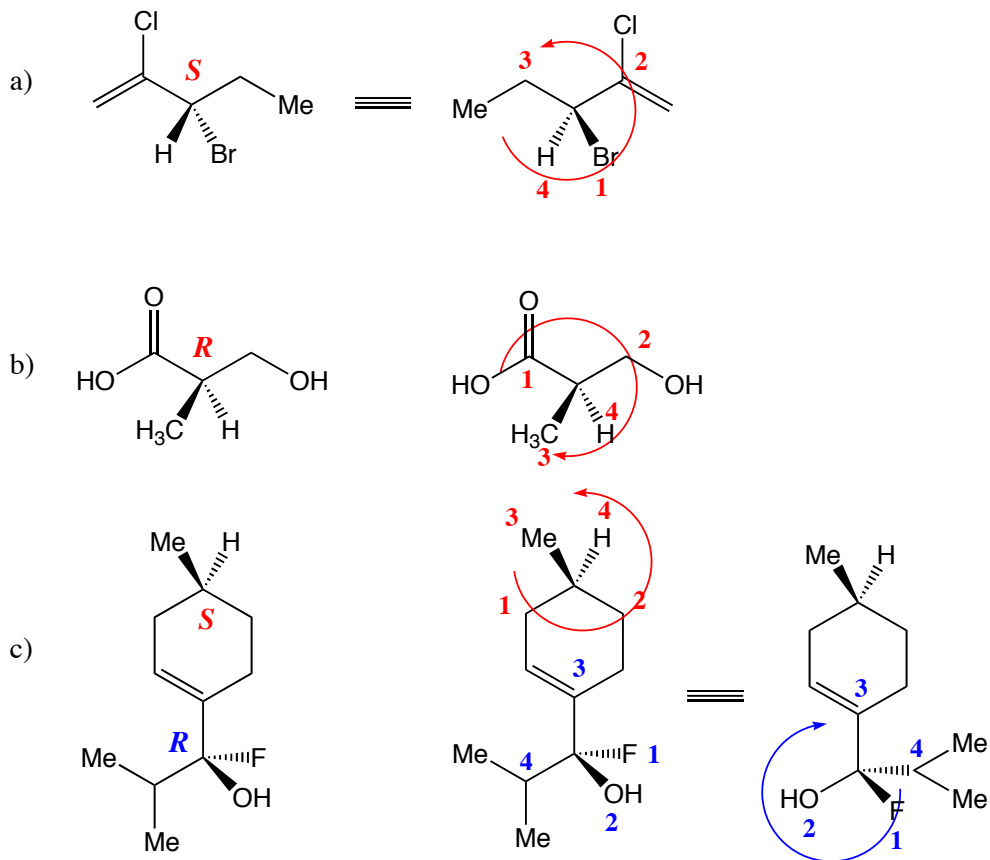


**Answers to Problem Set #4**

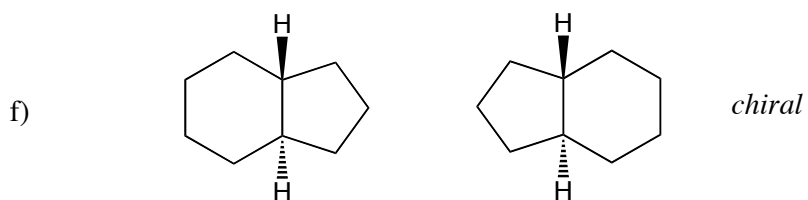
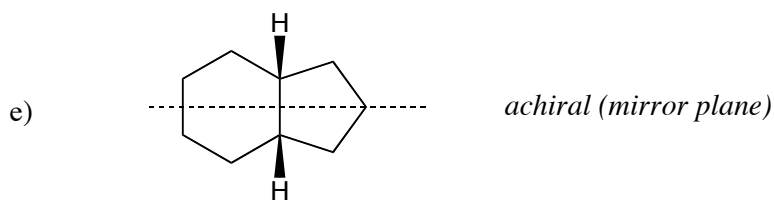
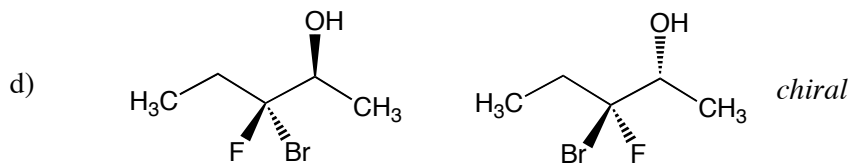
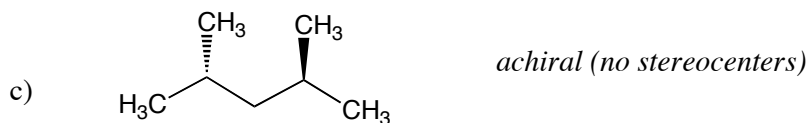
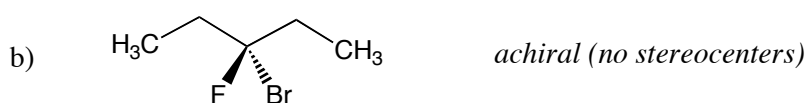
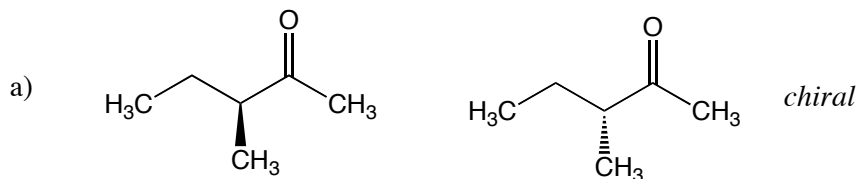
Question 1. Label each of the following molecules as chiral or achiral. For each achiral compound, describe why it is achiral (internal mirror plane, no stereocenters, etc.).

- |  |  |
|--|--|
| a. CHBrCl                                | <i>chiral</i>                                |
| b. CHF <sub>2</sub> Br                   | <i>achiral, no stereocenter</i>              |
| c. 2-methylheptane                       | <i>achiral, no stereocenter</i>              |
| d. 3-methylheptane                       | <i>chiral</i>                                |
| e. 4-methylheptane                       | <i>achiral, no stereocenter</i>              |
| f. <i>cis</i> -2-butene                  | <i>achiral, no stereocenter</i>              |
| g. <i>trans</i> -2-butene                | <i>achiral, no stereocenter</i>              |
| h. <i>cis</i> -1,2-dimethylcyclobutane   | <i>achiral, meso compound (mirror plane)</i> |
| i. <i>trans</i> -1,2-dimethylcyclobutane | <i>chiral</i>                                |

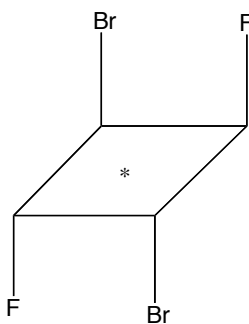
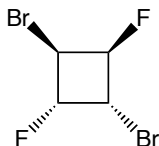
Question 2. Assign the stereochemistry (*R* or *S*) for each stereocenter in the following molecules.



Question 3. Determine whether the following molecules are chiral. For each chiral compound, draw the enantiomer. For each achiral compound, explain why it is achiral (internal mirror plane, no stereocenters, etc.).



Question 4. The following compound is a bit of an oddity. Is it chiral or achiral? How many stereocenters does it contain? Does it have an internal mirror plane? Does this change our "rules" for chirality at all?



*This molecule is achiral (mirror images are superimposable)*

*It contains **zero** stereocenters (wierd - I know)*

*It does **not** have a mirror plane – but it does contain a type of symmetry. It contains a **point of inversion** (all aspects of the molecule are reflected through this point - marked with a \*). Molecules with points of inversion are rare.*

*This does not change our rules for chirality - whether a molecule is or is not superimposable with its mirror image. But some "strange" molecules may force us to look very closely!*