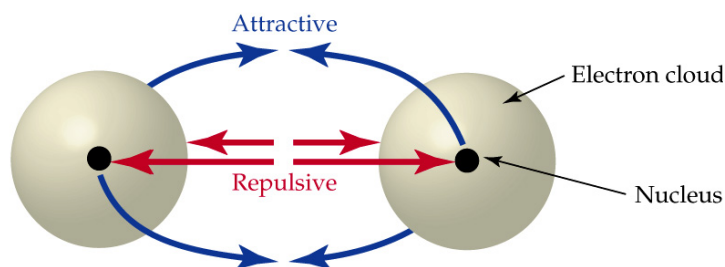


## Covalent Bonds

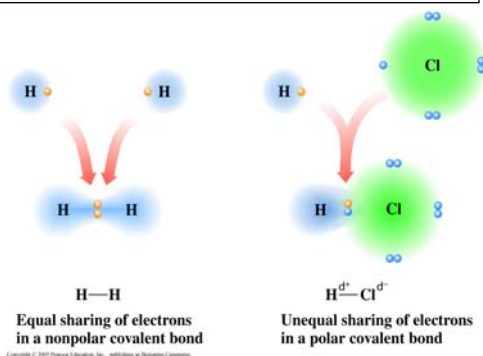
- **Covalent bonds** are formed when **two non-metal atoms** share electrons
- The bond is formed by the overlap of the atomic orbitals containing the outer most electrons



When two electrons are shared in a bond, they are called **bonding electrons**. Unshared electron pairs are called **non-bonding electrons** or **lone pairs**.

## Polar Covalent Bonds

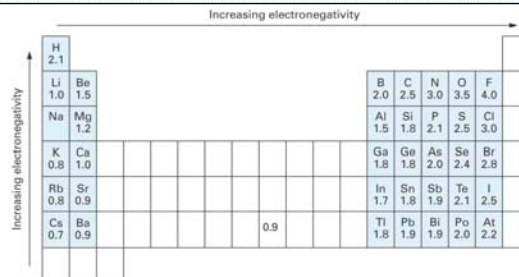
- Often, the two atoms in a covalent bond do not share the electrons equally
- When one of the atoms holds the shared electrons more tightly, the bond is **polarized**.



- A **polar covalent bond** is one in which the electrons are not shared equally.
- The unequal sharing of electrons is dependent on the **electronegativity** of the atoms in the bond

# Electronegativity

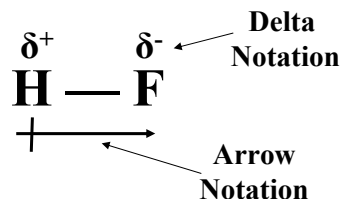
- Electronegativity (EN)** is the ability of an atom to attract bonding electrons towards itself.



- We can estimate the polarity of a bond calculating the difference in electronegativity between the two atoms in the bond



Electronegativities: 2.1 4.0  
Difference ( $\Delta\text{EN}$ ): 1.9



# Polar Covalent Bonds

- As a general rule for two atoms in a bond, we can calculate an electronegativity difference ( $\Delta\text{EN}$ ):

$$\Delta\text{EN} = \text{EN}(\text{Y}) - \text{EN}(\text{X}) \text{ for } \text{X}-\text{Y} \text{ bond}$$

- If  $\Delta\text{EN} < 0.5$  the bond is **non-polar covalent**.
- If  $0.5 < \Delta\text{EN} < 2.0$  the bond is **polar covalent**.
- If  $\Delta\text{EN} > 2.0$  the bond is **ionic**.

