1. Rank the following compounds in the trend requested. (15 points each)
a. Rank the following acids by strength. The most acidic compound is 1, while the least acidic compound is 5.

\[ \text{H}_2\text{COOH} \quad \text{HF} \quad \text{Cl}_2\text{COOH} \quad \text{ClC}_2\text{COOH} \quad \text{ClCH}_2\text{COOH} \]

\[ 5 \quad 1 \quad 3 \quad 2 \quad 4 \]

b. Rank by stability. The most stable conformer is 1, while the least stable is 5.

\[ \text{CH}_3\text{CH}_2\text{C}_2\text{H}_2\text{H}_5 \quad \text{CH}_3\text{CH}_2\text{C}_2\text{H}_2\text{H}_5 \quad \text{CH}_3\text{CH}_2\text{C}_2\text{H}_2\text{H}_5 \quad \text{CH}_3\text{CH}_2\text{C}_2\text{H}_2\text{H}_5 \quad \text{CH}_3\text{CH}_2\text{C}_2\text{H}_2\text{H}_5 \]

\[ 2 \quad 4 \quad 1 \quad 5 \quad 3 \]

c. Rank by stability. The most stable compound is 1, while the least stable is 5.

\[ \text{C(CH}_3)\text{C}_2\text{H}_2\text{C}_2\text{H}_5 \quad \text{C(CH}_3)\text{C}_2\text{H}_2\text{C}_2\text{H}_5 \quad \text{C(CH}_3)\text{C}_2\text{H}_2\text{C}_2\text{H}_5 \quad \text{C(CH}_3)\text{C}_2\text{H}_2\text{C}_2\text{H}_5 \quad \text{C(CH}_3)\text{C}_2\text{H}_2\text{C}_2\text{H}_5 \]

\[ 1 \quad 2 \quad 5 \quad 3 \quad 4 \]

d. The following compounds are all conjugate bases of vitamin C (vitamin C is the protonated form of these compounds). Rank these conjugate bases by stability. The most stable structure is 1, while the least stable is 5.

\[ \text{HO}\text{C}_2\text{O} \quad \text{HO}^\ominus\text{C}_2\text{O} \quad \text{HO}\text{C}_2\text{O} \quad \text{HO}^\ominus\text{C}_2\text{O} \quad \text{HO}\text{C}_2\text{O} \]

\[ 1 \quad 4 \quad 5 \quad 2 \quad 3 \]
2. Supply an unambiguous name for the following compounds. (4 points each)

a. \[ \text{3-methylhexane} \]

b. \[ \text{1,1-dimethylcyclobutane} \]

c. \[ \text{4-bromo-1-chloropentane} \]

d. \[ \text{trans-1-methyl-4-(1-methylethyl) cyclohexane} \]

or

\[ \text{trans-1-isopropyl-4-methylcyclohexane} \]

e. \[ \text{1,1-difluoro-3-iodopropane} \]

f. \[ \text{3-ethyl-2-methylhexane} \]

g. \[ \text{CH}_3\text{CH}_2\text{CH(CH}_3)_2 \]

\[ \text{2-methylbutane} \]

3. Consider the molecule \( \text{A} \) listed below.

\[ \text{H}_2\text{N}-\text{OH} \]

a.(6) Draw the conjugate base of \( \text{A} \).

\[ \text{H}_2\text{N}-\overset{-}{\text{O}}- \]

b.(6) Draw the conjugate acid of \( \text{A} \).

\[ \overset{+}{\text{H}_3\text{N}}-\text{OH} \]
4. Consider the molecule CH₃CO₂CCH
   a. (6) Draw a Lewis dot structure for this compound.

   ![Lewis structure]

   b. (12) What is the hybridization for each nonhydrogen atom in this molecule? (The atoms are labeled from left to right in the structure above.)

   C₁ _sp³_  C₂ _sp²_  O₁ _sp²_  O₂ _sp³_  C₃ _sp_  C₄ _sp_

   c. (6) What is the bond angle between the atoms O₂-C₃-C₄?

   180˚

5. Consider the molecule drawn below.

   ![Molecule diagram]

   a. (10) Draw the two chair conformations for the cis isomer of this compound. Circle the one that is more stable.

   ![Cis conformations]

   b. (10) Draw the two chair conformations for the trans isomer of this compound. Circle the one that is more stable.

   ![Trans conformations]

   c. (4) Is the cis or trans isomer more stable for this compound? Why?

   Cis is more stable because it allows a conformation where both substituents are equatorial.
6.(18) Draw all stereoisomers of 1,3-dibromocyclopentane.

7.(24) Consider the molecule (3R,2R)-3-bromo-2-chloro-1-fluorobutane. Draw this compound in a line drawing, Fischer projection, and a Newman projection looking down the C3(front)-C2(back) bond.
8. (30) Below are some organic compounds with biological activity. In each structure indicate the chirality (R or S) at each chiral center. Be sure to indicate which atom you are referring to for each assignment.

- L-Dopa
- Ibuprofen
- Methylphenidate, trade name Ritalin
- Ephedrine
9.(30) For each pair of compounds below indicate whether they are identical (I), enantiomers (E), diastereomers (D), constitutional isomers (C), resonance structures (R), or not related by any of these terms (N). Circle the appropriate letter for each pair of compounds.