Chem 51A Midterm 2 Review
Section I: Multiple Choice (15 Questions)

1. Rank the following compounds in order of increasing melting point (left side is lower melting point and right is higher melting point)

   \[
   \begin{align*}
   \text{I} & \quad \text{Cl} \\
   \text{II} & \quad \text{OH} \\
   \text{III} & \quad \text{OH} \\
   \text{IV} & \quad \text{O}
   \end{align*}
   \]

   a. I < II < III < IV
   b. I < III < II < IV
   c. IV < III < I < II
   d. IV < III < II < I

2. Which one of the following molecules contains an ester?

   \[
   \begin{align*}
   \text{A} & \quad \text{OH} \quad \text{O} \\
   \text{B} & \quad \text{O} \\
   \text{C} & \quad \text{O} \\
   \text{D} & \quad \text{O}
   \end{align*}
   \]

3. Rank the following compounds in order of decreasing angle strain (Left side is more angle strain and right side is less angle strain).

   \[
   \begin{align*}
   \text{I} & \quad \text{II} \\
   \text{III} & \quad \text{IV}
   \end{align*}
   \]

   a. I > II > III > IV
4. Which branched substituent corresponds to isobutyl?

- b. II > I > III > IV
- c. IV > III > I > II
- d. IV > III > II > I

5. Ephedrine and pseudoephedrine are two medications that are used to treat nasal congestion. What is the relationship between one isomer of ephedrine (left molecule) and one isomer of pseudoephedrine (right molecule)?

- a. Enantiomer
- b. Diastereomer
- c. Meso
- d. Identical

6. Which of the following statements regarding the molecule below is FALSE?
a. Cholesterol has the ability to Hydrogen bond
b. Cholesterol is soluble in water (polar solvent)
c. Cholesterol contains multiple stereogenic centers
d. Carbon attached to the hydroxyl-functional group has tetrahedral geometry

7. Rank the following molecules in terms of increasing boiling point (Hint: Draw out structures!):

I.)  CH₃(CH₂)₃CH₃  
II.)  CH₃(CH₂)₃COOH  
III.)  CH₃(CH₂)₃CHO

a. I < II < III  
b. II < III < I  
c. III < I < II  
d. I < III < II  
e. II < I < III

8. What is the IUPAC name of the following compound?
   a. 3-propyl-4-ethylhexane  
   b. 3-ethyl-4-propylhexane  
   c. 3,4-diethylheptane  
   d. 1,5-dimethylhexane  
   e. 4,5-diethylheptane

9. Which of the following regarding alkanes is False?
   a. All alkane carbons are sp3 hybridized  
   b. All alkanes contain nonpolar bonds  
   c. All alkanes are nonpolar molecules  
   d. All alkanes are able to rotate around its sigma bond  
   e. Formula for alkanes is CₙH₂ₙ

10. The following Newman projection of butane has what types of strain energies?

I.) Ring Strain

II.) Torsional Strain

III.) Steric Strain

a. II only
11. Determine which pair of molecules are diastereomers.

b. III only
c. I and II
d. I, II, and III
e. II and III

12. Which of the following chair conformations is a valid chair-chair interconversion of the chair below?
13. Taxol is a drug used to treat lung cancer, ovarian cancer, and breast cancer. How many chiral centers does it have?

![Taxol molecule]

a. 1  
b. 6  
c. 11  
d. 15

14. What is the parent chain in the molecule below?

![Molecule with a branch and a bromine atom]

a. 1  
b. 6  
c. 11  
d. 15
a. Hexane  
b. Alkane  
c. Heptane  
d. Alkyl

15. Which of the following statements are true regarding soap? 
   a. The surface of micelles interact with and sticks to nonpolar grease  
   b. The nonpolar hydrocarbon tails of soap are solvated by opposite, polar solvent  
      water  
   c. The ability of soap to form a seamless polar and nonpolar boundary allows it to 
      remove and trap grease on the inside  
   d. Soap is able to dissolve grease and dirt because it is large and symmetrical

**Section II: Short Answer (4 Questions)**

1. Thalidomide was a drug developed in the 1950s and was commonly prescribed as a 
   sedative to treat nausea and insomnia. When thalidomide was being sold, the drug was 
   being sold as a racemic mixture. (R)-Thalidomide causes the intended pharmacological 
   effects while (S)-Thalidomide causes teratogenic effects (disturbs the development of 
   the fetus).  
   a. Determine whether the molecule below is (R)-Thalidomide or (S)-Thalidomide 
      and circle the stereogenic center.

   ![Thalidomide molecule](image)

   b. What type of intermolecular forces are present in the thalidomide (the isomer 
      determined in 1a)?

   c. Draw the enantiomer of the thalidomide isomer you identified in 1a.
d. How many stereoisomers of thalidomide (the isomer found in 1a) are possible?

2. Malic acid (shown below) is an organic compound naturally found in fruits and gives fruit a sour taste.

   ![Malic acid structure]

   a. Draw the 3 staggered Newman projections of malic acid around the C2 and C3 bond (C2 should be the atom in the front).

   b. Circle the newman projection conformation that is lowest in energy.

   c. What functional groups are present in malic acid?

   d. Is malic acid soluble in water? Explain why or why not.

3. For the following structure:
a. Circle ALL stereogenic centers of the molecule and determine if its R or S configuration

b. Draw all enantiomers of the original molecule.

c. Draw all diastereomers of the original molecule.

d. Draw both chair conformations of the original molecule. Circle the higher energy conformation

4. Lysergic acid diethylamide, commonly known as LSD, is a psychedelic drug used by the CIA during The Cold War to conduct unethical experiments in order to gain intelligence information from Soviet Union leaders and for other purposes. According to recent studies, the R-enantiomer is more potent than the S-enantiomer. The specific rotation of pure R-enantiomer is +13.8 (c=0.55 in CHCl3).

   a. As an organic chemist, you decide to investigate the properties of LSD. You dissolve 0.389 g of LSD in 1 mL of CH3Cl and measure the optical rotation in a 1.000 dm sample tube as +4.075°. What is the specific rotation?

   b. You are interested in the optical purity of the sample you prepared. What is the enantiomeric excess?
c. Determine the enantiomeric ratio of the LSD sample.

**Nomenclature Question:**

What is the name of this compound?