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ANALYZING DATA

Calculate Bond Polarity

Electronegativity is the ability of an atom of an element to attract electrons when the atom is in a compound. A covalent bond is formed by sharing one or more pairs of electrons between two atoms. The bond is polar if the electrons are shared unequally between the two atoms. Atoms with higher electronegativity values attract electrons more strongly and gain a slightly negative charge. The less electronegative atom in a bond gains a slightly positive charge, as its electrons are pulled toward the other atom.

Figure 1 lists the electronegativity values for a few main-group elements. **Figure 2** shows how the electronegativity difference between two atoms is related to the type of bond that is likely to form.

Figure 1

Electronegativity Values and Other Data for Selected Elements							
Element	**Na**	**H**	**C**	**Cl**	**N**	**O**	**F**
Electronegativity (Pauling units)	0.9	2.1	2.5	3.0	3.0	3.5	4.0
Atomic number							
Number of valence electrons							

Figure 2

Electronegativity Differences and Bond Types	
Electronegativity difference range	**Most probable type of bond**
0.0–0.4	Nonpolar covalent
0.4–1.0	Moderately polar covalent
1.0–2.0	Very polar covalent
≥ 2.0	Ionic

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1. **SEP Compare Data** Which of the elements shown in **Figure 1** has the highest electronegativity? Which has the lowest?

2. **SEP Interpret Data** In an N—H bond, the difference in electronegativity is 0.9, suggesting that the atoms have a moderately polar covalent bond. Using the data in **Figure 1** and **Figure 2,** suggest the likely type of bond in the following substances: HCl, HF, NaCl, CO, and NO.

3. **SEP Construct an Explanation** A diatomic molecule consists of two atoms. At room temperature and standard pressure, hydrogen exists as a diatomic gas, H_2, with a nonpolar covalent bond. Look at **Figure 2** and explain why any particle consisting of two identical atoms will have a nonpolar covalent bond.

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4. **SEP Obtain Information** Using a periodic table, complete **Figure 1** by filling in the atomic number for each element and the number of electrons in the outer shell.

5. **CCC Patterns** Look at **Figure 1.** What relationship do you see between the electronegativity values of the elements and the number of electrons in their outer shells?

6. **SEP Analyze Data** Look at **Figure 1.** Sodium (Na) and hydrogen (H) have the same number of electrons in their outer shells but different atomic numbers and different electronegativity values. The same is true of chlorine (Cl) and fluorine (F). In each pair, what relationship do you see between the atomic numbers and the electronegativities?

7. **Predict** A cesium (Cs) atom has an atomic number of 55 and one electron in its outer shell. Considering the data in **Figure 1** and **Figure 2,** what electronegativity value would you expect it to have, and what kind of bond is it likely to form with a chlorine atom? Explain your reasoning.