Stereochemistry

**Step 1.** How many stereocenters does the molecule have?

1. Is the atom tetrahedral?
2. Are all four groups around it different (atoms, groups of atoms, lone pairs)?
   * Repeat for every possible stereocenter.

**Step 2.** Are the stereocenters R or S?

1. What are the priorities of the groups around the stereocenter?
   * Go by atomic number of the atoms bonded directly to the stereocenter. If two or more tie, go the the atoms bonded to those atoms and compare them, etc. For double bonds you can count that atom twice.
2. Looking down the bond from the stereocenter to its lowest priority group, do the higher priority groups go clockwise (R) from 1 to 3 or counterclockwise (S)?
   * Repeat for every stereocenter.

**Step 3.** How many stereoisomers does it have?

1. How many stereocenters does it have?
   * \(2^n\)
2. Is the molecule or any of its diastereomers a meso compound?
3. Does it have an internal plane of symmetry?
   * Subtract one for every meso compound.

**Step 4.** Is this molecule chiral?

1. Does the molecule have stereocenters?
2. Is the molecule a meso compound?
   * If yes and no, it is chiral.

**Step 5.** Which way does this molecule rotate polarized light?

1. Do you know whether the molecule is (+) or (-)?
   * If (+), clockwise. If (-), counterclockwise.
1. Draw a 3D form of this molecule
2. Find the stereocenters
3. Label them as you drew them
4. Draw and label the other stereoisomer:
5. Which way does each rotate light?

An advertisement by the Eastman Fine Chemicals Company (*J. Org. Chem.* 1992, 57 (9)) announces that the optically active molecules (R)-1-phenyl-1,3-propanediol and (S)-1-phenyl-1,3-propanediol can be purchased

a) Draw clear, 3D representations for these two molecules

b) The solubility of the (R)-isomer is greater than that of the (S)-isomer
equal to less than

c) The boiling point of the (R)-isomer is greater than that of the (S)-isomer

equal to less than

is is more likely to be
is less likely to be
is as likely to be the (R)-isomer as the (S)-isomer

d) The dextrorotatory isomer

e) What is the stereochemical relationship of these 2 molecules?

f) Draw a molecule:
   1) with the same molecular formula as these two molecules;
   2) with the same functional groups; and
   3) that is optically inactive