank the following sets of acids from most acidic (1) to least acidic (5), where #3 is provided. Put your answers in the box below each compound.

(d) (15 points) Indicate (circle) whether the arene substituent is an activator or deactivator and whether it is an ortho / para or meta director in electrophilic aromatic substitution. Draw one resonance structure and explain your choices.
3. (50 points) What’s in the Box?! – Fill in the missing reactants, reagents, and products.

(a)

(b)

(c)

(d)

(e)

(f)
4. (50 points) Reaction Puzzles

Puzzle 1 – Fill in all missing reagents and products in the boxes.

Puzzle 2 – Fill in all missing reagents and products in the boxes.
5. (50 points) **Mechanisms**

Draw the arrow-pushing mechanisms for both reactions. Be sure to clearly indicate all charged atoms and intermediates after each step (each mechanism involves at least two intermediates).

\[ \text{Cyclohexanol} + \text{H}^+ \rightarrow \text{Cyclohexene} \]

\[ \text{Cyclohexanol} + \text{H}^+ \rightarrow \text{Cyclohexene} \]
6. (50 points) **Multi-Step Synthesis – Choose any two**

Carry out two synthesis problems below using the starting material provided and any other reagents or sources of carbon needed. **Show the product after each reaction.** No mechanisms. Partial credit is given where possible so if you're stuck, take a deep breath then work backwards and/or forwards.

(a) \[
\text{HOH} \quad \text{\textrightarrow} \quad \text{HOH}
\]

(b) \[
\text{Cl} \quad \text{\textrightarrow} \quad \text{CCl}_2\text{H}
\]

(c) \[
\text{O} \quad \text{\textrightarrow} \quad \text{Br}
\]