Physical Science

Section 2.1

Chemistry – a science that studies matter and how it changes.

Matter – anything that has mass and occupies space (has a volume).
*Rocks are considered to be made of matter.
*Noise is not considered to be made of matter because it doesn’t have mass or volume.
*As heat is added to a solid substance, the atoms vibrate faster and move apart.

4 States of Matter
*Solids have a definite volume and shape. Its structure is rigid.
*Liquids have a definite volume but variable shape. Take the shape or their container.
*Gases have a variable volume and shape. They tend to fill all available space.
*Plasma is a form of energy (lighting).

Element – a substance that cannot be broken down into simpler substances.
*Oxygen is that most abundant element in the human body.
*Iron is most abundant element in Earth.
*Gold is usually found in a pure form in nature because it is nonreactive.
*Tooth fillings are often made of gold or porcelain because these materials are nonreactive.

30 Most Important Elements to Memorize

22. Cs – Cesium  23. Fr – Francium  24. Ba – Barium

Atom – the smallest particle that has the properties of an element.

Compound – a substance made of atoms of more than one element bound together.

Molecule – the smallest unit of a substance that exhibits the entire properties characteristic of that substance. It behaves like the original substance.

Diatom Molecules “means 2 molecules”

\[ \text{H}_2 \quad \text{N}_2 \quad \text{O}_2 \quad \text{F}_2 \quad \text{Cl}_2 \quad \text{Br}_2 \quad \text{I}_2 \]

Chemical formula – the chemical symbols and numbers indicating the atoms contained in the basic unit of a substance.

H\text{O}, water molecule contains how many hydrogen and oxygen atoms?
2 hydrogen atoms and 1 oxygen atom
C₆H₁₂O₆, glucose molecule contains how many carbon, hydrogen, and oxygen atoms? 6 carbon atoms, 12 hydrogen atoms, and 6 oxygen atoms.

How many atoms are contained in each molecule of H₂O? 2 + 1 = 3

How many atoms are contained in each molecule of C₆H₁₂O₆? 6 + 12 + 6 = 24

Pure substance - any matter that has a fixed composition and definite properties.
* Elements and compounds are pure substances, but mixtures are not.
* Pure substances can be represented by chemical formulas.
* For any pure substance, the boiling point and melting point will always remain constant.

Mixture - a combination of two or more pure substances that are blended together.

2 types of mixtures
1. Homogenous - mixing occurs between the individual units and is the same throughout.
2. Heterogeneous - the substances aren’t uniformly mixed (not same throughout).
* Air is a homogenous mixture of gases consisting mostly of nitrogen and oxygen.
* Carbonated drinks are homogeneous mixtures.
* A Coke/Pepsi is a mixture of gas and a liquid.
* Flour is suspended in water therefore is a heterogeneous mixture.
* Salt water is a homogenous mixture.
* Gasoline is a homogenous mixture.

Miscible - describes two or more liquids that are able to dissolve into each other in various proportions.
* Water and rubbing alcohol dissolve in each other.

Immiscible – describes two or more liquids that do not mix into each other.
* Oil floats on top of watery vinegar in this salad dressing.
* Motor oil floats on the top of water.

SECTION 2.2
Kinetic Theory - is useful for showing the differences between states of matter.
* All matter is made of atoms and molecules that act like tiny particles.
* These tiny particles are always in motion.
* The higher the temperature, the faster the particles move.
* At the same temperature, more massive (heavier) particles move slower than less massive (lighter) particles.

Pressure – the force exerted per unit area of a surface.

Viscosity – the resistance of a fluid to flow.
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**Energy** - the ability to change or move matter.
*When water freezes, energy is released.
*Energy must be transferred for any change of state to occur.
*Energy may be converted from one form to another, but it cannot be created nor destroyed.
*When you burn gasoline in a car's engine, you produce energy to move the car plus energy in the form of heat.

**Evaporation** - the change of a substance from a liquid to a gas.

**Condensation** - the change of a substance from a gas to a liquid.

**Sublimation** - the change of a substance from a solid to a gas.
* Sublimation causes ice cubes to become smaller when left in the freezer for several months.

The law of conservation of energy (1st Law of Thermodynamics)
Energy cannot be created or destroyed.

**SECTION 2.3**

**Chemical property** – the way a substance reacts with others to form new substances with different properties.
* Magnesium is so reactive it is used to make emergency flares.
* Light bulbs are filled with argon gas because argon does not react.
* Tungsten is the filament used in light bulbs.
* Knowing the chemical properties of a substance will tell you how the substance reacts with other substances.
* Flammability is a chemical property that tells whether a substance reacts in the presence of oxygen.

**Chemical change** – is a change that occurs when a substance changes composition by forming one or more new substances.
* During a chemical or physical change, energy may be converted into another form.
* Chemical changes are changes in composition.
* Car paint fading is an example of a chemical change.
* Cooking an egg is an example of a chemical change.
* Digesting food is an example of a chemical change.
* Iron rusting is an example of a chemical change.
* Breathing is an example of a chemical change.
* After burning a log, you only see a small pile of ashes because the total mass of the wood and oxygen is the same as the total mass of the ash and gases.

**Physical property** – is a characteristic of a substance that can be observed or measured without changing the composition of the substance.
* Freezing point, Boiling point, and Density are examples of physical properties.

**Physical change** – a change in the physical form or properties of a substance that occurs without a change in composition.
* During a chemical or physical change, energy may be converted into another form.
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*Dissolving is a physical change.
*Ice melting is a physical change.
*Pounding gold into a coin (malleability – shaping/bending metal)
*Evaporation of water is a physical change.
*Grinding quartz crystals down to produce sand is an example of a physical change.
*Physical changes do not change composition.

Reactivity – the ability of a substance to combine chemically with another substance.

Melting point – the temperature at which a solid becomes a liquid.

Boiling point - the temperature at which a liquid becomes a gas below the surface.
*This is where a liquid rapidly becomes a gas.
*When water is broken down, the oxygen and hydrogen atoms rearranged to form hydrogen and oxygen gas.

Density - the mass per unit volume of a substance.
*Ice floats in water because ice is less dense then liquid water.
*The density of water is 1.0 g/cm³.

\[ D = \frac{m}{V} \quad \text{Density} = \frac{\text{Mass}}{\text{Volume}} \]

[Buoyancy - force with which a more dense fluid pushes a less dense substance upward.]

[Worksheet on Density/Book Work]