# Compound or Mixture?

## (Lesson 11A)

**SPI 0807.9.4**

**Goal: I can tell the difference between a compound and a mixture.**

**Objectives:**

1) **Define compounds and mixtures, and list the process for separating each.**
2) **Distinguish between types of mixtures and parts of a solution.**
3) **Investigate samples to determine whether they are mixtures or compounds.**

# Compounds

A ,B,C,D,E,F,G,H,I,

J,K,L,M ,N ,O ,P,Q ,R,

S,T ,U ,V ,W,X, Y ,Z

# Compounds

- Pure substance composed of **two or more elements** that are **chemically combined.**

- In order for elements to combine, they must **react**, or undergo a **chemical change**, with one another.

# Familiar Compounds

- Table Salt: Sodium and Chlorine
- **Water**: Hydrogen and Oxygen
- **Sugar**: Carbon, Hydrogen, and Oxygen
- **Carbon Dioxide**: Carbon and Oxygen
- **Baking Soda**: Sodium, Hydrogen, Carbon, and Oxygen

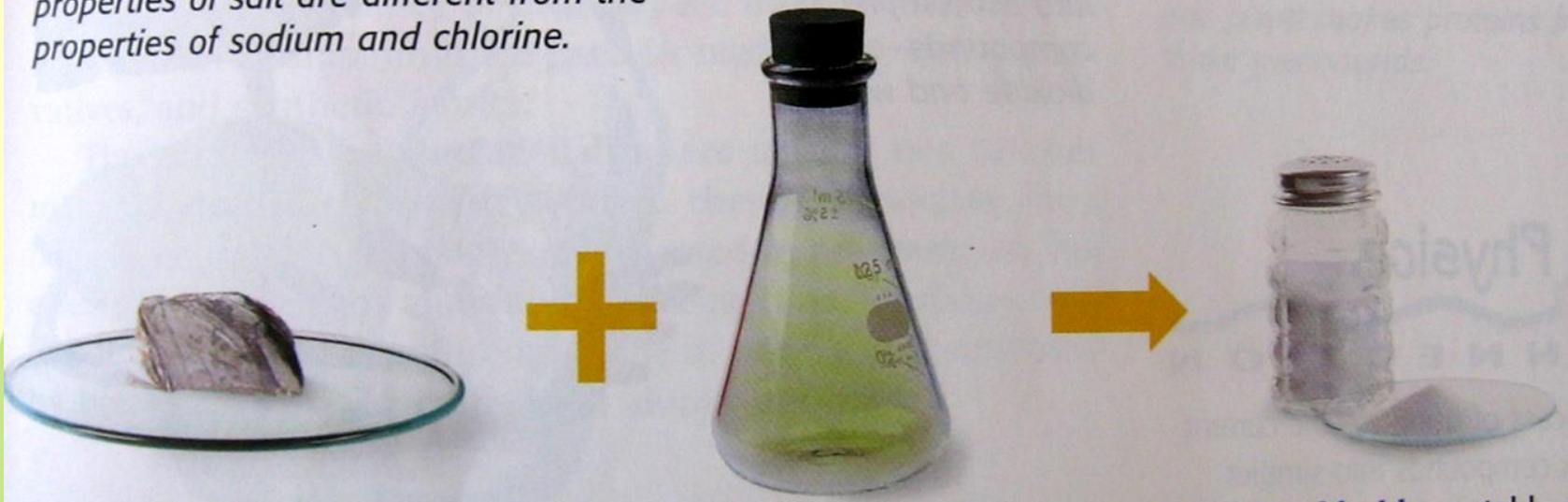
# Compounds Have Unique Sets of Properties

- **Physical properties**
- **Chemical properties**

- Compounds have **different properties from the elements that form it.**
  - Ex: Table salt is made of sodium (which reacts violently with water) and chlorine (which is poisonous).

compound A, and which is compound B?

**Figure 7** *Table salt is formed when the elements sodium and chlorine join. The properties of salt are different from the properties of sodium and chlorine.*



**Sodium** is a soft, silvery white metal that reacts violently with water.

**Chlorine** is a poisonous, greenish yellow gas.

**Sodium chloride,** or table salt, is a white solid that dissolves easily in water and is safe to eat.

# Compounds Can Be Broken Down into Simpler Substances

- Either broken down into **elements** through chemical changes…

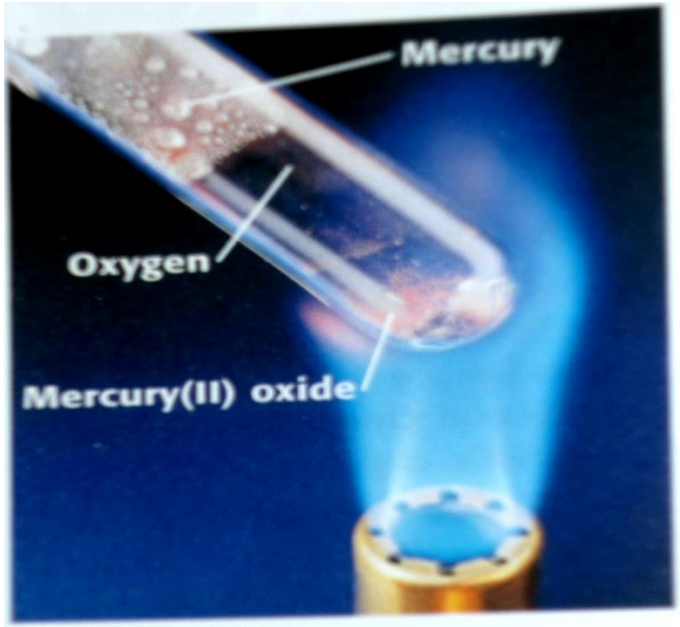



**Figure 8** *Heating mercury(II) oxide causes a chemical change that separates it into the elements mercury and oxygen.*

– Or undergo chemical changes and **form simpler compounds**

**Figure 9** *Opening a carbonated drink can be messy as carbonic acid breaks down into two simpler compounds—carbon dioxide and water.*

# Compounds Cannot Be Broken Down by Physical Changes

- Only way to break down a compound is through a **CHEMICAL change.**

# Think/Pair/Share

- How are compounds and elements alike?
- How are they different?
- A jar contains samples of the elements carbon and oxygen. Does the jar contain a compound? Explain.

# Mixtures

- Mixture: **combination of two or more** substances that are **not chemically combined**

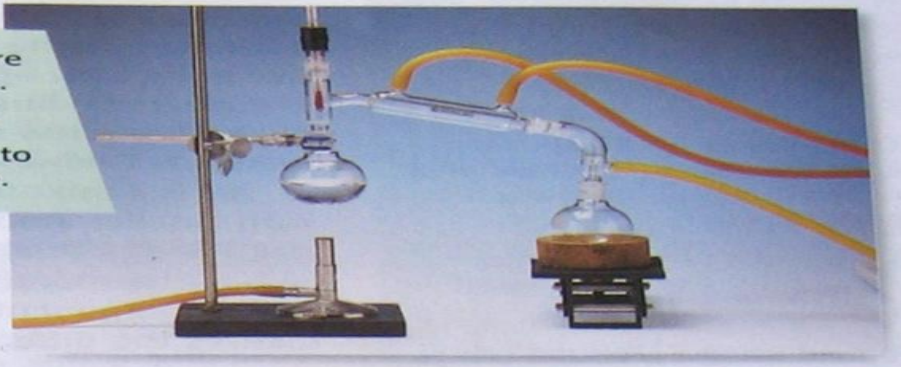
- Two or more materials form a mixture if they **do not react** to form a compound

- **Substance in a mixture keep their identities.**

- Mixtures can be **physically separated.**

# Common Techniques for Separating Mixtures

**Distillation** is a process that separates a mixture based on the boiling points of the components. Here you see pure water being distilled from a saltwater mixture. In addition to water purification, distillation is used to separate crude oil into its components, such as gasoline and kerosene.

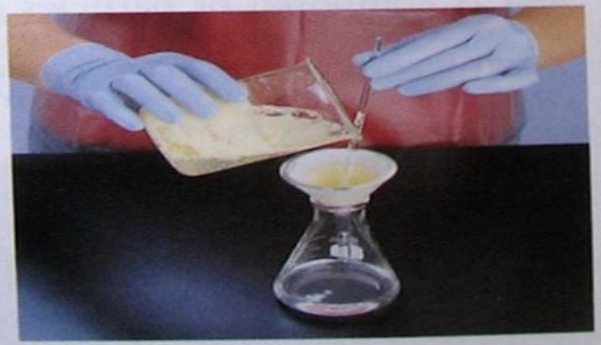


A **magnet** can be used to separate a mixture of the elements iron and aluminum. Iron is attracted to the magnet, but aluminum is not.

The components that make up blood are separated using a machine called a **centrifuge.** This machine separates mixtures according to the densities of the components.

A mixture of the compound sodium chloride (table salt) with the element sulfur requires more than one separation step.

1. The **first step** is to mix them with another compound—water. Salt dissolves in water, but sulfur does not.



2. In the **second step,** the mixture is poured through a filter. The filter traps the solid sulfur.

3. In the **third step,** the sodium chloride is separated from the water by simply evaporating the water.

# Solutions

- **Solution**: mixture that **appears to be a single substance** but is composed of particles of **two or more substances** that are distributed evenly amongst each other

- Also described as a **homogenous mixture**

- Process in which particles separate and spread evenly throughout a mixture is known as **dissolving**.

- The **solute** is the substance that is dissolved, and the **solvent** is the substance in which the solute is dissolved.

- Salt water

  Solute: Salt

  Solvent: Water

# Examples of Different States in Solutions

| | |
|---|---|
| Gas in gas | Dry air (oxygen in nitrogen) |
| Gas in liquid | Soft drinks (carbon dioxide in water) |
| Liquid in liquid | Antifreeze (alcohol in water) |
| Solid in liquid | Salt water (salt in water) |
| Solid in solid | Brass (zinc in copper) |

- Particles in solutions are so **small** that they never settle out, nor can they be **filtered out**, and they **don't scatter or block light**.

**Figure 12** *Both of these jars contain mixtures. The mixture in the jar on the left, however, is a solution. The particles in solutions are so small they don't scatter light. Therefore, you can't see the path of light through it.*

# Parts of a Solution

- solute = the substance that gets dissolved – or seems to disappear
- solvent = the substance that dissolves the solute
- If you have trouble remembering the difference, try writing the words like this:

SsOoLlVuEtNeT

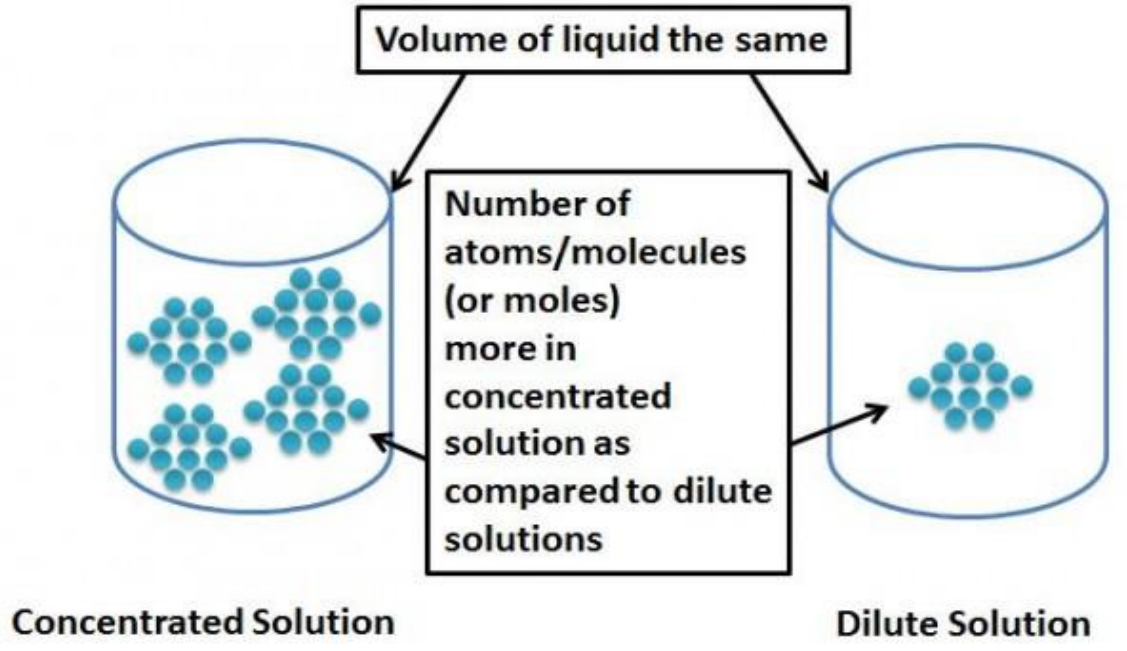
# Concentration:
# How much solute is dissolved?

- **Concentration**: measure of the **amount of solute dissolved in a solvent**

- Knowing the exact concentration of a solution is very important in chemistry and medicine because using the wrong concentration can be dangerous.

# Concentrated vs. Dilute

- Dilute- has less amount of solute dissolved in a solvent



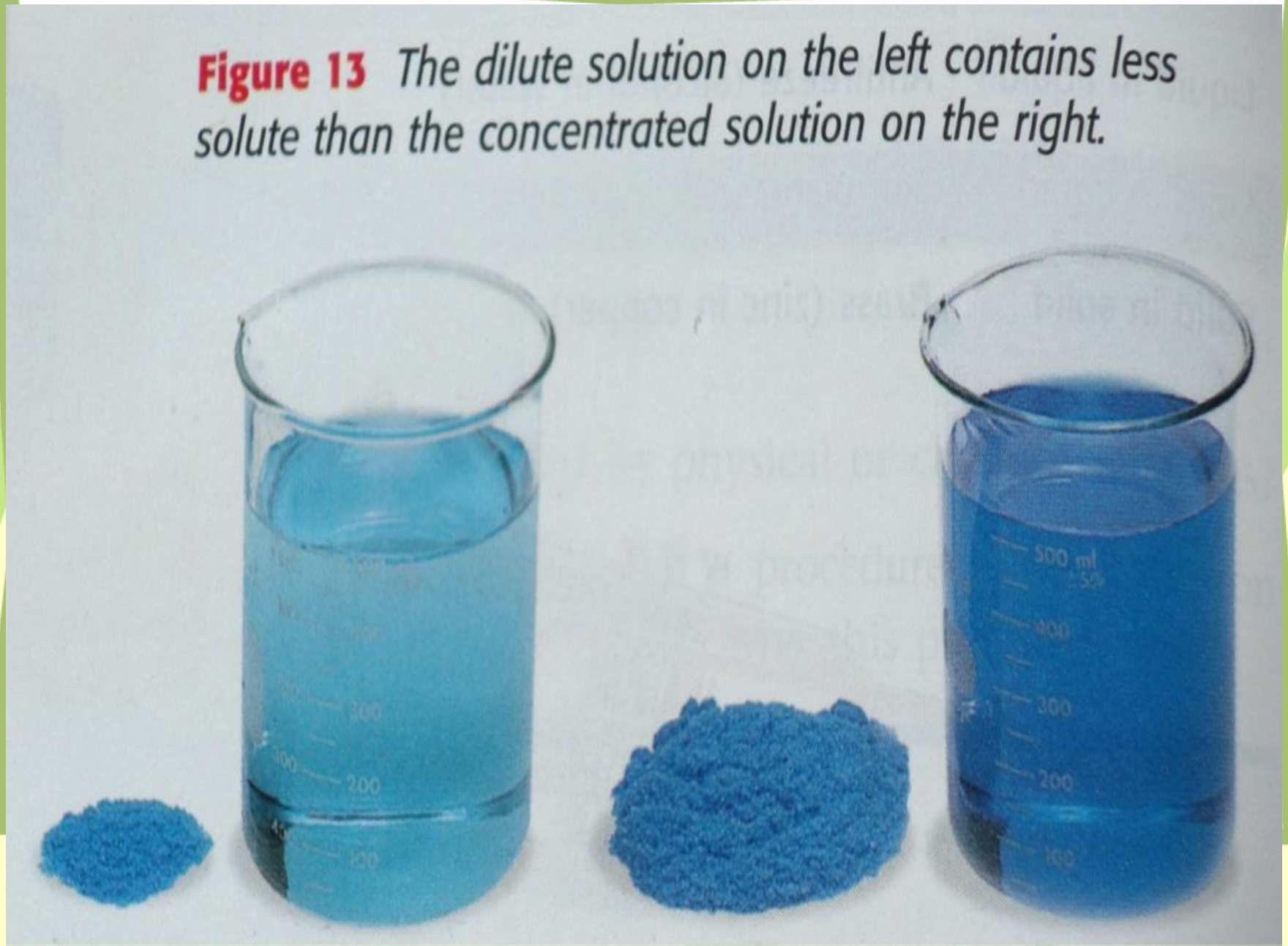


Figure 13 The dilute solution on the left contains less solute than the concentrated solution on the right.
500 ml
400
300
200
100

# Math Break

- Many solutions are colorless so you can't compare their concentrations by looking at the color. You must calculate the concentration. One way to calculate the concentration of a liquid solution is to divide the grams of solute by the milliliters of solvent.

- Example: Concentration of a solution in which 35 g of salt is dissolved in 175 mL of water is

$$\frac{35 \text{ g salt}}{175 \text{ mL water}} = 0.2 \text{ g/mL}$$

Calculate the concentration of Solution A which has 55 g of sugar dissolved in 500 mL of water.

# Math Break

$$\frac{55 \text{ g sugar}}{500 \text{ mL water}} = 0.11 \text{ g/mL in } \textbf{Solution A}$$

- Calculate the concentration of Solution B which has 36 g of sugar in 144 mL of water.

$$\frac{36 \text{ g sugar}}{144 \text{ mL water}} = 0.25 \text{ g/mL in } \textbf{Solution B}$$

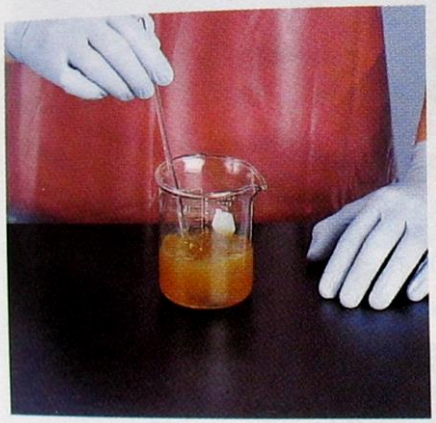
- Which solution is the more dilute one? **Solution A**
- Which is the more concentrated? **Solution B**

# What affects how quickly solids dissolve in liquids?

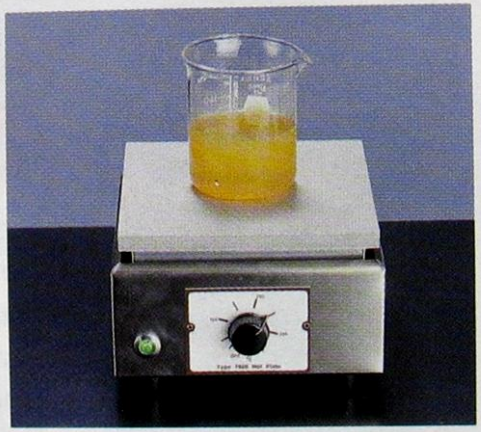
will dissolve. Look at

make a solute dissolve faster. You can see why you will enjoy a glass of lemonade sooner if you stir granulated sugar into the lemonade before adding ice!

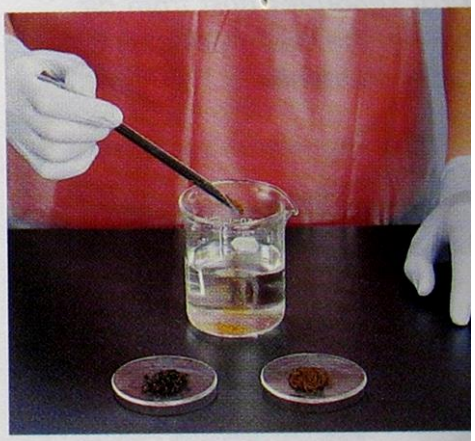
**Figure 15** *Mixing, heating, and crushing iron(III) chloride increase the speed at which it will dissolve.*



**Mixing** by stirring or shaking causes the solute particles to separate from one another and spread out more quickly among the solvent particles.



**Heating** causes particles to move more quickly. The solvent particles can separate the solute particles and spread them out more quickly.



**Crushing** the solute increases the amount of contact between the solute and the solvent. The particles of solute mix with the solvent more quickly.

# Suspensions

- Mixture in which particles of a material are dispersed throughout a liquid or gas but are **large** enough that they **settle out**.

- A suspension **can be separated** by passing it through a **filter**

# Application

- Many medicines, such as remedies for upset stomachs, are suspensions. The directions on the label instruct you to shake the bottle well before use.

- Why must you shake the bottle?

- What problem could arise if you don't?

# Biology Connection

- Blood is a suspension. The suspended particles, mainly red blood cells, white blood cells, and platelets, are actually suspended in a solution called plasma.
- Plasma is 90% water and 10% dissolved solutes including sugar, vitamins, and proteins.

# Colloids

- Mixture in which the particles are dispersed throughout but are **not heavy enough to settle out.**
- Colloids you might use often include: milk, mayonnaise, stick deodorant, gelatin, and whipped cream
- Colloids **cannot** be separated by **filtration**.

# Think/Pair/Share

- What are 2 methods of making a solute dissolve faster?

- Identify the solute and solvent in a solution made from 15 mL of oxygen and 5 mL of helium.