ACTIVITY 1– CHEMICAL AND PHYSICAL CHANGES

Background Information

Some properties of matter are independent of the amount of matter. We call these properties intensive properties. Among these properties are temperature, density, melting point, and boiling point. These properties could be listed on the periodic table, and can be used to help identify an element or material. The extensive properties of a material, like mass and volume, depend on the amount of material present.

We can group the properties of matter into two categories: physical and chemical. Color, density, freezing point, melting point, boiling point, hardness, and odor are all examples of a material's physical properties. In all cases we can observe these properties without changing the identity and composition of the material. Chemical properties show that the materials will react to produce different substance(s). Flammability or decomposition of a material are examples of chemical properties.

Physical changes can alter a material's physical appearance but will not change its composition. If we melt ice into water, we change the physical state from a solid to a liquid, but we do not change the composition of the water. The same is true when we evaporate liquid water. The gaseous water still has the same composition as the liquid water.

When a substance undergoes a chemical reaction (or we could say a chemical change) it loses its original characteristics and becomes a new substance(s). An example is when water decomposes into hydrogen and oxygen gas. Another example is when zinc metal reacts with hydrochloric acid to produce hydrogen gas and zinc chloride.

Solutions

Many of the chemicals in our bodies are dissolved in water — that is, they occur in aqueous solutions. Solutions are typically described in terms of solute and solvent. The solvent is the component of a solution that is present in the greatest amount. Solutes are substances dissolved in a solution, or the components present in the smaller amounts. The solubility of a solute is the amount of solute that will dissolve in a given amount of solvent. This is often described in terms of grams of solute per 100 g of solvent. Since solubilities are temperature dependent, the temperature must be specified. When a solution contains the maximum amount of solute for the conditions, we say that the solution is saturated.

We often use molarity to quantify concentrations (the ratio of amount of solute to solvent) of solutions. Molarity (M) is the number of moles of solute per liter of solution. A concentrated solution of sulfuric acid is about 18 molar.

Another way to express concentration is percent, or parts per hundred. This is probably the most familiar concentration term. Common vinegar solutions are about 5% acetic acid in water, which indicates that they contain 5 g of acetic acid for every 100 g of vinegar solution.

Polymers

The word polymer comes from the Greek *poly*, meaning "many" and *meros*, meaning "parts." Often referred to as macromolecules, polymers are enormously long molecules made of repeating smaller units. The smaller units that comprise a polymer are called monomers (from the Greek *mono*, meaning one). Polymers may be made of tens of thousands of repeating monomer units. Their molecular weights can reach to millions of daltons (1 dalton is equal to 1 atomic mass unit). Monomers are the building blocks of polymers, the links of the polymer chains. These molecular chains may be branched, interconnected at various points, or interconnected at a great many points so that they form rigid solids. At the molecular level they may be long chains, or sheets, or even complicated three-dimensional lattices.

The structure of sodium polyacrylate is shown below.