**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!
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 ___________________________
KEY ASU ID or Posting ID __________________________

Points by question

1 _____________ /13
2 _____________ /25
3a _____________ /7
3b _____________ /7
3c _____________ /7
3d _____________ /7
3e _____________ /7
3f _____________ /7
4 _____________ /14
5a _____________ /22
5b _____________ /22
6a _____________ /22
6b _____________ /14

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.

5-bromo-(3R)-hydroxypentanal

Question 2 (25 pts.) Give a complete arrow-pushing mechanism for the following, indicate the Lewis and Bronsted acids/bases for each intermolecular step only (LB, LB, BB, BA), AND DRAW ALL RELEVANT RESONANCE CONTRIBUTORS FOR THE INTERMEDIATES.
Question 3 (42 pts.) Provide the missing major organic products or reagents/conditions as appropriate, you can IGNORE stereochemistry in these problems

(a)  
\[
\text{CH}_3\text{NH}_2 + \text{CO}/\text{HCl} \xrightarrow{\text{AlCl}_3} \text{CH}_3\text{NH}_2\text{CHO}
\]

(b)  
\[
\text{H} + \text{CH}_3\text{COOH} \xrightarrow{1 \text{ Equ. } \text{NH}_3/\text{HCl (cat.)}} \text{H}_3\text{COO} + \text{NH}_3
\]

(c)  
\[
\text{CH}_3\text{OH (solvent)} \xrightarrow{\text{CH}_3\text{O}^- + \text{Na}} \text{CH}_3\text{OH}
\]

(d)  
\[
\text{Br} + \text{N}_2\text{H}_4 \xrightarrow{\text{KOH}/\text{heat}} \text{Br}
\]

(e)  
\[
\text{TsOH (cat.)} \xrightarrow{\text{(do an intramolecular reaction here)}} \text{OR}
\]

(f)  
\[
\text{CO}_2\text{H} + 1. \text{KMnO}_4/\text{-OH}/\text{boil} \xrightarrow{2. \text{H}_3\text{O}^+} \text{CO}_2\text{H}
\]

Question 4 (14 pts.) Reaction A is faster than Reaction B. Give a BRIEF explanation.

A  \[
\text{CH}_3\text{O} \xrightarrow{\text{SO}_3/\text{H}_2\text{SO}_4} \text{CH}_3\text{O} + \text{SO}_3\text{H}
\]

B  \[
\text{O}_2\text{N} \xrightarrow{\text{SO}_3/\text{H}_2\text{SO}_4} \text{O}_2\text{N} + \text{SO}_3\text{H}
\]

- electron donating groups are ACTIVATING, which makes reaction at ALL positions faster
- electron withdrawing groups are DEACTIVATING, which makes reaction at all positions slower
Question 5 (44 pts.) Synthesize the (target) molecules on the right from the starting molecules on the left. This cannot be done in one reaction. Give reagents and conditions and the intermediate molecules at each step. Do not show any mechanisms or transient intermediates. If other isomers are formed at any step then you need to indicate this but you do not need to draw their structures.

a) 

b) (ignore stereochemistry)
Question 6 (36 pts.)

a) Give a complete arrow-pushing mechanism for the following, indicate the Lewis and Bronsted acids/bases for each INTERMOLECULAR step only (LB, LB, BB, BA), but you do NOT need to show all resonance contributors for intermediates.

b) Give a complete arrow-pushing mechanism for the following, indicate the Lewis and Bronsted acids/bases for each INTERMOLECULAR step only (LB, LB, BB, BA).

Extra credit question (5 pts). On what kind of structure is Agent Orange based on?

Ketone  Chlorobenzene  Benzaldehyde  Acetal