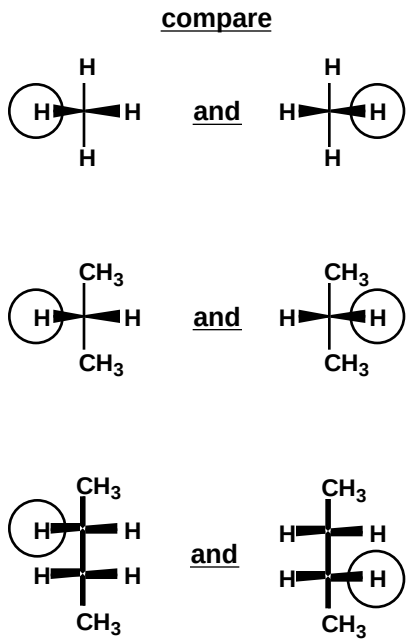
Text Related to Segment 6.02 ©2002 Claude E. Wintner

To begin, we shall illustrate our simple test using the constitutionally non-distinguishable hydrogen atoms in methane. We write the molecule twice (first line of the figure). Of the two constitutionally non-distinguishable groups we wish to compare, we mark with a circle one of them in one formula (which, remember, corresponds to a three-dimensional model). We mark the other group in the other formula. The circle is, as it were, a "reporter" about the state of affairs at the group in question. Now we compare the two formulae (models), *including* the marker. The two entire arrays are congruent — indistinguishable (just rotate the formula to see this). It follows that the groups that were marked cannot be distinguished. Such groups or atoms are called *configurationally stereohomotopic,* or, simply, *homotopic.*



In each pair the two formulae, including the "reporter" circles, are congruent — indistinguishable; the particular groups (hydrogen atoms) being compared are homotopic.

identification of homotopic groups

Thus, all four hydrogen atoms in methane are homotopic. If each were to be replaced (separately) by a group X, as in the previous segment, the four products would be, in all respects, indistinguishable. The same is true of the two

constitutionally non-distinguishable methylene hydrogen atoms in propane; again, they are homotopic. (And the same is true of all six methyl hydrogen atoms in propane as well.) Finally, we consider *one specific pair* of methylene hydrogen atoms in normal butane, with the same result. Note that we do *not* apply this test to a methyl hydrogen and a methylene hydrogen in propane or n-butane! We already have dealt with that situation; methyl and methylene hydrogen atoms reside in constitutionally *different* environments, and thus their comparison is of no interest in the present context.