Honors Chemistry Chapter 1 Section 2 pgs. 6-12.
Matter and its Properties

Objectives:
1. **Distinguish between the physical properties and chemical properties of matter.**
2. **Classify changes of matter as physical or chemical.**
3. **Explain the gas, liquid, and solid states in terms of particles.**
4. **Explain how the law of conservation of energy applies to changes of matter.**
5. **Distinguish between a mixture and a pure substance.**

Vocabulary: Define the following.
1. **mass--**
2. **matter--**
3. **atom--**
4. **element--**
5. **compound--**
6. **extensive property--**
7. **intensive--**
8. **physical property--**
9. **physical change--**
10. **change of state--**

11. solid--

12. liquid--

13. gas--

14. plasma--

15. chemical property--

16. chemical reaction--

17. reactant--

Section 2 Matter and its Properties pgs. 6-12.

Describe everything that comprises the universe using only 3 words and write them here.
Answer: 1. 2. 3.

Matter can be described by two general properties. What are they?
Answer:
1.

2.

In science there is a need to categorize information. Once this is done the similarities and differences between this information is easier to remember.
For instance, what are the components of all matter. Hint: There are only 92 naturally occurring components.
Answer:

What are the smallest units of your answer above?
Answer:

There are many more substances than the 92 naturally occurring elements. What are the substances composed of 2 or more elements called?
Answer:

Properties and Changes in Matter
Matter can therefore be categorized as either elements or compounds. Elements and compounds each have certain characteristics called properties. These properties allow us to tell certain substances apart and to separate them into their components. For instance write 5 properties of common table salt NaCl and water H_2O that you are familiar with here.

	Salt	Water
1.		
2.		
3.		
4.		
5.		

Some properties of matter depend on the amount of the substance and are called extensive properties while other properties do not depend on the amount of the substance called intensive properties.
Write 3 extensive properties and 3 intensive properties of salt and water here.

	Salt	Water
Extensive		
1.		
2.		
3.		
Intensive		
1.		
2.		
3.		

Physical Properties and Physical Changes

Physical properties are those characteristics that can be seen without changing a substance's identity; such as density, color, freezing, melting, and boiling points, etc. Any change in appearance without an identity change is a physical change.

States of Matter

Solid -- Has a particular shape and a definite volume, with an ordered arrangement of particles, (crystals).

Liquid -- Has no definite shape but has a definite volume.

Gas -- Has no definite shape or volume. A gas has a very low density.

Plasma--A high temperature state in which atoms lose most of their electrons.

Changes in State

A change in state occurs when substances are changed from one form to another when heated or cooled. For example, a solid can be changed to a liquid by heating and a gas can be changed to a liquid by cooling.

*****In general, the only difference between the solid, liquid, and gas state of a particular substance depends on the distance between particles and the speed at which the particles move. These changes are controlled by the amount of heat present.**

Chemical Properties and Chemical Changes

Chemical properties are those characteristics that result from the arrangement of subatomic particles within a substance; such as the ability to corrode or hydrogen combining with oxygen to form water, etc. These properties do change a substance's identity.

Physical changes are those that do not change the identity of the substance.

Chemical changes are those that do change the identity of the substance.

Which of the following demonstrates a physical change and which demonstrates a chemical change?

1. **Melting _____**
2. **Dissolving _____**
3. **Burning _____**
4. **Shredding _____**
5. **Digestion _____**
6. **Exploding fireworks _____**
7. **Buoyancy _____**
8. **Hydrolysis _____**
9. **Cooking food _____**
10. **Evaporation _____**
11. **Rusting _____**
12. **Density _____**

A chemical reaction is a process in which one or more substances are changed into new substances with different physical and chemical properties.

An easy way to determine whether the change was a chemical or a physical change is to determine if the new substance can be changed back into its original form. If the new substance can be changed back, then the change was physical, if not the change was chemical.

A chemical reaction occurs when a substance or substances called reactant(s) change or combine to yield new substances called products.

reactant(s) → products
yield

In chemical reactions new substances are produced as bonds are broken, atoms are rearranged, and new bonds are formed. Energy in some form is usually necessary to begin a chemical reaction. Energy is also absorbed or given off in a chemical reaction.

Mixtures

Mixtures are physical blends of elements or compounds. This means that the substances making up the mixture, whether they are elements or compounds, are not chemically combined.

Two Types of Mixtures

Heterogeneous mixtures are mixtures in which more than one substance can be seen with the naked eye.

Homogeneous Mixtures are mixtures that visibly appear to be only one substance.

Solutions are examples of the best blended types of homogeneous mixtures. There are many types of solutions. Examples are a solid dissolved in a liquid, a liquid dissolved in a liquid, gas dissolved in a liquid, gas dissolved in a gas, etc.

Solute-- This is the substance that is dissolved. It is the substance found in the lower concentration.

Solvent-- This is the substance that is dissolving the solute and is found in a higher concentration.

Solution-- This is the name of the solute and solvent when mixed together.

What is the name of a metal-metal solution?
Answer_____
----------.

Heterogeneous mixtures can sometimes separated into their component parts by such means as settling, filtration, manual separation, magnetism (if iron is present), evaporation, etc.

Homogeneous mixtures can be separated by distillation, crystallization, and chromatography.

A pure substance is homogeneous but not a mixture since everything within it has the exact same composition and characteristic properties.

Chapter 12 Sections 1 and 2 pgs. 401-415 only.
Section 1 pgs. 401-406. Types of Mixtures
Objectives:
1. **Distinguish between heterogeneous and homogeneous mixtures.**
2. **List three different solute-solvent combinations.**

3. Compare the properties of suspensions, colloids, and solutions.
4. Distinguish between electrolytes and nonelectrolytes.

<u>Vocabulary:</u> Define the following.
1. soluble--

2. solution--

3. solvent--

4. solute--

5. suspension--

6. colloid--

7. electrolyte--

8. nonelectrolytes--

<u>Solutions</u>
A substance that is soluble means that it can be dissolved. Solutions are the best mixed of all homogeneous mixtures consisting of extremely small particle size.
Solutions may exist as gases, liquids, or solids.
Particle size is 0.01 to 1 nanometers.
<u>Suspensions</u>
Suspensions are heterogeneous mixtures in which the particles are very large. These particles are so large that they will leave the solvent and settle to the bottom or a container if not agitated.
Particle size is greater than 1000 nanometers.

Colloid

Colloids appear as homogeneous mixtures that contain particle sizes intermediate between solutions and suspensions. The colloidal particles comprise the dispersed phase while the solvent is called the dispersing medium. Examples of colloids are mayonnaise, milk, and gelatin. Emulsions and foams are classified as colloids.
Particle size is between 1 nanometer and 1000 nanometers.
The Tyndall effect is the scattering of light in a transparent medium. When viewed under a microscope many colloidal particles move. This random motion is called Brownian movement.
List 3 additional colloids that you know of here.
1.

2.

3.

If a mixture displays the Tyndall effect it is either a suspension or a colloid. If the mixture settles out which of the two types is the mixture?
Answer:

Solutes

Solutes that are made of ionic compounds will conduct an electric charge in solution and are called electrolytes, while covalent compounds will not conduct an electric charge and are called nonelectrolytes.

Section 2 pgs. 407 to 415 only. The Solution Process
Objectives:
1. List and explain three factors that affect the rate at which a solid solute dissolves in a liquid solvent.
2. Explain solution equilibrium, and distinguish among saturated, unsaturated, and supersaturated solutions.
3. Explain the meaning of "like dissolves like" in terms of polar and nonpolar substances.

Vocabulary: Define the following.
1. solution equilibrium--

2. saturated solution--

3. **unsaturated solution--**

4. **supersaturated solution--**

5. **solubility--**

6. **hydration--**

7. **immiscible--**

8. **miscible--**

9. **Henry's law--**

10. **effervescence--**

Solubility and Polarity

Polar compounds will dissolve other polar compounds and nonpolar compounds will dissolve nonpolar compounds. The rule of thumb is that "like dissolves like."
Oil does not dissolve in water. What does this tell you about the polarity of water and oil?
Answer:

Vitamins

Doctors often describe vitamins in terms of the vitamin being water soluble or fat soluble. Vitamin C is a water soluble vitamin. This means that vitamin C will be lost very quickly from the body in the urine. Vitamin A on the other hand is fat soluble and will accumulate in the fats found in the body. It is therefore very possible to take too much vitamin A or overdose on the vitamin. There have been instances in which people have died from taking too much of a fat soluble vitamin.

Liquids that are soluble in each other are said to be miscible and those liquids not soluble in each other are called immiscible.

Solubilities of Solids

Surface Area

The solubility of a solid in a liquid depends on the surface area of the solid. Shaking or stirring a solid into a liquid breaks up the larger particles, increasing surface area and allowing the solid to dissolve faster.

Temperature

Usually increasing the temperature will increase the rate at which a solid dissolves in a liquid; whereas in the case of gas increasing temperature decreases the rate at which they dissolve.

The dissolving of an ionic compound involves the separation of ions from their lattice into individual dissolved ions. This process is called dissociation. If water is the solvent then the term hydration is used. Hydration means the surrounding of the individual ions by water molecules.

When ionic compounds dissociate a large amount of heat is released. Sometimes the release of heat can be hazardous. The ionization and hydration of sulfuric acid, H_2SO_4, can cause the solution to boil and spatter, especially when water is poured into the concentrated acid. For this reason, H_2SO_4 solutions are always made by adding the acid slowly to water while stirring.

A substance that dissolves is said to be soluble and one that does not dissolve is said to be insoluble.

Saturation

When the maximum amount of solute is dissolved in a solution, the solution is said to be saturated. Any additional solute will not dissolve.

If a solution can dissolve more solute than that already present in the solution, the solution is said to be unsaturated.

Supersaturated solutions have more solute dissolved than normally possible.

One method of making supersaturated solutions is to dissolve the solute at a high temperature and then slowly cool the solution.

A supersaturated solution can turn into crystals generating heat when disturbed even by jarring the solution.

In a saturated solution, the solute particles are dissolving and recrystallizing at the same rate or are in a state of dynamic equilibrium.

Gas Solubility

The solubility of a gas depends on 1. pressure and 2. temperature.

Henry's law states that the solubility of a gas increases as the pressure of the gas on the surface of the liquid increases. This becomes apparent in carbonated sodas. The

carbonation is due to CO_2 that has been added to the solution under pressure. The increase in pressure allows more carbon dioxide to dissolve. The rapid escape of a gas from a liquid in which it is dissolved is called effervescence.
When the pressure is removed by opening the cap of the bottle less carbon dioxide can dissolve and escapes from the soda making it go "flat."
The higher the temperature the less gas can dissolve. This is why many fish species such as brook trout that have a high demand for oxygen only live in colder waters, because the cold water can hold more oxygen.

Answer the following questions.

1. How does the polarity of a solid affect is solubility in a nonpolar solvent?

2. Explain the phrase "like dissolves like."

3. Two liquids are combined in a container and they form separate layers. These two liquids are said to be _____.

4. How can increase the solubility of most solids in a liquid?

5. How can you increase the solubility of a gas in a liquid?