Theory:

Colloid:

A colloid is one of the three primary types of mixtures, with the other two being a solution and suspension. A colloid is a mixture that has particles ranging between 1 and 1000 nanometers in diameter, yet are still able to remain evenly distributed throughout the solution. These are also known as colloidal dispersions because the substances remain dispersed and do not settle to the bottom of the container. In colloids, one substance is evenly dispersed in another. The substance being dispersed is referred to as being in the dispersed phase, while the substance in which it is dispersed is in the continuous phase.

To be classified as a colloid, the substance in the dispersed phase must be larger than the size of a molecule but smaller than what can be seen with the naked eye. This can be more precisely quantified as one or more of the substance's dimensions must be between 1 and 1000 nanometers. If the dimensions are smaller than this the substance is considered a solution and if they are larger than the substance is a suspension.

**Classifying Colloids**

A common method of classifying colloids is based on the phase of the dispersed substance and what phase it is dispersed in. The types of colloids includes sol, emulsion, foam, and aerosol.

1. **Sol**is a colloidal suspension with solid particles in a liquid.
2. **Emulsion** is between two liquids.
3. **Foam**is formed when many gas particles are trapped in a liquid or solid.
4. **Aerosol**contains small particles of liquid or solid dispersed in a gas.

Tyndall Effect:

The **Tyndall effect** is [light scattering by particles](https://en.wikipedia.org/wiki/Light_scattering_by_particles) in a [colloid](https://en.wikipedia.org/wiki/Colloid) or in a very fine [suspension](https://en.wikipedia.org/wiki/Suspension_(chemistry)). Also known as **Tyndall scattering**

The Tyndall effect is an easy way of determining whether a mixture is colloidal or not. When light is shined through a true solution, the light passes cleanly through the solution, however when light is passed through a colloidal solution, the substance in the dispersed phases scatters the light in all directions, making it readily seen.

**What is a Suspension?**

A suspension is a heterogeneous [mixture](https://www.chemicool.com/definition/mixture.html) in which solute-like particles settle out of a solvent-like phase sometime after their introduction. We use the terms 'solute-like' and 'solvent-like' because we are dealing with a heterogeneous mixture, while the terms solute and solvent refer to [homogeneous](http://www.chemicool.com/definition/homogeneous.html) solutions.

We apply the word 'suspension' when particles are big enough to eventually settle. If the particles are too small to ever settle, they are said to form a [colloid](http://www.chemicool.com/definition/colloid.html).

**Examples of Suspensions**

**Example 1**  
Sometimes, in the right light, you will be able to see particles of dust floating in a room. Eventually the dust will settle on the floor and on furniture, and the room will need to be cleaned. Dust in air is a suspension.

**Example 2**  
If you go to a beach and mix sand and water in a bucket you will form a suspension. Given time, the sand will settle on the bottom of the bucket to leave clear water.

## What Is Emulsification?

To emulsify is to force two immiscible liquids to combine in a suspension—substances like oil and water, which cannot dissolve in each other to form a uniform, homogenous solution. Although oil and water can’t mix, we can break oil down into teeny-tiny droplets that can remain suspended in the water. An emulsion happens when small droplets of one solution (the dispersed solution, which is often oil based) are dispersed throughout another (the continuous solution, which is often water based).

## How Does Emulsification Work?

Two unlike substances won’t form an emulsion on their own—you need help, in the form of an emulsifier. The emulsifier coats the droplets, keeping them separate from each other, because when left to their own devices, the droplets will clump together, causing the emulsion to separate. Emulsifiers are molecules with a fat-soluble part and a water-soluble part. The fat-loving part sticks to the oil, and the water-soluble part sticks to the water, creating an effective barrier around the droplets. Emulsifiers come in many forms, including milk proteins called casein and the protein lecithin found in egg yolks.

Materials and Equipment

* Cup, mug, or drinking glass
* Water
* Small bowls (3)
* Measuring spoon
* Cornstarch
* Medicine dropper
* Forks (3)
* Sugar
* Sand
* Optional: Camera
* Lab notebook

## Experimental Procedure

1. Fill an empty cup, mug, or drinking glass with water.
2. To one small bowl, add 1 tablespoon (tbsp.) of cornstarch.
3. Use the medicine dropper to add water from the cup to the small bowl with the cornstarch. Add the water one drop at a time, counting as you go, trying to sprinkle it evenly across the cornstarch.
4. After you have added 20 drops, stir the cornstarch with a fork. Break up any clumps that formed.
5. Repeat steps 4 to 5 until you have added 100 drops of water total.
6. After you have added 100 drops total, repeat steps 4-5 until you reach 200 drops total, but now stir the mixture after every 10 drops instead of every 20 drops.
7. After adding 200 drops total, look at your mixture and answer the questions in the data table in your lab notebook.
   1. If you want, you can wait until you have made all three mixtures before answering the questions in your data table. Comparing the mixtures to each other may make it easier for you to answer the questions and determine which mixture is which.
   2. To determine whether particles have dissolved, see if it looks like there are fewer particles visible than there were at the beginning *or* you can no longer make out individual particles in the mixture.
   3. *Tip:* If too much water is added to a colloidal solution, it may not behave like a colloidal solution anymore. To determine if the mixture is a colloidal solution, think about whether it *ever* behaved like one while you were adding water and mixing it.
   4. *Hint:* If you are having trouble determining whether a mixture is a true solution, a colloidal solution, or a suspension based on your other answers, try re-reading the Introduction in the Background tab.
8. To a new small bowl, add 1 tbsp. of sugar.
9. Repeat steps 4-8 with the bowl of sugar.
   1. Be sure to answer the questions in the data table in your lab notebook about this mixture.
10. To a third small bowl, add 1 tbsp. of sand.
11. Repeat steps 4-8 with the bowl of sand.
    1. Be sure to answer the questions in the data table about this mixture.
12. When you are done making all three mixtures, compare each of them.

Result:

Water and cornstart- colloid

Water and sand- suspension

Water and sugar - transparent solution

