Chemical bond \equiv a force that holds 2 or more atoms together

atoms react to form bonds to get a full outer shell of 8 valence electrons
(except for H which has only 2 electrons in its valence shell)

compounds are neutral (same number of + and - charges)

atoms may give away or take electrons (ionic bonds) or they may share electrons (covalent bonds) to get their outermost electron level full

**Chemical Bonds**

**Ionic bond** - electrons are donated to form a *formula unit*

**Covalent bond** - electrons are shared in a *molecule*

(polar covalent bond - electrons are shared unequally because one atom attracts the shared electrons more than the other)

**Metallic bond** - electrons form a "sea" around metal cations

**Bond energy** \equiv the energy required to break a bond

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Ion \equiv an atom that has a net positive or negative charge

(# protons \neq # electrons)

**ATOMS WANT A FULL OUTER ENERGY LEVEL**

usually 8 electrons (H and He only have room for 2 electrons)

**ATOMS WILL TRANSFER OR SHARE ELECTRONS TO GET 8**

(ionic)  (covalent)

positive ions are smaller than their atoms
(they LOST an energy level)

negative ions are BIGGER than their atoms
(they gained an electron and the like charges repel others in their area)

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**Ions**

on back:

**electron dot diagram** \equiv model of an atom where each
dot represents a valence (outer) electron

(# of valence electrons = group #)

\[ \text{Na}^- + \cdot\text{Cl}^- \rightarrow \text{Na}^+ :\text{Cl}^- \]
Ionic Compounds  
≡ made of a metal + a non-metal  
• formed by attraction of oppositely charged particles  
• example: NaCl  
• very stable, very strong bonds ... THE STRONGEST TYPE OF BOND  
(because they have a high melting point/high boiling point)  
• conducts electricity when dissolved in water or melted  
(because it has freely moving charged particles)  
• crystals shatter when hit  
(because ions with same charge get close then repel)  
• use the ratio of ions to get formula of compound

Ionic Compounds

on back:

there is a strong repulsion by like charges  
compound is SHATTERED

when struck by hammer

ionic formulas

*Be sure to use enough of each ion to make a neutral compound

Naming Ionic Compounds

To name ionic compounds (metal + nonmetal)  
1. Name the metal first: use the full element name  
2. Name the non-metal: use -ide ending  
   (or name the polyatomic ion...see chart)  
3. If the metal forms more than one type of ion,  
   use Roman numerals to indicate its charge  
   (copper, iron, lead, chromium, titanium)

behave

CaCl₂  
calcium chloride

Ca  Cl

+2  -1

need 2 Cl to take both of Ca's electrons

cation ≡ a positive ion; metals give away electrons and become cations  
anion ≡ a negative ion; non-metals take electrons and become anions
Activities of Groups

Octet Rule: Atoms gain, lose, or share electrons to acquire a full set of eight valence electrons.

An element's Group number (1-8) indicates the number of valence electrons.

If an atom has only 1 or 2 valence electrons, it will want to give them away so its new outer shell of electrons will be full. It will become a positive ion.

If an atom has 6 or 7 valence electrons, it will want to take electrons to get to a full valence shell of 8 electrons. It will become a negative ion.

Covalent Bonds

- a chemical bond that results from sharing valence electrons. (2 non-metals)
- Atoms form molecules when they are covalently bonded.

To name a molecule:
1. name the first element: use the full element name
2. name the second element: use -ide ending
3. use prefixes to show the number of atoms present (don't use "mono" for the first element)

exceptions: H₂O = water
            NH₃ = ammonia

Naming Covalent Compounds

on back:
1 = mono  example: CO₂
carbon dioxide
2 = di
diphosphorous pentoxide
3 = tri
4 = tetra
5 = penta
6 = hexa
7 = hepta
8 = octa
9 = nona
10 = deca
### Metallic Bonds

Metals form their cations which are surrounded by a "sea" of electrons; these electrons can move around because the electrons can flow -- the metal lattice is flexible.

Metals can be hit and not break (malleable).

Metals can be drawn into wires (ductile).

Metals conduct electricity; the more electrons shared, the stronger the bond.

### Metallic Bonds/Alloys

**on back:**

Alloy ≡ a mixture of elements; one must be a metal.

Alloys have properties different from individual elements; i.e., steel is stronger than iron.

<table>
<thead>
<tr>
<th>Substitutional Alloy</th>
<th>Brass</th>
<th>Zinc Atoms Replace Some Copper Atoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interstitial Alloy</td>
<td>Steel</td>
<td>Carbon Atoms Fit Between Iron Atoms</td>
</tr>
</tbody>
</table>

Airplane parts use aluminum + magnesium alloys because they are strong and lightweight.

![Cu^2+ e Cu^2+ e Cu^2+ e e e e]