**YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM**

- PRINT YOUR NAME ON EACH PAGE!
- READ THE DIRECTIONS CAREFULLY!
- USE BLANK PAGES AS SCRATCH PAPER
  work on blank pages will not be graded...
- WRITE CLEARLY!
- MOLECULAR MODELS ARE ALLOWED
- DO NOT USE RED INK
- DON'T CHEAT, USE COMMON SENSE!

**Infrared Correlation Chart**

- C-H: 3000–3100
- N-H: 3000–3100
- C=O: 1600–1660
- C-N: 1600–1660
- C=C: 1680
- C=CH: 1710
- C=CH2: 2200
- C=O: 2200
- O-H: 3500
- O-NR2: 1500
- O-CH3: 1650
- C-CH3: 1650
- C-NR2: 1500

**NMR Correlation Charts**

- R-NH2: variable and condition dependent, ca. 2–6 
- R-CH3: 1–2
- R-OH: 3–5
- R-C-NR2: 3–5
- Aromatic: 6–8
- Alkyl: 9–11
- Aromatic: 12–14
- Aromatic: 15–17

**Interaction Energies, kcal/mol**

Eclipsing

- H/H: ~1.0
- H/Me: ~1.4
- Me/Me: ~0.9
- Me/Me: ~2.6
- Et/Me: ~0.95
- i-Pr/Me: ~1.1
- t-Bu/Me: ~2.7
- Gauche

- Et/Et: ~3.1

**Class you are REGISTERED FOR (onground or hybrid)**

The room where most students will take the test for your class, i.e. LS A-191 for onground and PS H-152 for hybrid)

**Answer Key**

- Person on your LEFT (or Empty or Aisle)
- Person on your RIGHT (or Empty or Aisle)

PRINTED FIRST NAME ___________________________ PRINTED LAST NAME ___________________________

- The room where most students will take the test for your class, i.e. LS A-191 for onground and PS H-152 for hybrid)

**COMPLETE THIS SECTION : Up to TWO POINTS will be removed for incorrect/missing information!**
YOU MUST COMPLETE THIS PAGE WITH YOUR NAME
(EVEN THOUGH YOU ALREADY DID THIS ON THE COVER PAGE)
AND ALSO GIVE YOUR ASU OR POSTING ID NUMBER
WE NEED THIS NUMBER BECAUSE YOU WOULDN'T BELIEVE THE NUMBER OF
STUDENTS WHOSE NAMES WE CAN'T READ!

PRINTED FIRST NAME ____________________ PRINTED LAST NAME ____________________ ASU ID or Posting ID ____________________

Points by question
1_________ / 14
2_________ / 24
3_________ / 39
4_________ / 24
5_________ / 14
6_________ / 22
7_________ / 38

Points Removed for cover errors ___/2

Extra Credit ___/5

Total (incl Extra)______/175+5

**YOU ARE NOT ALLOWED TO TAKE SPARE COPIES OF THIS EXAM FROM THE TESTING ROOM**
Question 1 (14 pts.) Give the IUPAC name for the following compound. Be sure to use cis/trans, E/Z or R/S where appropriate.

6-bromo-4-methylhex-(3E)-en-(2R)-ol

grading - subtract 2 points each error, do not propagate errors

Question 2 (24 pts).

a) For the bonds indicated in the two structures below, give the acetylide anion, the organic structure it reacts with and all other required reagents/conditions to make that bond (you do not have to show how the acetylide anion is made).

b) The bond indicated in the structure below can NOT be made in an acetylide reaction. Briefly explain why (1 - 2 sentences maximum!).

bond can NOT be made because it is not possible to do an SN2 reaction at an sp2 hybridized carbon atom.
Question 3 (first part, 18 pts.) For each reaction
1) Provide the missing major organic product or reagents/conditions as appropriate
2) State whether each reaction is an Addition, Elimination, Substitution or Rearrangement
3) State whether each reaction is Reduction, Oxidation or Neither

a) \[
\begin{align*}
\text{Br} & \quad \longrightarrow \\
\text{addition} & \quad \text{neither}
\end{align*}
\]

b) \[
\begin{align*}
\text{addition} & \quad \text{reduction}
\end{align*}
\]

Question 3 (second part, 21 pts.) Give the major organic product or reagents/conditions for the following reactions
DO NOT STATE whether the reaction is Addition/Elimination/Substitution/Rearrangement
DO NOT STATE whether each reaction is reduction/oxidation/neither

a) \[
\begin{align*}
\text{Excess } \text{Na}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4/\text{H}_2\text{O} & \quad \text{Excess } \text{Na}^+ - \text{OMe} \\
\text{or any strong non-bulky base}
\end{align*}
\]

b) \[
\begin{align*}
\text{addition} & \quad \text{reduction}
\end{align*}
\]

c) \[
\begin{align*}
\text{addition} & \quad \text{neither}
\end{align*}
\]

d) \[
\begin{align*}
\text{addition} & \quad \text{reduction}
\end{align*}
\]

e) \[
\begin{align*}
\text{addition} & \quad \text{neither}
\end{align*}
\]

5 pts Extra Credit. Which functional group can be polymerized to form an organic metal?
- alcohol
- alkene
- alkyné
- epoxide

from "O-Chem in Real Life" page: organic metals, week #2
Question 4 (24 pts.) For (2R)-bromo-(3R)-methylpentane, draw a Lewis structure with wedged/dashed bonds with proper sterochemistry, draw a 3D/sawhorse structure AND a Newman projection of the conformation that would undergo E2 elimination, AND give the alkene that would be formed in an E2 elimination reaction, you do not need to show the lowest energy conformation.

Question 5 (14 pts). For synthesis of the structure below
1) decide which would be the best bond to make in an SN2 reaction
2) perform retrosynthetic analysis on the bond you want to make and give the synthons
3) give the synthetic equivalents to perform the SN2 reaction, assign each one as a Lewis acid or Lewis base, and give the curved arrow pushing showing bond formation
Question 6 (22 pts.) Show how you would synthesize the target compound on the right from the starting compound on the left. Show reagents and conditions, and the structures of important intermediate compounds. Do not show any (arrow pushing) mechanisms.
Question 7 (38 pts). Give a curved arrow pushing mechanisms for the following two reactions.

1) Add non-bonding electrons and C-H bonds to the line-angle structures as required.
2) Indicate the Lewis acid/Lewis base (LA, LB) at each INTERMOLECULAR step as appropriate, and whether they are also Brønsted acids/bases (LA/BA, LB, BB).
3) Include ALL IMPORTANT RESONANCE CONTRIBUTORS for intermediates.
4) GIVE THE NUMBER OF STEPS IN YOUR MECHANISMS.

a) \[ \text{Ph} \text{OH} \text{Ph} \text{H} \text{HCl cat. / H}_2\text{O} \rightarrow \text{Ph} \text{C}=\text{O} \text{Ph} \text{H} \text{H} \]

- Number of steps: 4

b) \[ \text{LB/BB} \text{OH} \text{conc. H}_2\text{SO}_4 \text{heat} \rightarrow \text{number of steps: 5} \]

- Number of steps: 5