Chapter Sixteen: Compounds

- 13.1 Chemical Bonds and Electrons
- 13.2 Chemical Formulas
- 13.3 Molecules and Carbon Compounds

Chapter 13.1 Learning Goals

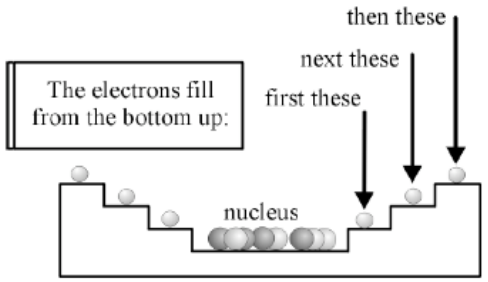
- Infer the relationship between the number of valence electrons and the behavior of atoms.
- Compare and contrast ionic and covalent bonding.
- Draw Lewis diagrams to represent the valence electrons of atoms.

Investigation 13A

Chemical Bonds and Electrons

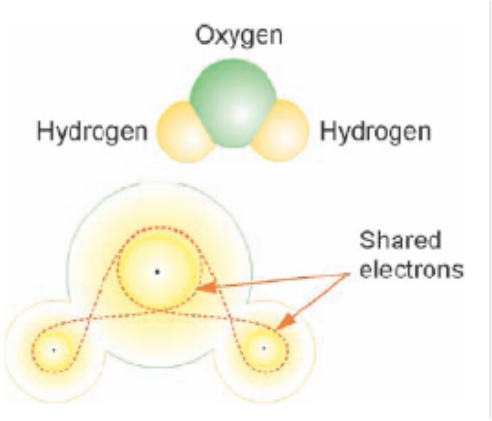
- **Key Question:**

  Why do atoms form chemical bonds?



13.1 Chemical Bonds and Electrons

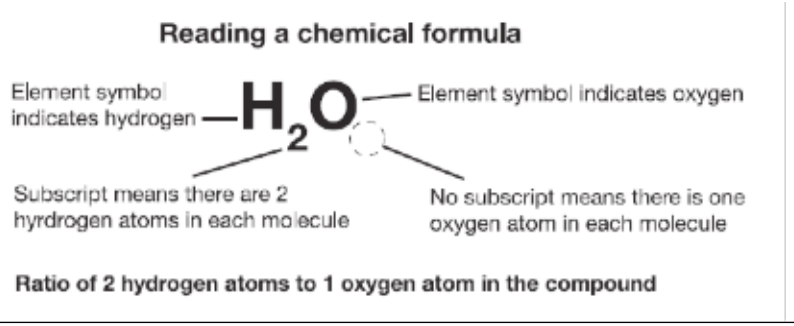
- A chemical bond forms when atoms transfer or share electrons.
- A covalent bond is formed when atoms share electrons.



13.1 Chemical formulas

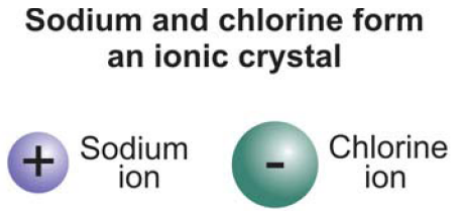
- A molecule's chemical formula tells you the ratio of atoms of each element in the compound.

Water molecule



13.1 Ionic bonds

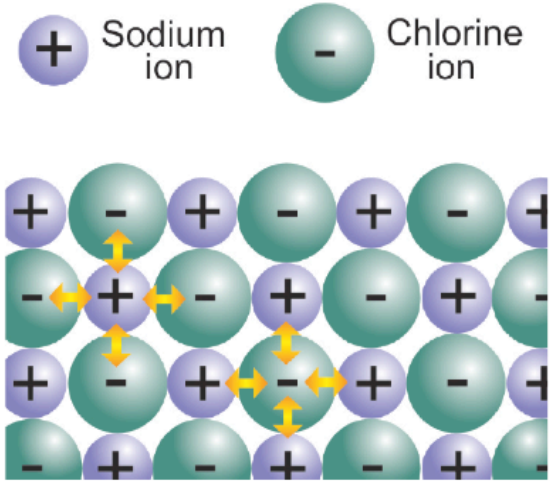
- Not all compounds are made of molecules.
- Ionic bonds are bonds in which electrons are transferred from one atom to another.



Sodium and chlorine form an ionic bond because the positive sodium ion is attracted to the negative chloride ion.

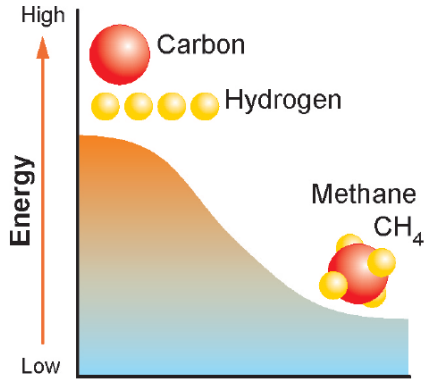
Chlorine and Sodium Bonds

Sodium and chlorine form an ionic crystal



13.1 Why chemical bonds form

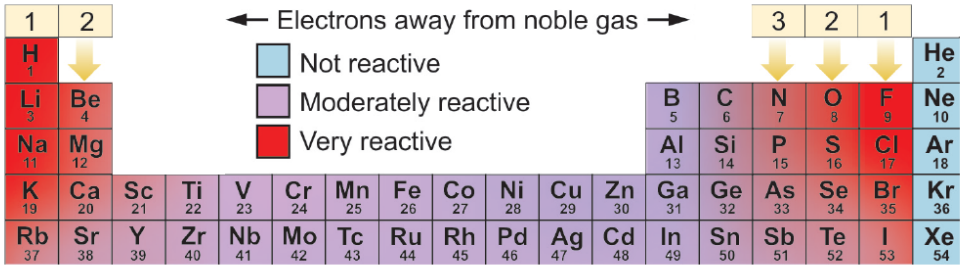
- It takes energy to separate atoms that are bonded together.
- The same energy is released when chemical bonds form.
- Atoms form bonds to reach a lower energy state.



13.1 Reactivity

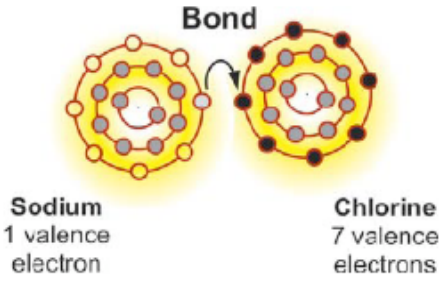
- In chemistry, reactive means an element readily forms chemical bonds, often releasing energy.
- Some elements are more reactive than others.
- The closer an element is to having the same number of electrons as a noble gas, the more reactive the element is.

Periodic Table and Reactivity

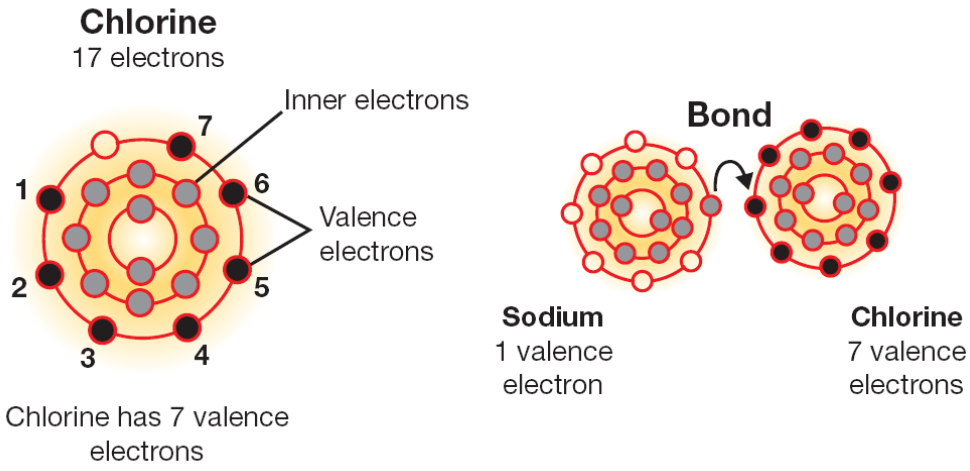


13.1 Valence electrons

- Chemical bonds are formed only between the electrons in the highest unfilled energy level.
- These electrons are called valence electrons.

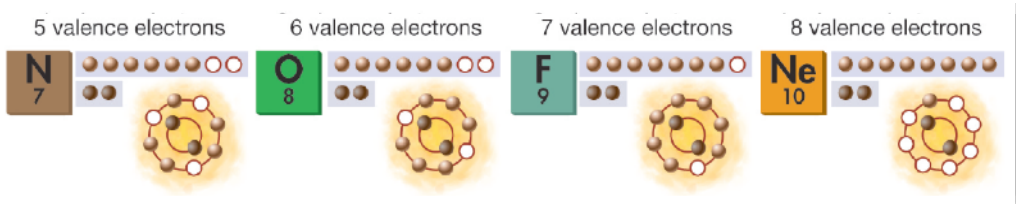


Valence Electrons and Bonding



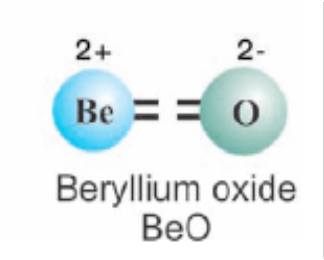
13.1 Valence electrons and the periodic table

- Going from left to right across a period each new element has one more valence electron than the one before it.



How many valence electrons does nitrogen have?

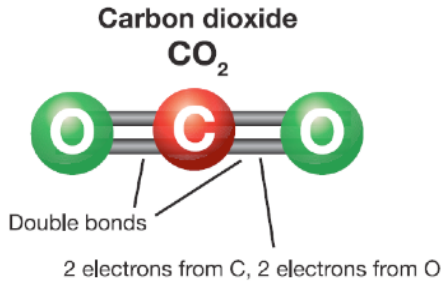
13.1 Valence electrons and the periodic table



- Oxygen combines with one beryllium atom because beryllium can supply two valence electrons to give oxygen its preferred number of 8.

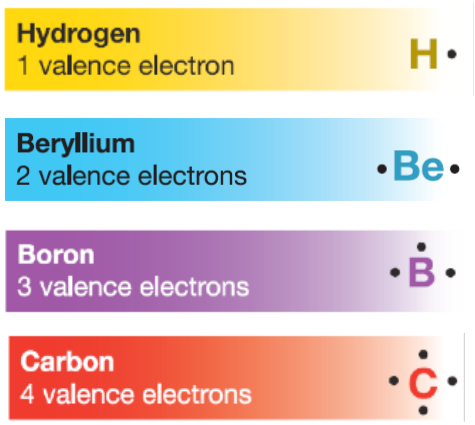
13.1 Valence electrons and the periodic table

- Carbon has four valence electrons.
- Two oxygen atoms can bond with a single carbon atom, each oxygen sharing two of carbon's four valence electrons.



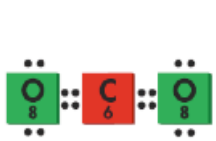
13.1 Lewis dot diagrams

- A clever way to keep track of valence electrons is to draw Lewis dot diagrams.
- A dot diagram shows the element symbol surrounded by one to eight dots representing the valence electrons.

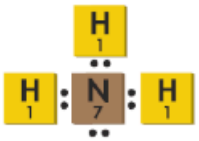


What is the dot structure for nitrogen?

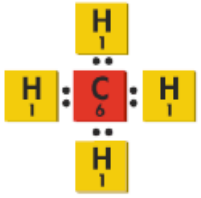
Lewis Dot Diagrams



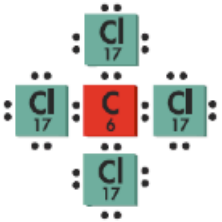
CO_2 Carbon dioxide



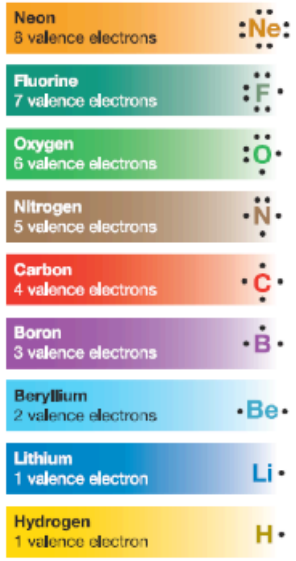
NH_3 Ammonia



CH_4 Methane



CCl_4 Carbon tetrachloride



Element Reactivity