1. Draw stereochemical formulas for all the possible stereoisomers of the following compounds. Label pairs of enantiomers and meso compounds.
(a) $CH_3CHBrCH_2CH(CH_3)NH_2$
(b) $CH_3CHBrCH_2CH_2CH(CH_3)Br$
(c) $CH_3(CHOH)_3CH_3$
(d) 1,4-dicyanocyclohexane

2. (a) What is the lowest molecular weight alkane that is chiral? Draw stereochemical formulas of the enantiomers and specify each as R or S. (b) What is the other alkane with the same molecular weight that is also chiral? Give structures for the enantiomers and designate as R or S. (c) Draw the structure of the lowest molecular weight alkane that is meso.

3. In a study of the chlorination of propane, four products (A, B, C, and D) of formula $C_3H_6Cl_2$ were separated by gas chromatography. Further chlorination of A, B, C, and D gave 1, 2, 3, and 3 trichloroproducts, respectively. Use of chiral shift reagents in NMR experiments showed that only C could be obtained in optically active form. Identify A, B, C, and D.

4. Identify the relationship between the following pairs of molecules, e.g., conformational enantiomers, configurational diasteromers, identical, etc. Provide a structural drawing for each molecule.
(a) (R,R)-2,3-dibromobutane and (S,S)-2,3-dibromobutane (Fischer projection)
(b) (+)-tartaric acid and meso-tartaric acid (Fischer projection)
(c) 1,3-diaxial-dimethylcyclohexane and 1,3-diequatorial-dimethylcyclohexane (chair conformation)
(d) (3R,5S)-3,5-dihydroxyheptane and (3S,5R)-3,5-dihydroxyheptane
(e) cis-1-ethyl-2-methylcyclohexane and trans-1-ethyl-2-methylcyclohexane

5. The specific rotation of (+)-tartaric acid is +12.0°. What is the optical purity, enantiomeric excess, and percentage composition of a mixture of (+)- and (–)-tartaric acid with a specific rotation of 9.8°?

6.
(a) Draw a structure with formula $C_4H_4F_2Cl_2$ that is **not** optically active and **does not** have a plane of symmetry in any conformation.
(b) Draw three enantiomeric pairs with formula C_5H_8.