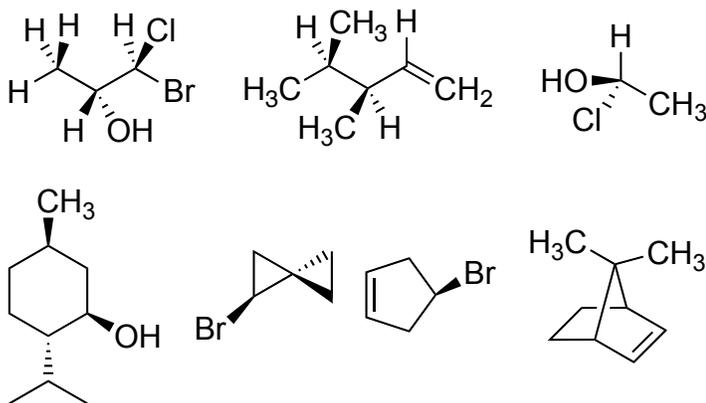


Name: _____ SB#: _____

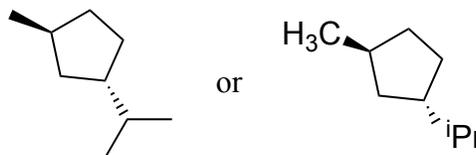
Please do all work on your own paper and use this page as your cover sheet. Staple all pages behind this page.

1. For each of the following structures, identify all chiral centers with a star (*), and further label the center (*R*) or (*S*). Identify any internal mirror planes of symmetry. Label the molecule chiral or achiral and label any *meso* structures. Redraw each structure on your own paper.

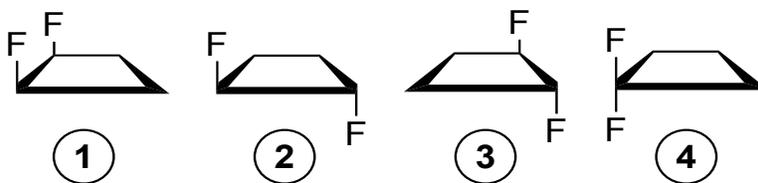


2. Draw the structure (lines, wedges, dashes and abbreviations like “Me”, “Et” only please; i.e. don't draw out all the carbons) and IUPAC name for each isomer having the formula C_9H_{18} and that contains a **5-membered ring bearing exactly 2 substituents**. Identify with (*R*) or (*S*) any and all chiral centers in the isomers. (Expect to find **over 20 isomers!**)

For example, (*1S,3S*)-1-isopropyl-3-methylcyclopentane is



3. Here are 4 isomeric difluorocyclobutanes:



- (a) How are the compounds in each pair related (enantiomers, diastereomers, or constitutional isomers)?
Give relation of: **1 vs. 2, 1 vs. 3, 1 vs. 4, 2 vs. 3, 2 vs. 4, 3 vs. 4.**
- (b) Identify each compound as chiral or achiral.
- (c) Which compounds, alone, would be optically active?
- (d) Which compounds have a plane of symmetry?
- (e) Are the boiling points of these pairs expected to be the same or different? **1 and 2, 2 and 3, 3 and 4**
- (f) Are any of the compounds *meso*?
- (g) Would an equal mixture of **1** and **2** be optically active? How about an equal mixture of **2** and **3**?