



# Electronegativity

UNIT 3 PERIODIC TRENDS

# Bonding Electrons

- ▶ Electronegativity is a measure of the tendency of an atom to **attract a bonding pair of electrons**.

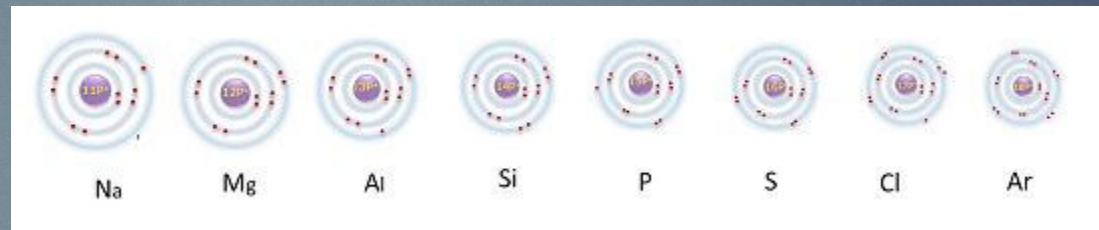
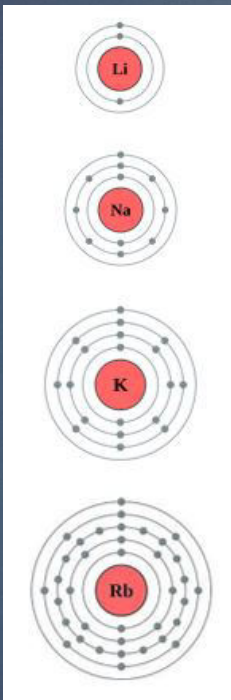
			1s	2s	2p
Lithium	Li	$1s^2 2s^1$	$\uparrow\downarrow$	$\uparrow$	$\square\square\square$
Beryllium	Be	$1s^2 2s^2$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\square\square\square$
Boron	B	$1s^2 2s^2 2p^1$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\square\square$
Carbon	C	$1s^2 2s^2 2p^2$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\uparrow\square$
Nitrogen	N	$1s^2 2s^2 2p^3$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\uparrow\uparrow$
Oxygen	O	$1s^2 2s^2 2p^4$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow\uparrow\uparrow$
Fluorine	F	$1s^2 2s^2 2p^5$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow\uparrow\downarrow\uparrow$
Neon	Ne	$1s^2 2s^2 2p^6$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow\uparrow\downarrow\uparrow\downarrow$

- ▶ **Fluorine** has the highest electronegativity because it only needs to gain one more electron to complete its valence orbital.
- ▶ **Noble gases** cannot attract any more electrons because their valence orbitals are already full.



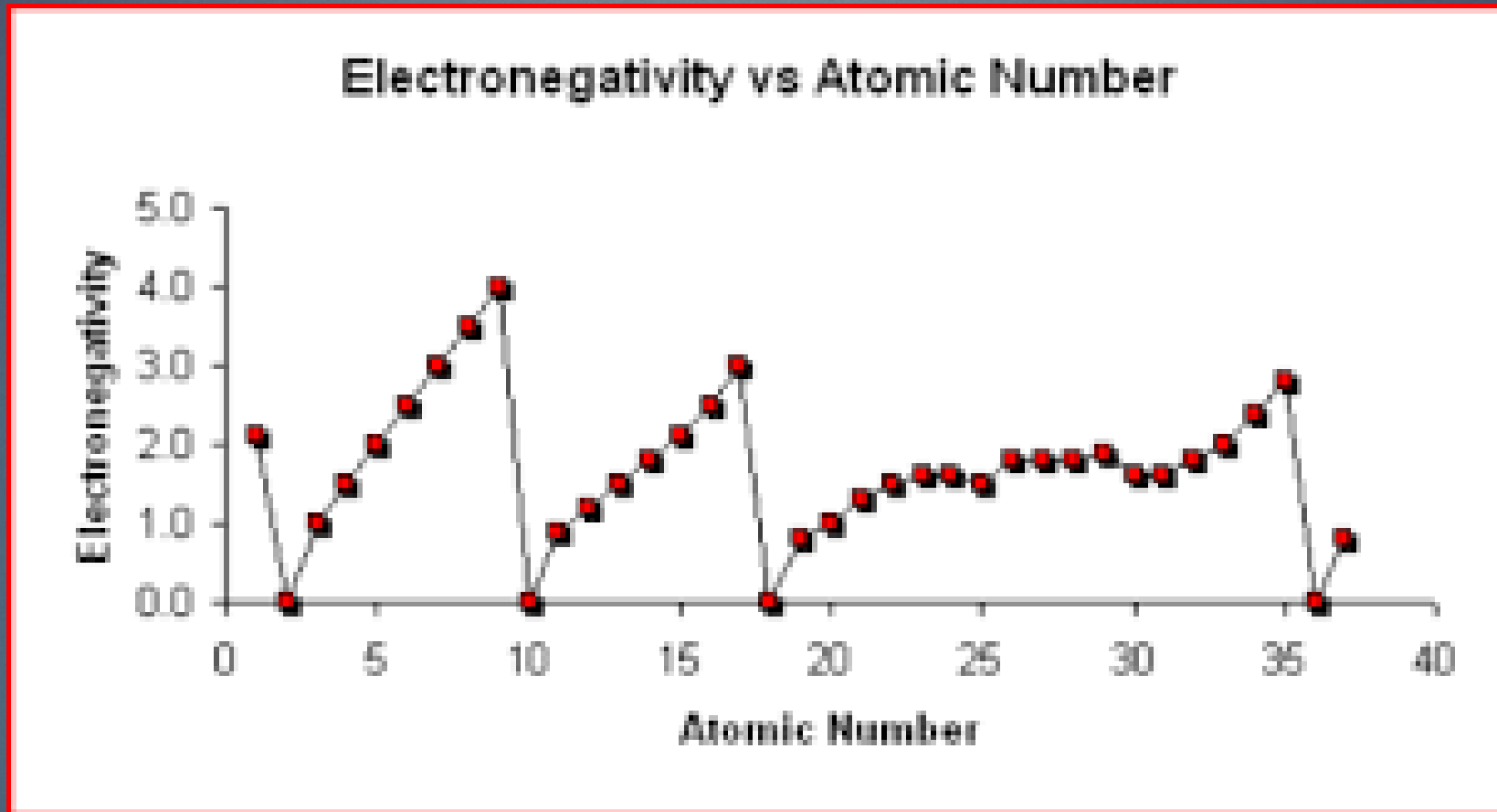
# Electronegativity and Atomic Radius

- ▶ The **smaller** the atom, the **easier** it is to gain an electron because the valence orbital is closer to the nucleus.



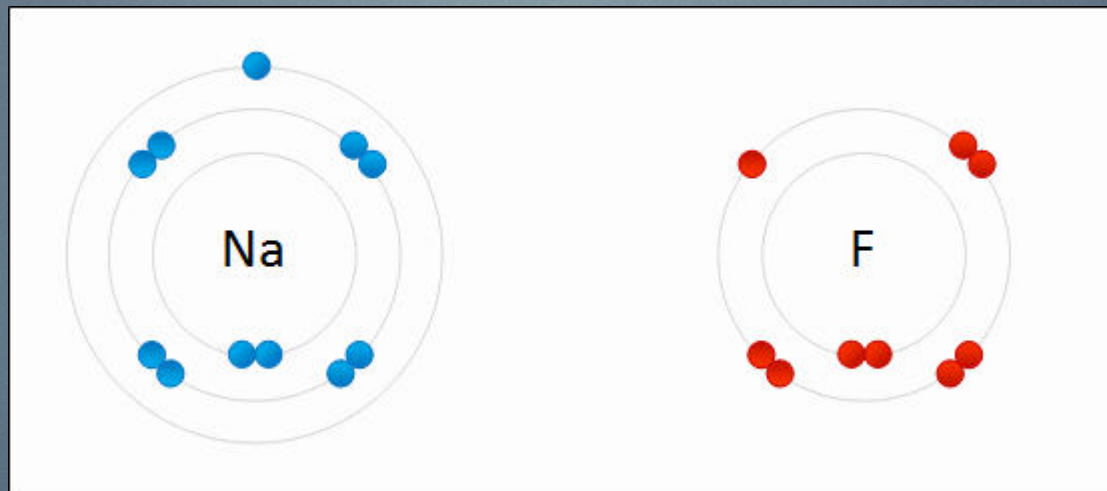
- ▶ Electronegativity **decreases as atoms get larger** because according to Coulomb's law it is **more difficult** for the nucleus of one atom **to attract electrons** from another atom.

# Electronegativity vs Atomic #



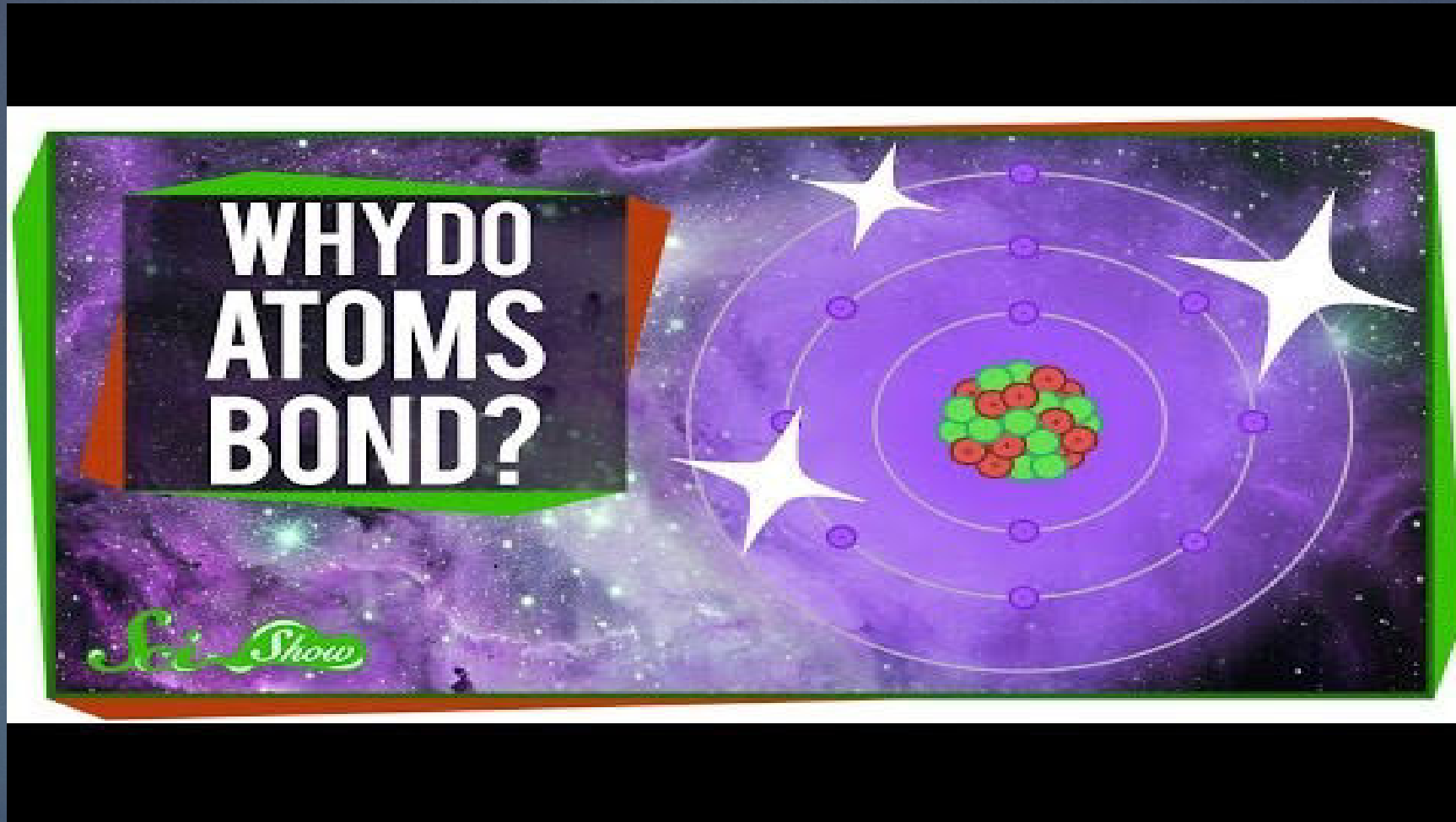
# Electronegativity of Nonmetals

- ▶ Nonmetals have a **higher** electronegativity value because they want to **gain electrons** to complete their valence orbital.
- ▶ Nonmetals gain electrons through **ionic bonding**.

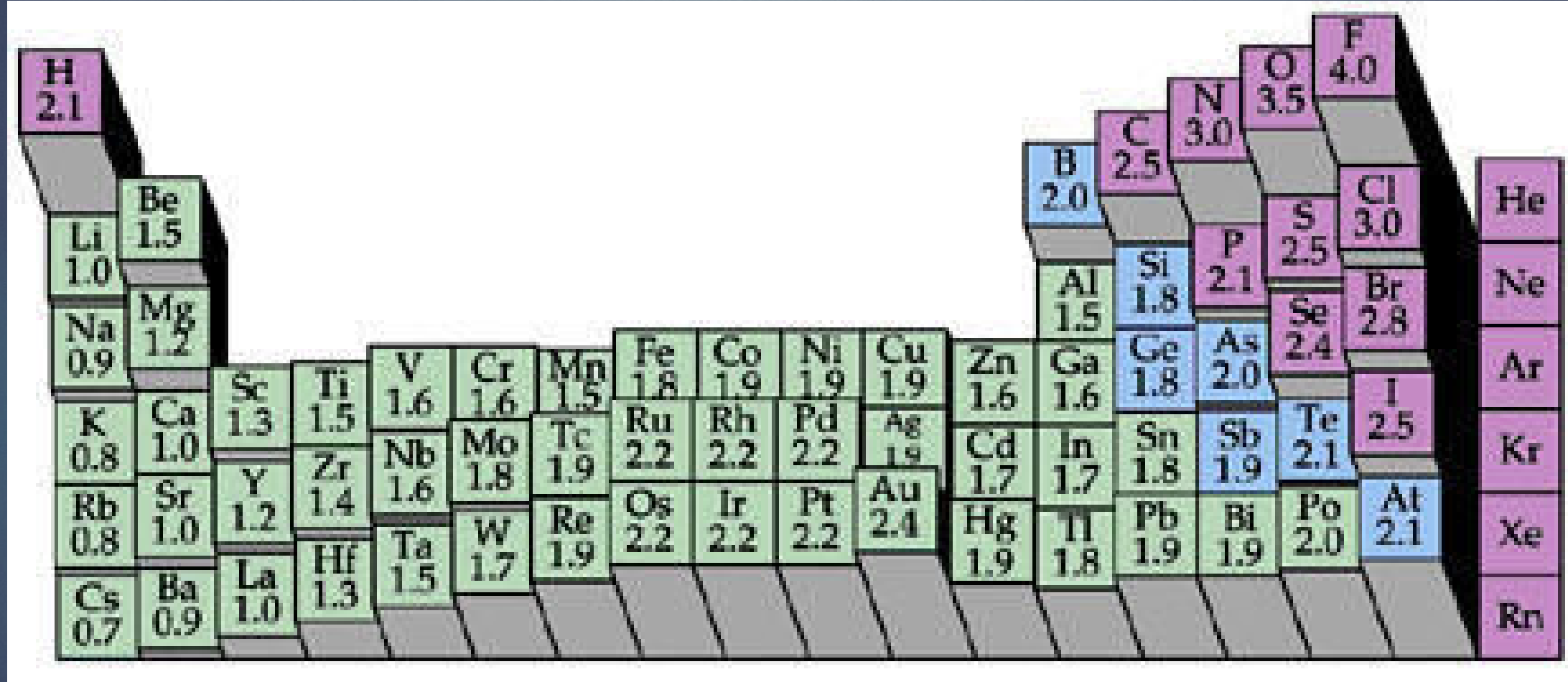




# Why Do Atoms Bond?



100



# Types of Bonding

► If two atoms bond together, the **difference** in their electronegativity values determines the type of bond.

- **Non-polar covalent**  $< 0.4$
- **Polar covalent** 0.4 to 1.6
- **Ionic**  $> 1.6$

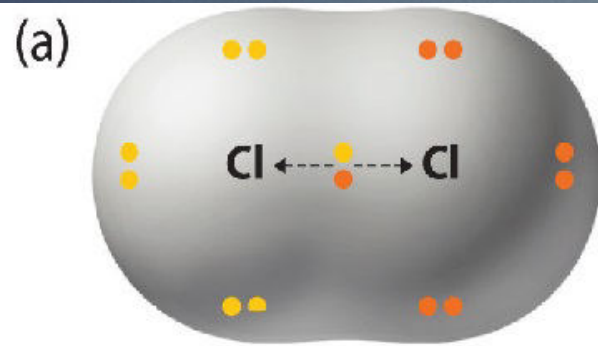
**Electronegativity Values  
of Some Atoms**

2.1 H						
1.0 Li	1.5 Be	2.0 B	2.5 C	3.0 N	3.5 O	4.0 F
0.9 Na	1.2 Mg	1.5 Al	1.8 Si	2.1 P	2.5 S	3.0 Cl
0.8 K	1.0 Ca				2.4 Se	2.8 Br



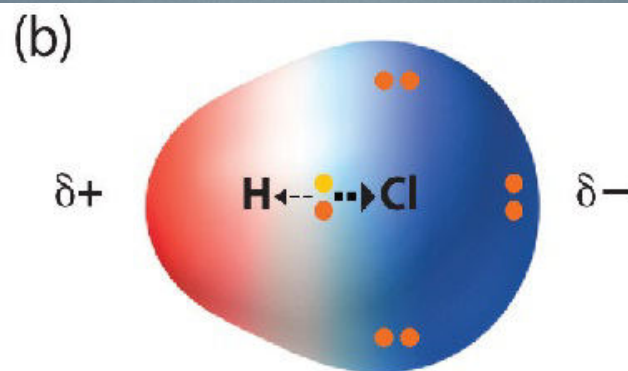
# Types of Bonds

- ▶ **Covalent bonding** occurs when nonmetals **share** electrons
- ▶ **Ionic bonding** occurs when metals **transfer** electrons to nonmetals



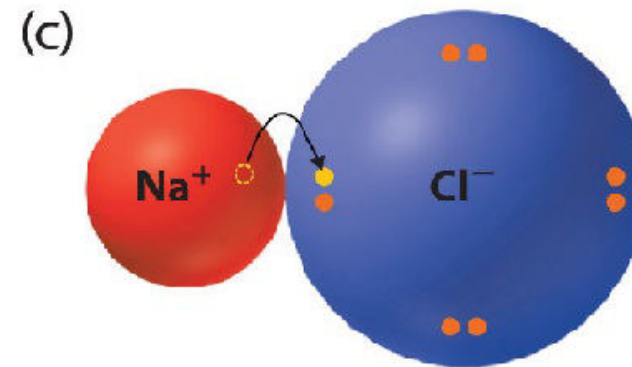
## Nonpolar covalent bond

Bonding electrons shared equally between two atoms.  
No charges on atoms.



## Polar covalent bond

Bonding electrons shared unequally between two atoms.  
Partial charges on atoms.



## Ionic bond

Complete transfer of one or more valence electrons.  
Full charges on resulting ions.