

Group G: Isomers

Isomers are chemical compounds with the same chemical formula, but which have different chemical and physical properties. In this part of the exercise we will consider three types of isomers of the many that exist. These are *constitutional isomers* (compounds where the bonds are different, but the atoms are the same), *geometric isomers* (the bonds are the same, but their arrangement in space is different) and *rotational isomers* or *rotamers* which arise by the rotation about a bond.

The chemical formula for the molecule CH_3CHClF is a structural formula (attempts to show how the atoms are connected). There are two different ways in which this molecule can be constructed without changing the nature, or the number, of the chemical bonds. These compounds are different, and are examples of a class of geometric isomers called *enantiomers*. Examine the models to determine how enantiomers are related to each other.

The chemical formula for the molecule $\text{C}_2\text{H}_2\text{Cl}_2$ is not a structural formula. There are three ways in which to construct molecules with this chemical formula. Two of them have the atoms connected in the same way, but differ only in how the atoms are arranged in space. They are examples of geometric isomers called *diastereomers*. In the third molecule the atoms are connected differently, and so it is a *constitutional isomer* of the other two. From your models can you tell how diastereomers differ from enantiomers?

Take your models of C_2H_2 , C_2H_4 and C_2H_6 from Part E, and holding one of the carbon atoms, gently try to rotate the other carbon atom. The carbon atoms of C_2H_6 can be rotated relative to each other, but the others can not. Why can this rotation occur? As you rotate about the carbon-carbon bond in the molecule for which this is possible you will notice two limiting arrangements of the atoms relative to each other. Draw these two rotamers.

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
CH_3CHClF (first way)				-----
CH_3CHClF (second way)				-----

Species	Lewis Dot Structure	Electron Pair Geometry	Molecular Shape	Polarity
C ₂ H ₂ Cl ₂ (first way)				-----
C ₂ H ₂ Cl ₂ (second way)				-----
C ₂ H ₂ Cl ₂ (third way)				-----
CH ₃ CH ₃ (first rotamer)				-----
CH ₃ CH ₃ (second rotamer)				-----