

Section 11.5

Colloids



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Learning Objectives



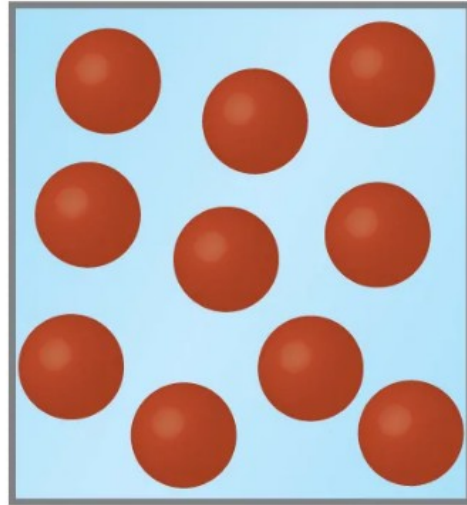
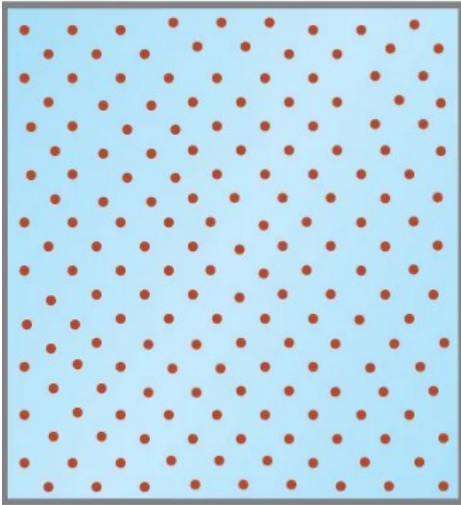
- Describe the composition and properties of colloidal dispersions
- List and explain several technological applications of colloids

Suspensions and Colloids



- **Suspensions** are heterogeneous mixtures composed of relatively large particles that are visible.
 - They are cloudy
 - The suspended particles settle out after mixing
- **Colloids** have intermediate properties between suspensions and solutions.
 - Particles are larger than most molecules but smaller than suspension particles
 - The particles do not settle out upon standing

Examples



Tyndall Effect



- Particles in a colloid are large enough to scatter light
- This can make colloidal mixtures appear cloudy or opaque



Colloid Facts



- The particles that make up colloids can be hundreds or thousands small molecules or single extremely large molecules.
- Components of a colloid can be any phase.
- Particle component present in relatively small amounts is called the **dispersed phase**.
- The substance or solution the particulate is dispersed in is called the **dispersion medium**.
- If particles aggregate, they can break the colloid.

Colloid Examples



Dispersed Phase	Dispersion Medium	Common Examples	Name
solid	gas	smoke, dust	—
solid	liquid	starch in water, some inks, paints, milk of magnesia	sol
solid	solid	some colored gems, some alloys	—
liquid	gas	clouds, fogs, mists, sprays	aerosol
liquid	liquid	milk, mayonnaise, butter	emulsion
liquid	solid	jellies, gels, pearl, opal (H_2O in SiO_2)	gel
gas	liquid	foams, whipped cream, beaten egg whites	foam
gas	solid	pumice, floating soaps	—

Preparing Colloids



- Colloids are typically prepared by one of two means
 - 1) Dispersion methods: breaking down larger particles. For example, paint pigments are produced by dispersing large particles by grinding in special mills.
 - 2) Condensation methods: growth from smaller units, such as molecules or ions. For example, clouds form when water molecules condense and form very small droplets.

Emulsions

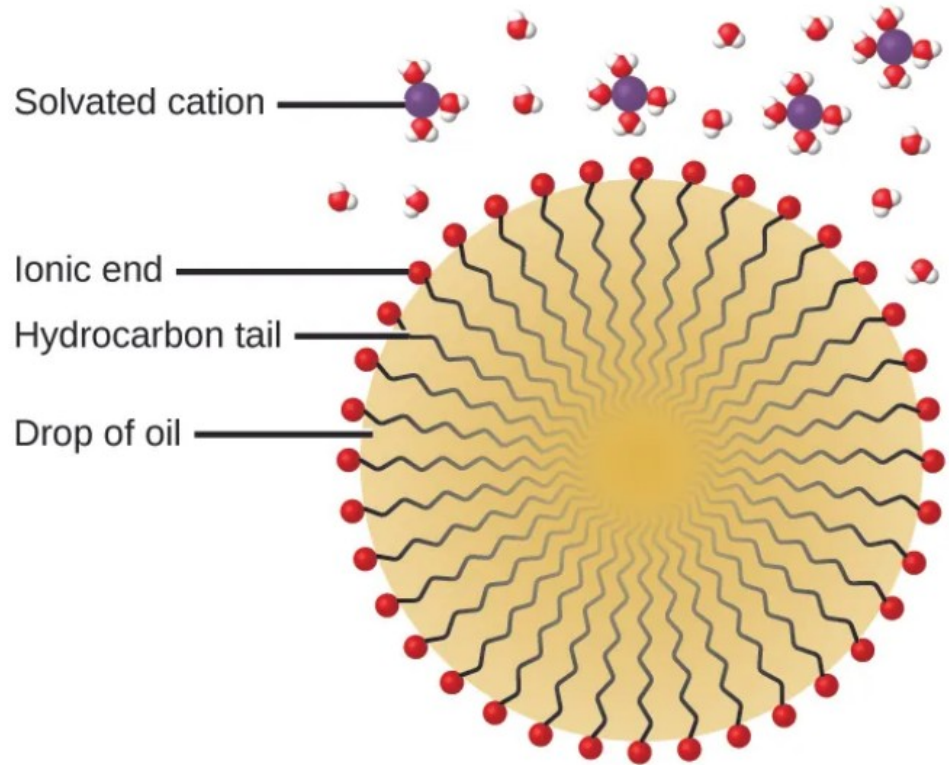


- **Emulsions** are colloids of two immiscible liquids
 - May be prepared by shaking together or blending the liquids.
 - One liquid breaks into droplets of colloidal size, which then disperse throughout the other liquid.
 - The droplets will typically coalesce and reform two phases.
- **Emulsifying Agents** can be used to stabilize emulsions.

Soaps and Detergents



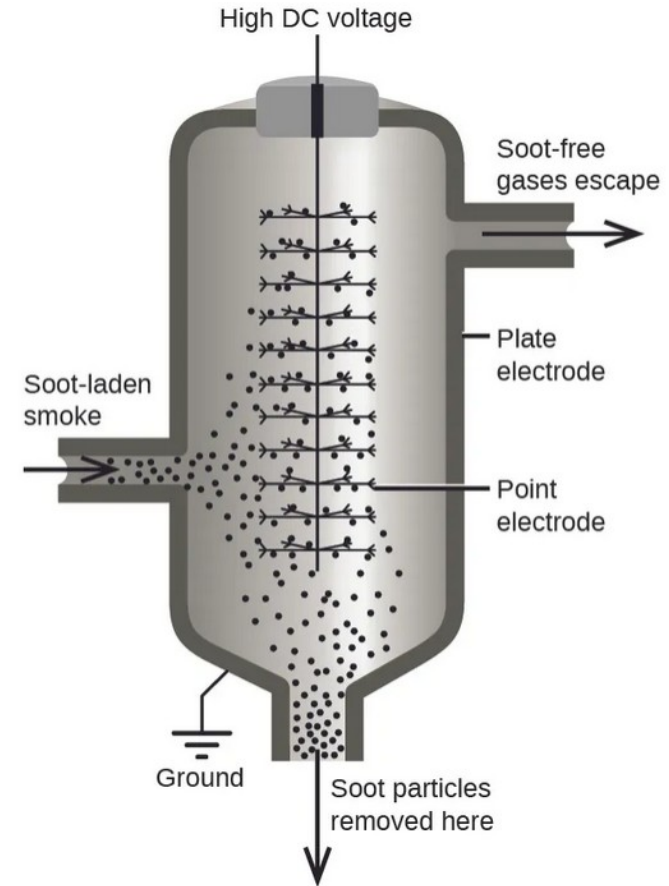
- Molecules with both hydrophobic and hydrophilic ends (**amphiphilic**) can be used as detergents.
- These molecules are capable of trapping dirt in particle formations known as **micelles**.



Electrical Properties of Colloids



- Dispersed colloidal particles are often electrically charged.
- This helps keep them dispersed because particles containing like charges repel each other.
- The charged nature of some colloidal particles may be exploited to remove them from a variety of mixtures.



Gels



- A **gel** is a colloidal dispersion of a liquid phase throughout a solid phase.
- The fibers of the dispersing medium form a complex three-dimensional network, the interstices being filled with the liquid medium or a dilute solution of the dispersing medium.

