NEW CHAPTER FOUR

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4-1 ATOMS, BONDING, THE PERIODIC TABLE

- Valence electrons—those electrons with the highest energy.
- The electrons in the outermost election shell
- An element's chemical properties are determined by the number of valence electrons in its atoms

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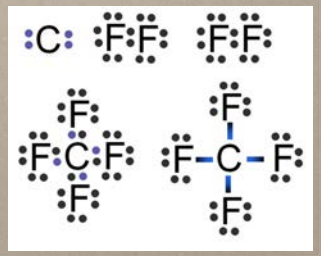
4-1 ATOMS, BONDING, THE PERIODIC TABLE

- Electron dot diagram includes the symbol for the element surrounded by dots. Each dot stands for one valence electron



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4-1 ATOMS, BONDING, THE PERIODIC TABLE

- Chemical bond—the force of attraction that holds atoms together as a result of the rearrangement of electrons between them.

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4-1 ATOMS, BONDING, THE PERIODIC TABLE

- As you look down a group, you'll find that the last placed electron is in the exact same spot for each element, just in a higher or lower cloud.

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4-1 ATOMS, BONDING, THE PERIODIC TABLE

- Group 1 Metals are called Alkali Metals. They are super likely to react, because they have only one electron in their outermost shell. It's likely to be shared with another atom—given away, donated, so that it feels like there are no electrons in that shell, and the shell below that is full. Alkali metals will often lose an electron, giving them a positive charge.

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4-1 ATOMS, BONDING, THE PERIODIC TABLE

- Group 17 Nonmetals are called Halogens. They have seven electrons in their outermost shell, and are super likely to borrow one, in order to fill the shell. If they gain an electron, they have a negative charge.

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4-1 ATOMS, BONDING, THE PERIODIC TABLE

- Group 18 gases are called "Noble Gases", because they are extremely unlikely to react with any other atoms. Their valence electrons are totally full, which makes them unlikely to gain or lose any electrons at all.

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4-2 IONIC BONDS

- ion is an atom (or group of atoms) that has an electric charge (as the result of gaining or losing electrons)
- When a neutral atom loses a valence electron, it loses a negative charge and becomes positive
- When a neutral atoms gains an electron, it gains a negative charge and becomes negative

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4-2 IONIC BONDS

- Polyatomic Ions–ions that are made up of more than one atom
- Ionic bond–the attraction between two oppositely charged ions
- Ionic Compound–the result of an ionic bond (Because two oppositely charged ions joined to form one larger molecule)

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4-2 IONIC BONDS

- Chemical formula–a group of symbols that show the ratio of elements in a compound
- Subscripts vs Coeffecients

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Coefficients vs. Subscripts

- $4Al_2O_3$
- *Notice the two different types of numbers:*
- *The 4 is a COEFFICIENT, which tells you how many of that molecule are present. It stretches across the WHOLE molecule.*
- *The 2 and 3 are subscripts, which tell you how many of each element are in a molecule. They don't stretch--they just go to the element before the number.*

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Coefficients vs. Subscripts

- *By the way, if there is no coefficient, or no subscript, you can pretend/imagine/ write in a ONE.*
- $4H_2O + 2O_2 = 4H_2O_2$
- $= 4H_2O_1 + 2O_2 = 4H_2O_2$

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4-2 IONIC BONDS

- Naming—For an ionic compound, the name of the positive ion comes first, followed by the name of the negative ion
- Magnesium Chloride
- Sodium Chloride
- Hydrogen Oxide

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4-2 IONIC BONDS

- Crystal—ions form an orderly three-dimensional arrangement
- Every ion in an ionic compound is attracted to the ions of an opposite charge that surround it
- High melting points—ionic compounds have really high melting points compared to non-ionic (Covalent) compounds

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4-3 COVALENT BONDS

- Chemical bond formed when 2 atoms share electrons
- Molecule—a neutral group of atoms joined by covalent bonds
- Attractions between the shared electrons and the protons in the nucleus of each atom hold the atoms together in a covalent bond

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4-3 COVALENT BONDS

- Double bond—two atoms sharing two pairs of electrons
- Triple Bond—two atoms sharing three pairs of electrons
- Molecular Compound—water, salt (opposite of ionic bonds) (a compound made up of covalently bonded molecules)
- molecular compounds have poor conductivity, low melting points, low boiling points

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4-3 COVALENT BONDS

- nonpolar bonds—electrons are shared equally
- polar bonds—-electrons are shared unequally
- Van der Waals forces—weak attractions to the slight positive and negative charges within a molecule

4-4 BONDING IN METALS

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- Metal Crystal is composed of closely packed, positively charged metal ions. The valence electrons drift among the ions
- Metallic Bond—an attraction between the positive metal ion, and the electrons surrounding it

4-4 BONDING IN METALS

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- Luster—shininess
- Malleability—can be made into sheets
- Ductility—can be made into wires
- Thermal Conductivity—Carries Heat
- Electrical Conductivity—Carries Electricity

4-4 BONDING IN METALS

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- Alloy—a mixture made of two or more elements
- Iron + Carbon + Nickel + Chromium = Steel
- Steel is stronger, lighter, more durable than any of its four ingredients
- The usefulness of alloys is that they make new substances with different properties than their ingredients—they're not mixtures of the properties