A successful organic chemistry student will practice problems solving at every opportunity. Seeing mechanisms and problem solving in the text and during lecture is not enough to ensure success. The list below contains suggested homework problems. These problems are found within the text chapter and at the end of each chapter. The solutions and explanations for each problem are contained in the Study Guide – available for purchase in the bookstore or available for viewing at the Reference Desk in the library.

At this point in your college career, you should realize that “homework” is an important learning tool in its own right. Homework is not to be submitted and no points will be granted, although the instructor will be happy to discuss any questions you have.

Note to students: Some of these problems are found spread throughout the chapter, while the higher numbered problems will be found at the end of the chapter. The term or comments listed next to each problem below may or may not make sense to you; their purpose is to remind your instructor what topic each question addresses.

CHAPTER 1 HOMEWORK

2,3 isomers
5 c, d, k formal charge
6 c, d formal charge
7 formal charge
9 c, d, f Lewis showing LP
12 EN, partial charge
18 dipole moment from Lewis
19 BP with IM forces
20 sol in water
25 hydrogen bonding
30 acetonitrile (Lewis, Dip, Res)
31 resonance of NO

continued on other side
CHAPTER 2 HOMEWORK

11 classify func groups
15 classify func groups with carbonyl
16 classify func groups in complex molecule
17 ID hybrid
18 ID func groups
19 count sigma and pi
24 bromine + alkene
30 Lewis, hybrid, geo
33 classify func groups in complex molecule
35 a hybrid
37 H$_2$, Br$_2$ rxns

CHAPTER 3 HOMEWORK

1 ID acid/base Lewis struc
2 note to student: "Identify Lewis acid and base only"
3 Lewis acid and base reaction
7 predict prods from arrows
9 ID stronger acid
12 acidity order
15 Ka to pKa comparison
20 pKa predict rxn direction
23 acidic structure
29 acidity order
33 predict prods form arrows
CHAPTER 4 HOMEWORK

1. choose Nu/Ephil
2. Nuc Sub
3. Ephile metal
4. mechanism bleach
8. Elec Addn Predict
9. cation stability
10. cation stability
17. same as above
18. synthesis
19. EPhile/Nu, prod, mech
20. supply reagent
21. same as above

CHAPTER 5 HOMEWORK

7. ID alkyl groups
8. const isomers or not
13. draw chlorobutane conformers
15. line struc
16. condensed from line struc
17. name alkanes
18. write structures from names
20. nomen of alcohols and halides
21. write struc for alcohols and halides
25. name benzenes
26. draw benzenes
27. nomenclature of rings
28. draw structure from name
31. nomenclature
32. nomenclature
33. nomenclature
36. a) and b) conformers of cyclohexane
39. c) conformer using Newman Projections
40. cyclohexane conformers

continued on other side
It is strongly suggested you work the following additional problems issued by your instructor for Chapter 5.

Draw both chair conformations for each compound shown below. In each case, predict which conformer is more stable. You will need to build each chair carefully and then examine the positions of the substituents to make your decision.

a) cis-1,2-dimethylcyclohexane  
b) trans-1,2-dimethylcyclohexane  
c) trans-1-ethyl-3-methylycyclohexane

CHAPTER 6 HOMEWORK

6.2 chiral objects  
6.3 identify chiral centers  
6.8 name with R & S  
6.10 STUDENTS: Use Fischer Projections here.  
Draw and name stereoisomers  
6.23 name stereoisomers  
6.25 identify stereoisomer types

It is strongly suggested you work the following additional problems issued by your instructor for Chapter 6.

Problem #1: Examine the three Fischer Projections shown below:

**STRUCTURE A**  

**STRUCTURE B**  

**STRUCTURE C**
These structures each represent a compound known as tartaric acid. Let's assume that carbon #2 is the second carbon from the top. Answer the following questions. (The answers are given as well, so don’t peak until YOU get an answer!) HINT: The COOH is the priority #2 substituent in every case here.

1) Which structure is the (2S,3S) form?  
2) Which structure is the (2R,3S) form?  
3) Which structure is the (2R,3R) form?  
4) Which structure is a MESO form? How do you know?

ANSWER to Problem #1:

<table>
<thead>
<tr>
<th></th>
<th>1) Structure C is (2S,3S)</th>
<th>2) Structure A is (2R,3S)</th>
<th>3) Structure B is (2R,3R)</th>
<th>4) Structure A is MESO, because it contains a plane of symmetry.</th>
</tr>
</thead>
</table>

Problem #2: Which of the following disubstituted cyclohexanes would be considered ACHIRAL. How do you know?

Structure A  
Structure B  
Structure C  
Structure D

ANSWER to Problem #2:

Structures B and C contain a plane of symmetry and so are ACHIRAL.
CHAPTER 7 HOMEWORK

Problems marked with a "*" serve as excellent practice.

1 predict Substitution products
2 synthesis (optional - challenging problems!)
7 stereochemistry S_N2
9 resonance
10 S_N1, S_N2 pathways
11 choose better Nu
15 mechanism
23 mechanism for sub and elim
25 predict elim products
27* predict product
28* predict product
29 Nu strength
30 predict elim products
31 predict products
33* predict faster rxn
35 synthesis

It is recommended you examine the additional Chapter 7 exercises shown below. The topics illustrated are not covered by the textbook author's exercises. Try to work the problems without looking at the answers ahead of time.

#1) What major product is expected from each of the following two reaction paths?

\[
\begin{align*}
\text{CH}_3 & \xrightleftharpoons{\text{Br}^-} \text{CH} \xrightarrow{\text{t-butoxide}} \text{CH}_3 \\
\text{I} & \quad \text{I} \\
\end{align*}
\]
ANS: The bromide ion is a poor base but a fairly good nucleophile and so a substitution mechanism would result. The t-butoxide ion is a strong bulky base that will favor elimination.

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH} \quad \text{CH}_3 \\
\text{I} & \\
\text{I} & \\
\text{t-butoxide} & \\
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH} \quad \text{CH}_3 \\
\text{I} & \\
\text{Br} & \\
\end{align*}
\]

#2) Predict the two elimination products that could form from the reaction shown below. Which product is favored? Why?

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_2 \quad \text{CH} \quad \text{CH}_3 \\
\text{Br} & \\
\text{O-H} & \\
\end{align*}
\]

ANS: There is a choice between removal of two different beta hydrogens. The path that yields the more highly alkyl-substituted alkene is more stable (Saytzeff Rule).

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_2 \quad \text{CH} \quad \text{CH}_2 \\
\text{CH}_3 & \quad \text{CH} \quad \text{CH} \quad \text{CH}_3 \\
\end{align*}
\]

MINOR

MAJOR

#3) Examine the reaction shown below and take note of the changes in the carbon skeleton.

\[
\begin{align*}
\text{CH}_3 & \quad \text{C} \quad \text{C} \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{H} & \\
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3 & \quad \text{C} \quad \text{C} \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{H} & \\
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_2\text{OH} \quad -\text{H}^+ \\
\text{CH}_3 & \quad \text{C} \quad \text{C} \quad \text{CH}_3 \\
\end{align*}
\]

What mechanism is used to get the product shown? How did the carbon skeleton undergo this change?

ANS: The secondary alkyl halide undergoes a $S_N1$ reaction because a weak nucleophile is present. There is ample time for the $2^\circ$ carbocation to form. When it does, it can undergo a methyl shift to form the more stable $3^\circ$ carbocation. Then the ethanol molecule adds, a proton is released, and the final rearranged product is present.
CHAPTER 8 HOMEWORK
Problems marked with a "*" serve as excellent practice.

Chap 6.20  E/Z nomenclature
Chap 8
3  structure of alkenes
6  products of hydration and dehydration
8* rearrangement
13  hydrogenation
15  bromination
18  ozonolysis
22  a and c (ignore stereochemistry portion)
23  c only (peroxyacids)
25  nomenclature
26  nomenclature
29* predict reactions
30* a,d,e,f (predict reactions)
31* a,b,c,g (predict reactions)
32* b,c,e (predict reactions)
33* a,c,d,e,f,g,h (predict reactions)
34  optional (alkyl group shift)

It is recommended you examine the additional Chapter 8 exercises shown below. The topics illustrated are not covered by the textbook author's exercises. Try to work the problems without looking at the answers ahead of time.

1) Predict the product of the following reaction:

\[
\begin{align*}
\text{CH}_2 & \quad \text{CH}_2 \\
\text{C} & \quad \text{C} \\
\text{1) } & \quad \text{B}_2\text{H}_6 \\
\text{2) } & \quad \text{H}_2\text{O}_2, \text{OH}^- \\
\end{align*}
\]

Answer: \[
\begin{align*}
\text{C} & \quad \text{CH}_2\text{OH} \\
\end{align*}
\]
2) Predict the product of the following:

\[
\begin{align*}
\text{RCOOH} & \quad \text{H}^+ \\
\text{H}_2\text{O} & \\
\end{align*}
\]

Answer:

\[
\begin{align*}
\text{TRANS DIOL} \\
\end{align*}
\]

CHAPTER 13 HOMEWORK
Problems marked with a "*" serve as excellent practice.

4 properties
5 nomenclature
6 alcohol synthesis
8 alcohol synthesis
9 alcohol with HX
10 alcohol with HX
14 form alkyl halides from ROH
16 form cyclic ethers
17 a-d same
25 a,d,f,g,h oxidation and reduction
27 Cr (VI) oxidation
29 a, e oxidations
32 retrosynthesis
35* a-d, f-h reaction of alcohols
36* a-c, h same
38* a-g predict products
39 b,c,d same
41 a,b reagents
44 b,c,d reactions
48 a,b reactions
It is recommended you examine the additional Chapter 13 exercises shown below. The topics illustrated are not covered by the textbook author's exercises. Try to work the problems without looking at the answers ahead of time.

1) \[
\begin{array}{c}
\text{O} \\
. \\
. \\
\end{array}
\]

\[\xrightarrow{\text{HBr}}\]

\[\xrightarrow{\text{NaOH}}\]

2) \[
\begin{array}{c}
\text{CH}_3\text{CH}_2\text{OH} \\
\end{array}
\]

\[\xrightarrow{\text{PCC}}\]

**ANSWERS:**

1) HBr path \[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{OH} \\
\end{array}
\]

2) NaOH path \[
\begin{array}{c}
\text{H} \\
\text{H} \\
\text{OH} \\
\end{array}
\]

2) \[
\begin{array}{c}
\text{CH}_3\text{CH} \\
\end{array}
\]

END OF HOMEWORK!

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