EVERYTHING YOU NEED TO KNOW ABOUT: **CHEMISTRY**

Compounds

Compounds: a substance that is made up of only *one type of molecule* and that molecule has at least *two different elements*

Example: Salt is a compound because:
- It is made of one molecule – NaCl
- The molecule NaCl is made of two different elements – Na and Cl

Example: Glucose is a compound because:
- It is made of one molecule – $C_6H_{12}O_6$
- The molecule $C_6H_{12}O_6$ is made of three different elements – C, H, and O

Nonexample: Iron (Fe_2) is not a compound because
- It is made of one molecule – Fe_2 *but*
- The molecule Fe_2 is ONLY made of ONE element - Fe

Nonexample: Pizza would not be a good analogy for compounds because:
- It is made of many different things that are not bonded together (cheese, sauce, toppings, crust)

Families of the Periodic Table

Alkali Metals:
- Found in Group 1
- Most reactive metals; combine easily with nonmetals
- Although Hydrogen is in group 1, it is not consider an alkali metal

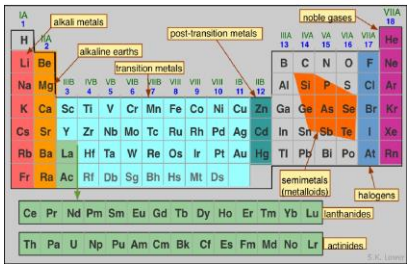
Alkaline Earth Metals:
- Found in Group 2
- Very reactive metals but less reactive than the Alkali Metals

Transition Metals:
- Found in groups 3 – 12
- Least reactive metals
- Generally hard solids with high melting points

Halogens:
- Found in Group 17
- Very reactive
- Reactivity increases as you move down the column

Noble Gases:
- Found in Group 18
- All found in a gas state
- All do not like to react or bond with other elements
- Also called "inert" which means that it will not react

PERIODIC TABLE OF ELEMENTS



Matter – Atoms and Molecules

Matter: matter makes up everything that has mass and volume (takes up space); all matter is made up of atoms

Examples: Air, soda, people, books
Non-examples: Dreams, colors, ideas

States (or Phases) of Matter:
- Solid – fixed shape; fixed volume; particles move very slowly – vibrate in place
- Liquid – fixed volume; takes shape of container; medium speed particles
- Gas – takes volume of container; takes shape of container; particles move very quickly

Atoms: The smallest piece of matter;
- Anything that is made of matter is made of atoms
- Atoms combine to make molecules
- An atom is one piece of element
- Example: one atom of gold is the smallest piece of gold that exists and cannot be divided into smaller pieces and still be gold

Molecules: Two or more atoms bonded together forms a molecule.

Example: Na-Na , H-O-H , $C_6H_{12}O_6$
Non example: Na, O, C

Mixtures

Mixture: a substance that is made of a mix of at least *two different molecules* that are not bonded together

Example: Salt water is a mixture because:
- It is made of more than one molecule – salt (NaCl) and water (H_2O)

Example: Macaroni and Cheese would be a good analogy for mixture because:
- It is made of two separate things – macaroni and cheese

Nonexample: Titanium is not a mixture because:
- Titanium can be found on the periodic table
- That means that titanium is made of only one element

Nonexample: A piece of paper would not be a good analogy for mixture because:
- The paper is the same everywhere
- The paper does not appear to have separate parts to represent different molecules

Subatomic Particles

Parts of an Atom: An atom is made of three parts: protons, neutrons and electrons

Protons: positive charge; found in the nucleus; equal to the atomic number

Neutrons: no charge (neutral charge); found in the nucleus; equal to atomic mass minus atomic number

Electrons: negative charge; found outside the nucleus; equal to the atomic number
- **Valence Electrons**: found on the outermost ring of electrons; used for bonding; have the most energy

Elements

- There are 109 different elements on the periodic table;
- Elements are all the different kinds of matter that exist;
- Some things can be found in pure element form,
  - Gold is only made of gold atoms
  - Lead is only made up of lad atoms
- Other things are made up of combinations of different elements,
  - Water is made up of two elements – oxygen and hydrogen
  - Sugar is made up of three elements – carbon, oxygen and hydrogen
- If something is not found on the periodic table, it is made up of a combination of different kinds of elements.

The Periodic Table

Arrangement: The periodic table is arranged by increasing atomic number from left to right, top to bottom

Periods: the horizontal rows; atomic number increases as you move from left to right

Example: Sodium is in Period 3;
Francium is in Period 7

Groups: the vertical columns; these are often called families; elements in the same column usually share common properties or characteristics

Example: Sodium is in Group 1
Francium is in Group 1

Metals: The metals are located along the left side of the periodic table

Metalloids: The metalloids are located along the zigzag line in the center of the periodic table

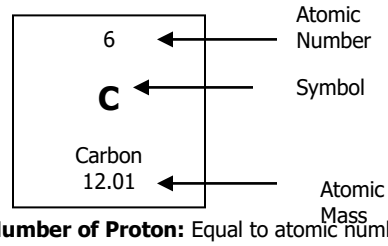
Nonmetals: The nonmetals are located on the right side of the periodic table

Reading the Periodic Table

Atomic Number: The number of protons in the nucleus; also equal to the number of electrons since atoms have an overall neutral charge

Atomic Mass: The number of protons and neutrons

Atomic Symbol: The letters used to represent the element name



Number of Proton: Equal to atomic number
Number of Electrons: Equal to atomic number
Number of Neutrons: Atomic Mass minus Atomic Number

Nonmetals vs. Metals

Properties of Metals	Properties of Nonmetals
Solid at room temp.	Mostly gas at room temp
Malleable and ductile	Brittle when solid
Have luster (shiny)	Dull, not shiny
Good conductors	Bad conductors
Tend to lose electrons in chemical reactions	Tend to gain electrons in chemical reactions

Physical Properties

Density: mass per unit volume of a material
Density = mass divided by volume

- ✓ Usually expressed in grams per cubic centimeter or gram per milliliter

Solubility: a measure of how much of a substance dissolves in a given amount of another substance

- ✓ Solute: what's being dissolved
- ✓ Solvent: what something is dissolved in
- ✓ Solubility increases as temperature goes up
- ✓ Solution: a mixture in which the particles are too small to be distinguished from each other and remain constantly and uniformly mixed

Melting Point and Boiling Point:

- ✓ Phase, or state, of matter is a physical property
- ✓ Matter exists in three phases: solid, liquid and gas
- ✓ Melting point – the temperature when a solid changes to a liquid
- ✓ Boiling point – temperature at which gas bubbles form in a liquid and rise to the surface to escape the liquid as a gas

Specific Heat: the amount of heat needed to raise 1 gram of a substance by 1 degree Celsius

- ✓ If the specific heat is high, a large amount of energy is required to heat up the substance
- ✓ If the specific heat is low, the material easily heats up with a little energy

Physical vs. Chemical Properties

Property: any characteristic that can be used to identify and describe matter

Physical Property: a characteristic of a substance that can be observed without changing the identity of the substance

Examples: mass, volume, color, phases, magnetism, malleability, solubility, melting point, density

Chemical Property: a characteristic that describes how matter will change under certain conditions

Examples: ability to burn, ability to rust, reactivity

Physical vs. Chemical Changes

Physical Change: alters the physical properties of a substance without changing the identity of the substance

Examples: melting ice, tearing a sheet of paper, sharpening a pencil

- ✓ Physical changes can cause a change in volume, mass or phase
- ✓ Often times, physical changes can be reversed

Chemical Change: occurs when a substance is changed into a new substance with different properties

Examples: baking cookies, forming rust

- ✓ All chemical reactions involve chemical reactions
- ✓ Very difficult or impossible to reverse

Signs of a Chemical Change:

- ✓ Forming a precipitate (a solid that forms from a chemical reaction between two liquids)
- ✓ Gas formation
- ✓ Color change
- ✓ Energy change

Properties of Metals

Malleability: able to be hammered and shaped or rolled into thin sheets

Ductility: able to be stretched or drawn into wires without breaking

Magnetism: a force of attraction or repulsion that exists between like or unlike poles

Conductivity: a material that allows electrons to flow easily; easily pass on heat or electricity on to other materials (the opposite is an insulator)

Law of Conservation of Mass

Reactants: the substances that exist before a chemical reaction takes place and the substances are turned into something new

Products: the substances created by a chemical reaction

Law of Conservation of Mass: the total mass of the reactants must be equal to the total mass of the products

$$C + O \rightarrow CO_2$$
$$12g + 6g \quad 18g$$

Chemical Bonds

Ionic Bond: the type of bond formed when one atoms transfers (gives) electrons to another atom

Covalent Bond: the type of bond formed when atoms share electrons

Ion: an atom that has lost or gained electrons and therefore has a positive or negative charge.

If an atom loses electrons, it becomes positive because it lost negative particles.

If an atom gains electrons, it becomes negative because it gains negative particles.