Grade 6 Science

Week of November 16 – November 20

Heterogeneous Mixtures

Mechanical Mixtures

Mechanical mixtures have two or more particle types that are not mixed evenly and can be seen as different kinds of matter in the mixture.

Obvious examples of mechanical mixtures are chocolate chip cookies, granola and pepperoni pizza.

Less obvious examples might be beach sand (various minerals, shells, bacteria, plankton, seaweed and much more) or concrete (sand gravel, cement, water).

Mechanical mixtures are all around you all the time. Can you identify any more right now?

Suspensions

Suspensions are mixtures that have solid or liquid particles scattered around in a liquid or gas.

Common examples of suspensions are raw milk, salad dressing, fresh squeezed orange juice and muddy water.

If left undisturbed the solids or liquids that are in the suspension may settle out and form layers. You may have seen this layering in salad dressing that you need to shake up before using them. After a rain fall the more dense particles in a mud puddle may settle

to the bottom. Milk that is fresh from the cow will naturally separate with the cream rising to the top. Homogenization breaks up the fat molecules of the cream into particles small enough to stay suspended and this stable mixture is now a colloid. We will look at colloids next.

Solution, Suspension, and Colloid: https://youtu.be/XEAiLm2zuvc

Colloids

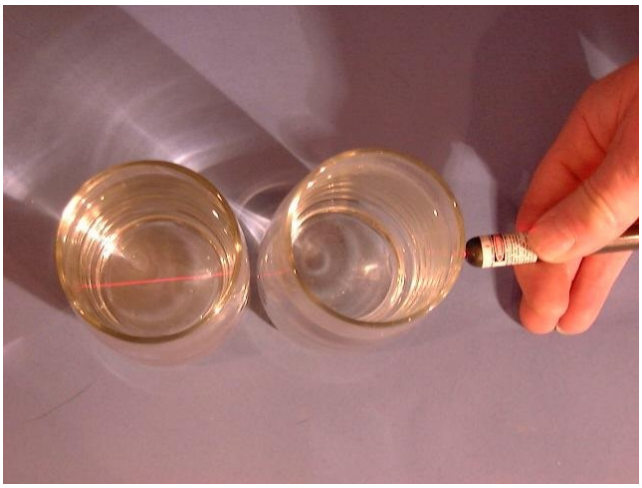
Colloids: https://youtu.be/MPortFIqgbo

Colloids are two phase mixtures. Having two phases means colloids have particles of a solid, liquid or gas dispersed in a continuous phase of another solid, liquid, or gas.

Colloids are different from a suspension because the dispersed particles are very small and will not separate into layers like a suspension.

Colloids are different from a solution because the dispersed phase is considered particulate and is dispersed but not dissolved like in a solution.

These small particles in colloids scatter light as opposed to the dissolved particles in solutions that do not scatter light. This light scattering by the dispersed particles in a colloid were first identified by John Tyndall so we now call it the Tyndall Effect or Tyndall scattering. If you shine a light through a colloid you will see it like with the laser below. Note that the light is not visible in the solution.



You can think of colloids as having smaller particles than in a suspension but larger or less soluble particles than in a solution. These particles are bigger than molecules but are still too small to see. If you want to get technical, the dispersed particles in a colloid range from 1 to 1 000 nanometers. A nanometer is one billionth of a meter or really small.

Below is a video that reviews the differences in light scattering for a colloid and a solution.

Solutions or Heterogeneous Mixtures? https://youtu.be/QjlylBuPBxg

Colloid Types

Colloids can be Sols, Emulsions, Foams or Aerosols.

- Sols are a solid dispersed in a liquid.
- Emulsions are a liquid dispersed in a liquid.
- Foams are a gas dispersed in a liquid or solid.
- Aerosols are a liquid or solid dispersed in a gas.

Table of Colloid Types

Continuous Phase	Dispersed Phase	Type of Colloid	Example
Solid	Solid	Solid Sol	Cranberry Glass, Pearls
Solid	Liquid	Solid emulsion or Gel	Gelatin, Agar, Cheese, Opal, Lubricants
Solid	Gas	Solid Foam	Pumice, Styrofoam, Aerogels
Liquid	Solid	Sol	Ink, Blood, Cell Fluid
Liquid	Liquid	Emulsion	Milk, Mayonnaise
Liquid	Gas	Foam	Shaving Cream, Whipping Cream
Gas	Solid	Aerosol	Smoke, Fine Dust
Gas	Liquid	Liquid Aerosol	Fog, Clouds
Gas	Gas	*Note all gases are soluble.	None

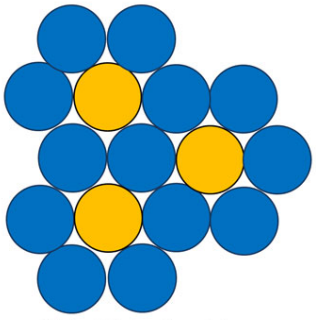
Emulsions

Emulsions are a form of colloid in which a liquid is dispersed in another liquid that acts as the continuous phase.

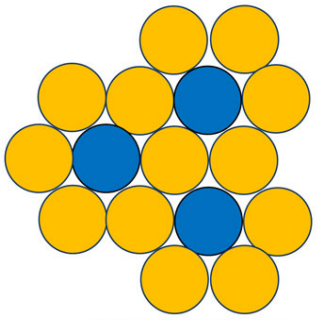
In milk the dispersed phase is fat droplets and the continuous phase is water. Remember that to have milk as a stable emulsion it must be homogenized to turn the cream into fat droplets small enough to remain dispersed. This form of homogenization is related to food science not Chemistry. Although the process creates a stable emulsion we know the an emulsion is a heterogeneous mixture. Right?

By contrast, in butter the dispersed phase is water and continuous phase is butter fat. To make butter you separate the cream from raw milk and churn it until it thickens and then remove the extra liquid or butter milk. This process leaves butter - a liquid in oil emulsion.

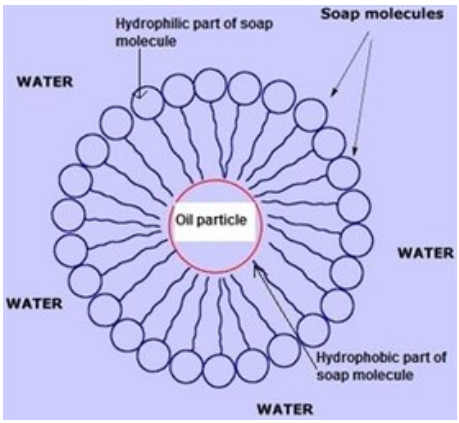
To produce an emulsion often an emulsifying agent is used. These emulsifying agents are molecules that can surround the dispersed particles and make a layer around them to keep them separated from the continuous phase and each other.



Oil-in-Water Emulsion



Water-in-Oil Emulsion



Emulsifiers are used to stabilize many food products and there is a long list of them.

Our liver makes an emulsifier, called bile, that is stored in our gall bladder and is released into our small intestine when we eat fatty foods. These fats are emulsified by bile into tiny droplets with a much higher surface area so enzymes can digest the fat molecules.

When we wash dishes the dish detergent emulsifies the grease on dishes and suspends it as tiny particles in the dish water and keeps it off the dishes.

Aerosols

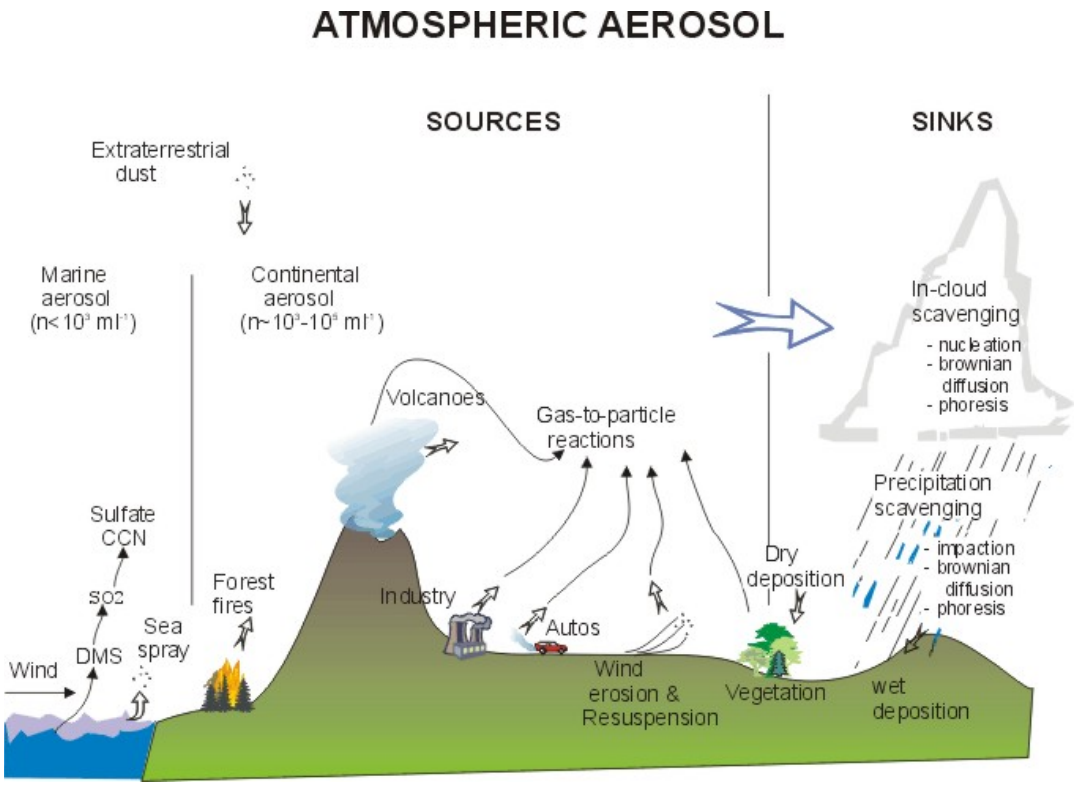
Aerosols are a form of colloid in which a solid or liquid is dispersed in a gas that acts as the continuous phase.

Aerosols like other colloids exhibit Tyndall scattering of light and this is why we can not see through fog or clouds despite the dispersed liquid being transparent water.

Aerosols like smoke, fine dust particulate or smog (smoke + fog) can have negative impacts on our respiratory health. These small particles can be inhaled into the lungs and negatively impact lung function. A sneeze might produce a bioaerosol containing viruses.

Common treatment for lung diseases are inhalers and sprays that contain aerosols of liquid or solid powder medicines that can be delivered directly to the lungs when inhaled.

Many processes take place on our planet that produce aerosols and have impacts on the Earth's climate. Again it is the scattering of light by dispersed particles that causes changes in the warming and cooling of the atmosphere. These energy changes in the atmosphere have impacts on climate.



Complete the following.

1.Give a definition for a mechanical mixture and give three examples of mechanical mixtures.

2. Watch the “Solution, Suspension and Colloid” video. List the three different mixtures with their type and what they contain. State whether the result Is homogenous or heterogenous.

3. Give a definition for a suspension and give three examples of suspensions.

4. Watch the “Colloids” Video and complete the following table.

Colloid Example	Dispersed Phase	Continuous Phase
Cranberry Glass		
Hair Gel		
Polystyrene		
Aerogel		
Blood		
Mayonnaise		
Homogenized Milk		
Shaving Cream		
Smoke		
Clouds		

5. Give a definition for a colloid and list the four types of colloids.

6. Describe the Tyndall effect and what it is used to identify.

7. What are the differences between a suspension and a colloid?

8. What is an emulsion? Explain with an example.

9. What is an aerosol? Explain with an example.

10. Why can aerosols like smoke have a negative impact of our respiratory (lung) health?

11. Classify each of the following heterogeneous mixtures as a mechanical mixture (components are visible), suspension, or colloid. For the colloids indicate the type as an emulsion or an aerosol.

a. Trail mix.

b. Paint.

c. Whipping cream.

d. Butter.

e. Milk.

f. Italian salad dressing.

g. Orange juice.

h. Farm-fresh milk.

i. Homogenized milk.

j. Concrete.

k. Sunscreen (cream).

l. Sunscreen (spray).

m. Beach sand.

n. Smoke.

o. Spaghetti sauce.

p. Cheese.

q. Fog.

r. Cell fluid or cytoplasm