Understanding Bond Types

Chapter 13 Part 1

Name ____________________

Class ____________________

Date ____________________

▶ One way to understand the terms *covalent bond*, *polar covalent bond*, and *ionic bond* is to think of these three bond types as part of a continuum of bond possibilities. The character of the bond depends on how strongly each of the atoms attracts an electron pair. The electronegativity of an atom is a measure of its electron-attracting power.

Diatomic molecules formed from the same two atoms, such as Cl_2, always form nonpolar covalent bonds because there is no electronegativity difference. When one of the chlorine atoms in Cl_2 is replaced by an element with less electron-attracting power, the electron pair is drawn closer to the chlorine nucleus and farther from the other nucleus. The degree of departure from equal sharing depends upon the magnitude of the electronegativity difference.

In the table, the electronegativities of chlorine and six other elements are shown on the right of the models. The first model represents the Cl_2 molecule. A pair of electrons is shown equally shared by the chlorine nuclei. Calculate the electronegativity difference between chlorine and each of the other atoms and enter these differences in the table. Use these electronegativity differences to position the electrons between the six pairs of atoms. The greater the electronegativity difference, the closer the electrons are drawn to the more electronegative atom. Indicate in column 5, whether you consider the bond covalent, polar covalent, or ionic. Add ion charges (+ or –) or partial charges (∂^+ or ∂^-) to the atoms of your models wherever charges are justified. (Note: The uniform size of the circles representing all the elements does not reflect the fact that the atoms have different atomic radii.)

Bond	Model	Electronegativities	Electronegativity Difference	Bond Type
Cl – Cl	(Cl) : (Cl)	3.0 and 3.0		
Cl – S	(Cl) (S)	3.0 and 2.5		
Cl – P	(Cl) (P)	3.0 and 2.1		
Cl – Si	(Cl) (Si)	3.0 and 1.8		
Cl – Al	(Cl) (Al)	3.0 and 1.5		
Cl – Mg	(Cl) (Mg)	3.0 and 1.2		
Cl – Na	(Cl) (Na)	3.0 and 0.9		