

Colloids

Particles that are intermediate in size between those in solutions and suspensions form mixtures known as colloidal dispersions, or simply **colloids**. Particles between 1 nm and 1000 nm in diameter may form colloids. After large soil particles settle out of muddy water, the water is often still cloudy because colloidal particles remain dispersed in the water. The particles in a colloid are small enough to be suspended throughout the solvent by the constant movement of the surrounding molecules. The colloidal particles make up the *dispersed phase*, and water is the *dispersing medium*.

Tyndall Effect

Many colloids appear homogeneous because the individual particles cannot be seen. The particles are, however, large enough to scatter light. You have probably noticed that a headlight beam is visible from the side on a foggy night. This effect, known as the Tyndall effect, occurs when light is scattered by colloidal particles dispersed in a transparent medium. The Tyndall effect is a property that can be used to distinguish between a solution and a colloid.

Robert Brown discovered that particles appear as tiny specks of light, when you cast a bright light at it under a microscope. They are seen to move rapidly in a random motion, which is due to collisions of rapidly moving molecules. This is called Brownian motion.

<u>Solutions</u>	<u>Colloids</u>	<u>Suspensions</u>
Homogeneous	Heterogeneous	Heterogeneous
Particle size: 0.01-1 nm; can be atoms, ions, molecules	Particle size: 1/1000 nm, dispersed; can be aggregates or large molecules	Particle size: over 1000 nm, suspended; can be large particles or aggregates
Do not separate on standing	Do not separate on standing	Particles settle out
Cannot be separated by filtration	Cannot be separated by filtration	Can be separated by filtration
Do not scatter light	Scatter light (Tyndall effect)	May scatter light, but are not transparent.

Solutes: Electrolytes versus Nonelectrolytes

Substances that dissolve in water are classified according to whether they yield molecules or ions in solution. An ion is an atom or molecule with a net electric charge due to the loss or gain of one or more electrons. Molecules are a group of atoms bonded together, representing the smallest fundamental unit of a chemical compound that can take part in a chemical.

When an ionic compound dissolves, the positive and negative ions separate from each other and are surrounded by water molecules. These solute ions are free to move, making it possible for an electric current to pass through the solution. A substance that dissolves in water to give a solution that conducts electric current is called an **electrolyte**. Sodium chloride, NaCl, is an electrolyte, as is any soluble ionic compound. Certain highly polar molecular compounds, such as hydrogen chloride, HCl, are also electrolytes because these molecules form the ions H_3O^+ and Cl^- when dissolved in water.

By contrast, a solution containing neutral solute molecules does not conduct electric current because it does not contain mobile charged particles. A substance that dissolves in water to give a solution that does not conduct an electric current is called a **nonelectrolyte**. Sugar is a nonelectrolyte. The electrodes are conductors that are attached to a power supply and that make electric contact with the test solution. For a current to pass through the light-bulb filament, the test solution must provide a conducting path between the two electrodes.

The light bulb glows brightly if a solution that is a good conductor is tested. Such solutions contain solutes that are electrolytes. For a moderately conductive solution, however, the light bulb is dim. If a solution is a poor conductor, the light bulb does not glow at all. Such solutions contain solutes that are nonelectrolytes.