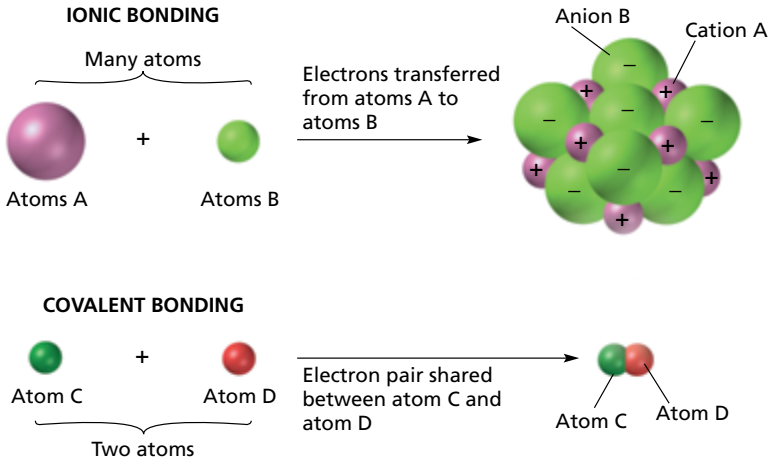

FIGURE 1 In ionic bonding, many atoms transfer electrons. The resulting positive and negative ions combine due to mutual electrical attraction. In covalent bonding, atoms share electron pairs to form independent molecules.

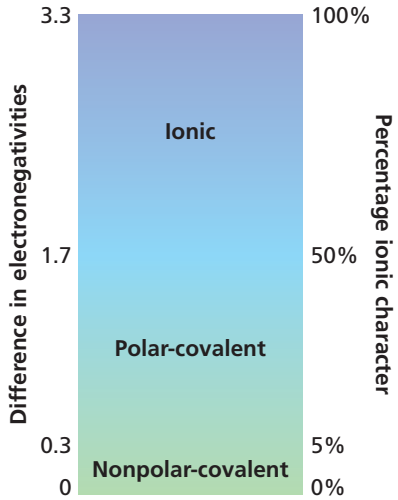

FIGURE 2 Differences in electronegativities reflect the character of bonding between elements. The electronegativity of the less-electronegative element is subtracted from that of the more-electronegative element. The greater the electronegativity difference, the more ionic is the bonding.

the elements' electronegativities (see **Figure 2**). For example, the electronegativity difference between fluorine, F, and cesium, Cs, is 4.0 – 0.7 = 3.3. (See **Figure 20** on page 161 for a periodic table of electronegativity values.) So, according to **Figure 2,** cesium-fluorine bonding is ionic. Fluorine atoms, which are highly electronegative, gain valence electrons, causing the atoms to become anions. Cesium atoms, which are less electronegative, lose valence electrons, causing the atoms to become cations.

Bonding between atoms with an electronegativity difference of 1.7 or less has an ionic character of 50% or less. These compounds are typically classified as covalent. Bonding between two atoms of the same element is completely covalent. Hydrogen, for example, exists in nature not as isolated atoms, but as pairs of atoms held together by covalent bonds. The hydrogen-hydrogen bond is a **nonpolar-covalent bond,** *a covalent bond in which the bonding electrons are shared equally by the bonded atoms, resulting in a balanced distribution of electrical charge.* Bonds having 0% to 5% ionic character, corresponding to electronegativity differences of roughly 0 to 0.3, are generally considered nonpolar-covalent bonds. In bonds with significantly different electronegativities, the electrons are more strongly attracted by the more-electronegative atom. *Such bonds are* **polar,** *meaning that they have an uneven distribution of charge.* Covalent bonds having 5% to 50% ionic character, corresponding to electronegativity differences of 0.3 to 1.7, are classified as polar. *A* **polar-covalent bond** *is a covalent bond in which the bonded atoms have an unequal attraction for the shared electrons.*

Nonpolar- and polar-covalent bonds are compared in **Figure 3,** which illustrates the electron density distribution in hydrogen-hydrogen and hydrogen-chlorine bonds. The electronegativity difference between chlorine and hydrogen is 3.0 – 2.1 = 0.9, indicating a polar-covalent bond. The electrons in this bond are closer to the more-electronegative chlorine atom than to the hydrogen atom, as indicated in **Figure 3b.** Consequently, the chlorine end of the bond has a partial negative charge, indicated by the symbol δ–. The hydrogen end of the bond then has an equal partial positive charge, δ+.