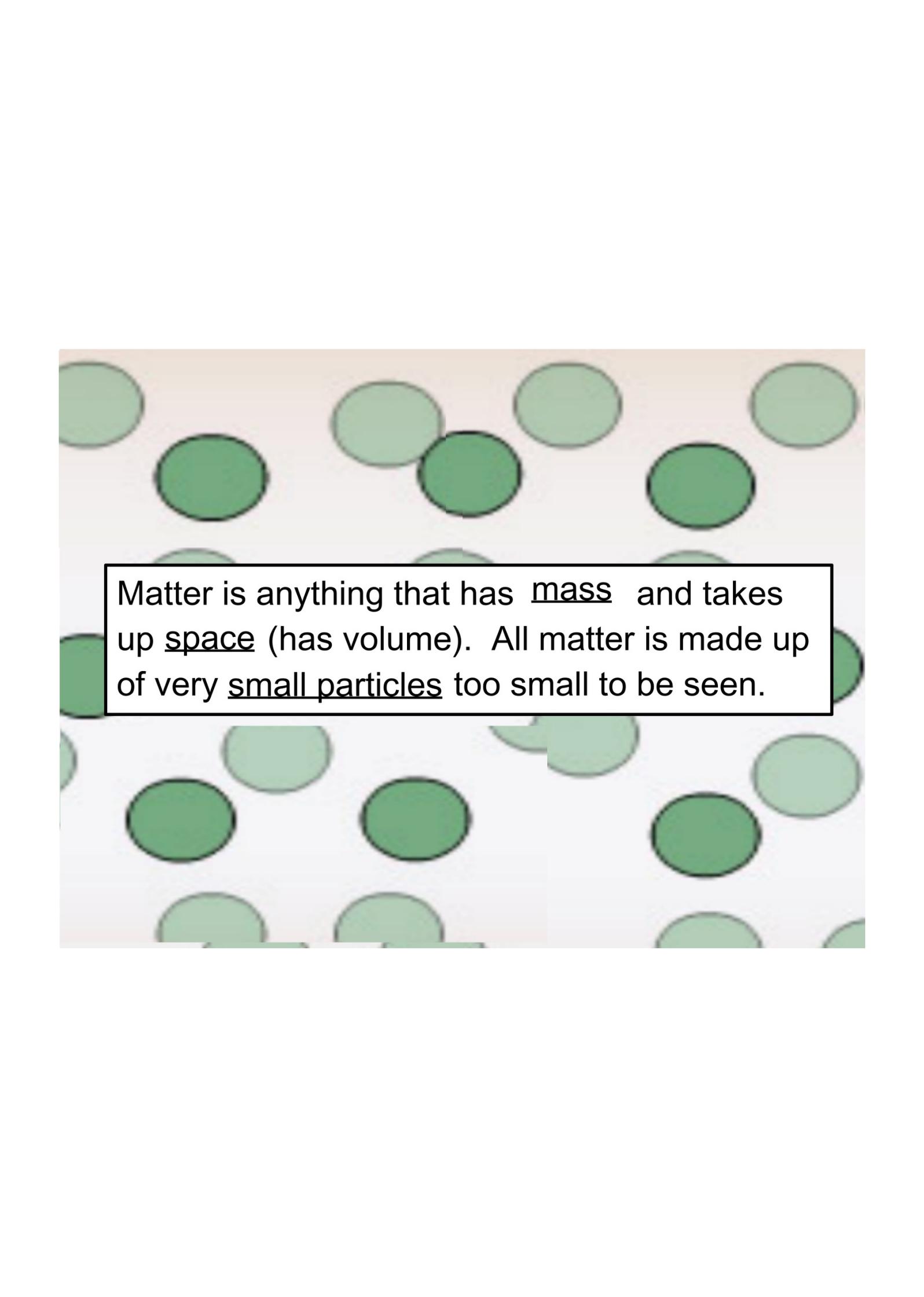




States  
of  
Matter

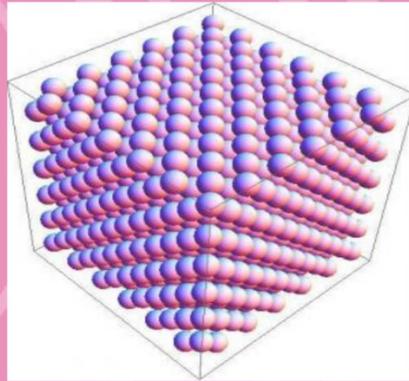


# Solids, Liquids, & Gases



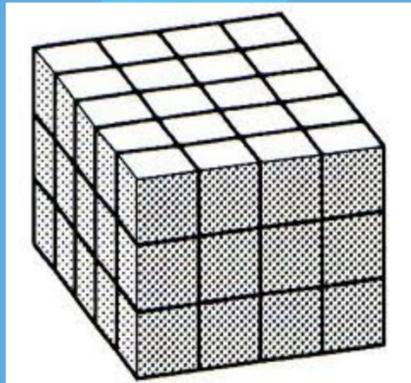
Matter is anything that has mass and takes up space (has volume). All matter is made up of very small particles too small to be seen.

Solids have a definite shape and volume.



Particles in a solid are very close to one another (dense) and vibrate, but stay in the same place.

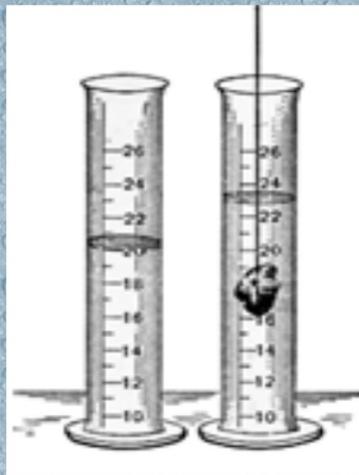
The volume of a solid with rectangular sides can be determined by measuring the length, width, and height with a ruler and multiplying them together.



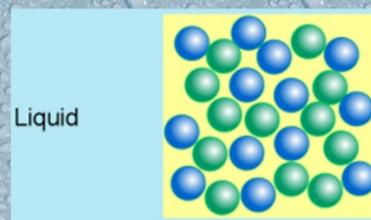
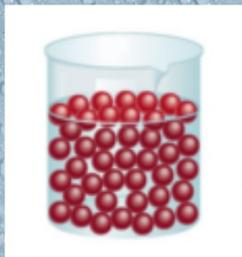
$$\text{volume} = \text{length} \times \text{width} \times \text{height}$$

The volume of an irregularly shaped solid can be determined by water displacement in a graduated cylinder.

The volume of water displaced equals the volume of the object.



Liquids have a definite volume, but their shape changes according to the shape of their container.



The particles are also close to one another, but they are able to move apart from each other and flow from place to place.

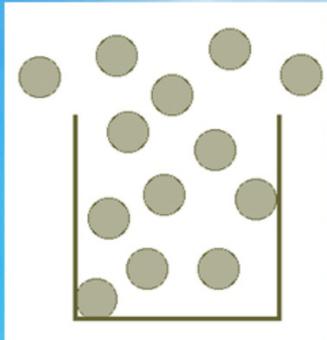
The volume of a liquid can be measured using a graduated cylinder or a graduated syringe.



measures in mL

Gases have no definite shape or volume, but take the shape and volume of their containers, filling the space available.

The particles easily move far apart from each other and spread out through the available space.

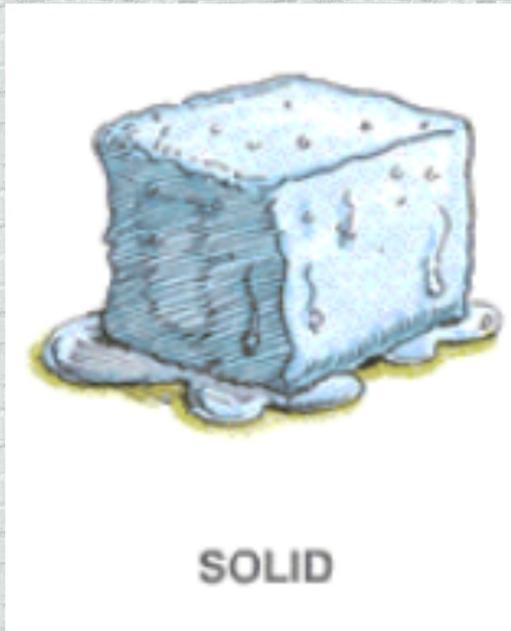


1. All matter is made of particles too small to be seen. true
2. The state of matter whose particles can only vibrate in place is a solid. true
3. Gases are the only state of matter in which particles can move past one another. false
4. The particles in a liquid take the shape of their container. true
5. To find the volume of an irregular solid, you must multiply the object's length, width, and height together. false
6. A liquid's particles can spread out and completely fill the shape of its container. false

$L \times W \times H$

keeps its shape

definite mass



definite volume

particles vibrate

definite volume

definite mass



particles move  
freely- flow

measured in mL

shape changes  
with the container

particles move  
freely



has mass

fills the entire  
container

A photograph of a beach with various colored rocks and shells on the sand. The rocks are in shades of brown, tan, grey, and pink. The sand is dark and wet, with some small shells scattered around. The title 'Mixtures and Solutions' is overlaid on a semi-transparent grey banner in the center.

# Mixtures and Solutions

Mixtures are composed of two or more substances that are mixed together but can be separated from each other.



Mixtures can be made from various combinations of solids, liquids, or gases.



The substances in a mixture do not permanently change in a mixture, but they keep their separate properties.

A solution is one type of mixture.

Something dissolves.

They are composed of substances that mix so completely that they cannot be distinguished as separate substances.



Solutions can, however, be separated back into separate substances.



One example of a solution is a mixture of a solid that dissolves completely in a liquid.

Example: salt dissolved in water



Mixture

Solution

sand and water

Kool-Aid

Mixture

Solution Mixture

lemonade

rice and beans

Solution Mixture

Mixture

sugar water

salad

Solution Mixture

Mixture

cereal and milk

ocean water

Mixture

Solution Mixture

Solutions are made of two parts:  
the solute and the solvent.



The substance in a solution that is in the greatest amount is the solvent. It is usually the liquid. Most of the time the solvent is water.

The substance in a solution that is in the least amount is the solute. It is usually the solid.



### Examples

sugar

salt

kool-aid powder



The relationship between the amount of solute to solvent determines its concentration.

To make a solution more concentrated, add more solute.



To make a solution less concentrated, add more solvent.

If the Kool-Aid I made is too sweet, do I add more solute or solvent?



solute

solvent



I ordered unsweetened tea at the restaurant. What would I add to make it sweeter?

solute

solvent

I poured a glass of iced tea. I left it sitting on the counter. When I came back later to drink it, it didn't taste the same.

Is my tea now more concentrated or less concentrated? less concentrated

Why? The ice melted.

What was added to my tea? more solvent

Cup One has 50 mL of water and 10 g of sugar.

Cup Two has 50 mL of water and 20 g of sugar.

Which cup is more concentrated? Why?

Cup One has 100 mL of water and 20 g of salt.

Cup Two has 50 mL of water and 10 g of salt.

Compare the concentration of salt to water.

# Methods for Separating Mixtures

# Filtration

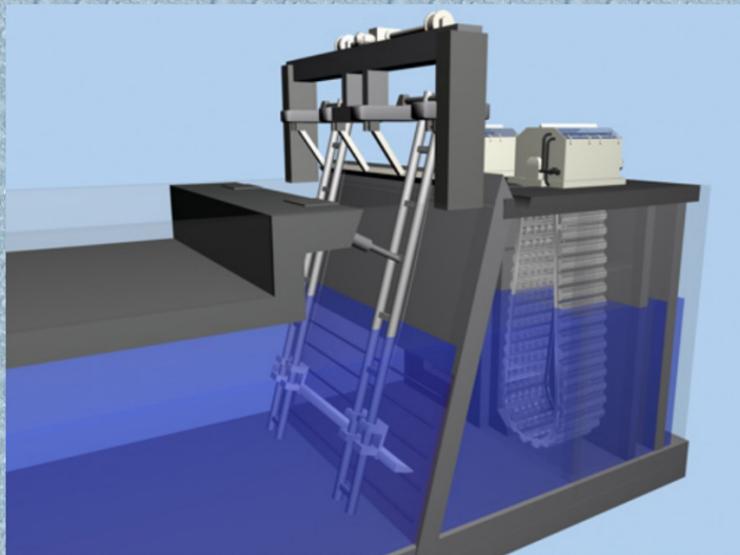
Filtration is used to separate solid particles from a liquid.



For example, pouring the mixture through a filter paper in a funnel will trap the solid particles and only allow the liquid to pass through.



This method is used in water treatment plants as part of the process for separating dirt and other solid particles from water to produce clean drinking water.



## Sifting

Sifting is used to separate smaller solid particles from larger solid particles.



For example, the mixture of different sized solid particles can be put into a container that has a screen material at the bottom with holes of a certain size.



When the mixture is shaken, the smaller particles go through the screen leaving the larger particles in the container.



Cooks, for example, sift flour to get a small particle size for baking leaving larger particles of flour in the sifter above the screen.

Sand and gravel companies separate rocks into different sized particles for road building and other construction projects using this method.



## Magnetic Attraction

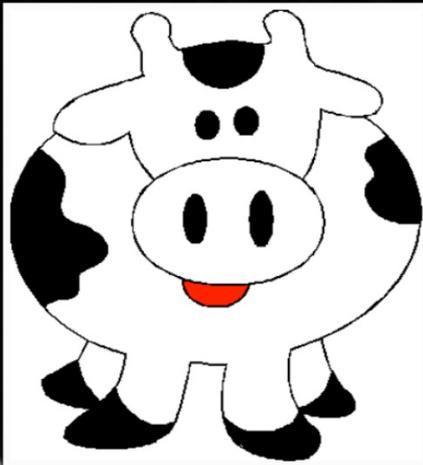
Magnetic attraction is used to separate magnetic material from a mixture of other substances.



When a magnet is stirred through a mixture, it pulls out the magnetic material from the mixture.

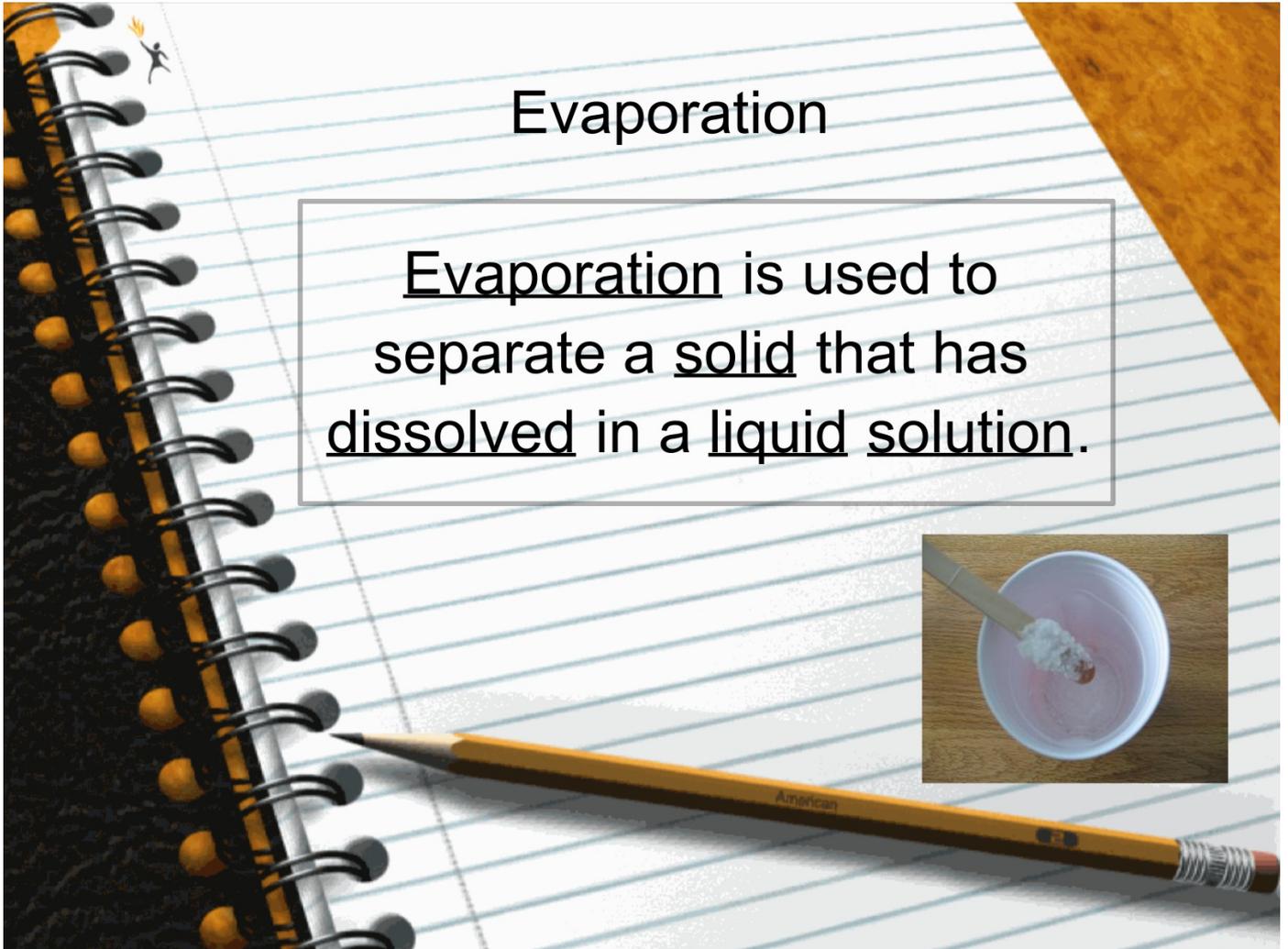


A cow magnet, for example, is given to a cow to swallow. It stays in the first stomach of the cow, keeping magnetic materials like wire and other harmful materials that cows swallow from going into the rest of their digestive system.

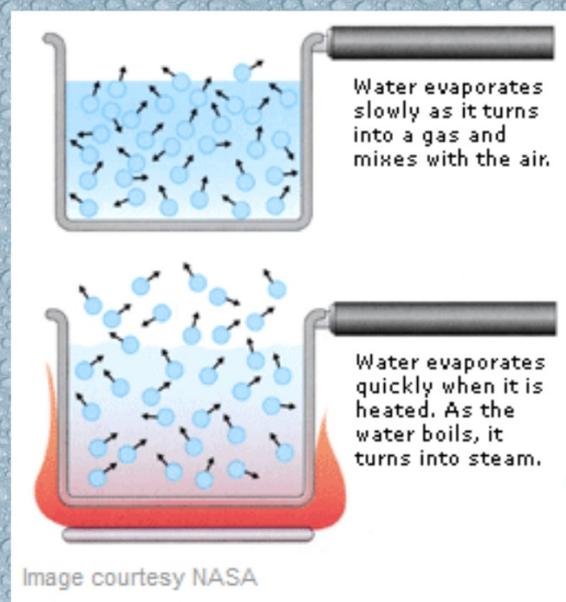


# Evaporation

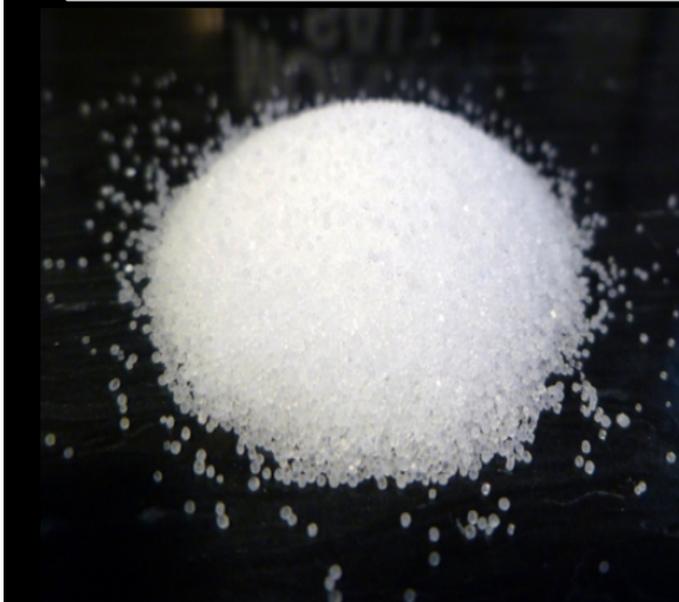
Evaporation is used to separate a solid that has dissolved in a liquid solution.

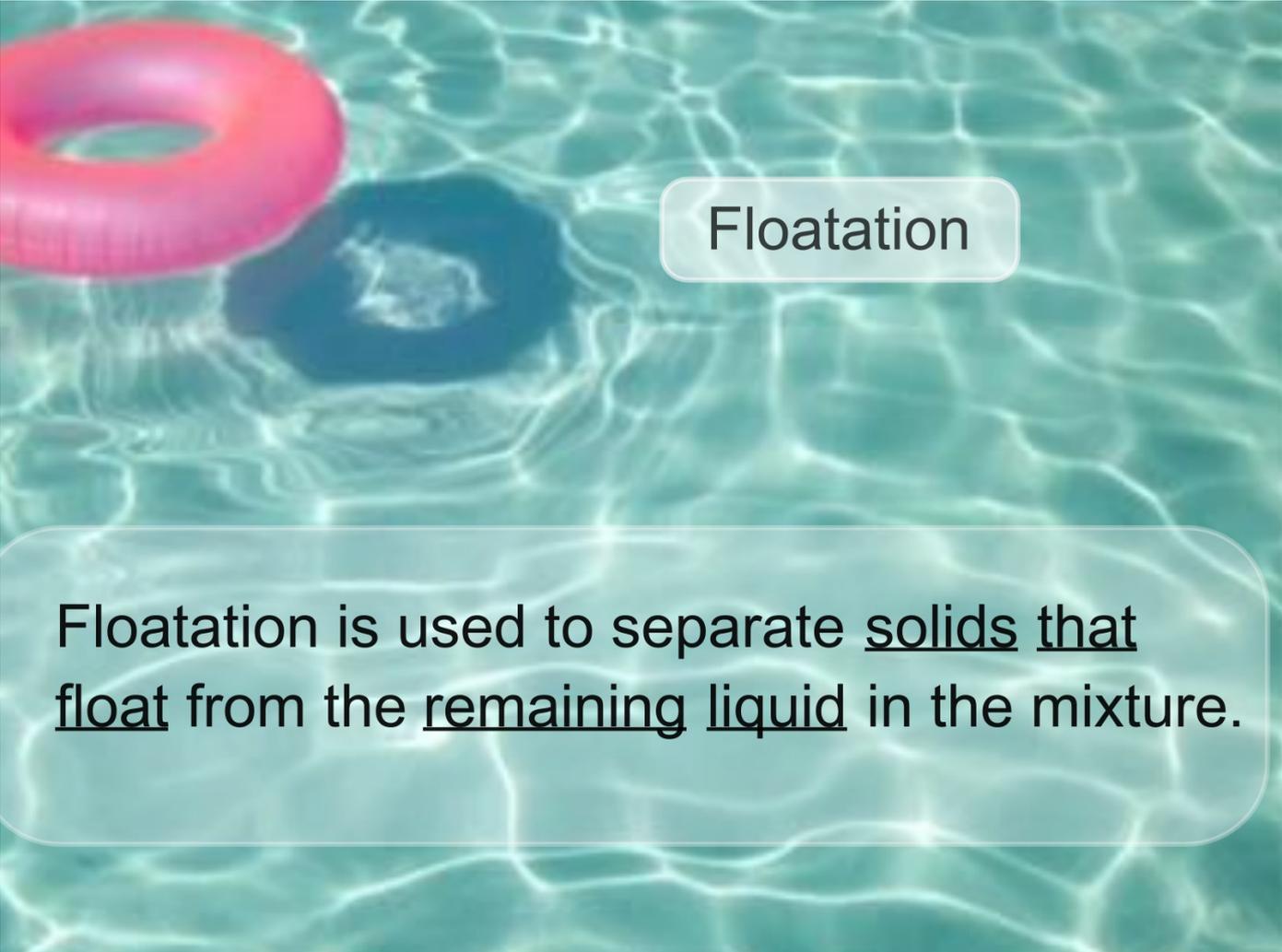


The solution is heated or left uncovered until all the liquid turns to a gas (evaporates) leaving the solid behind.



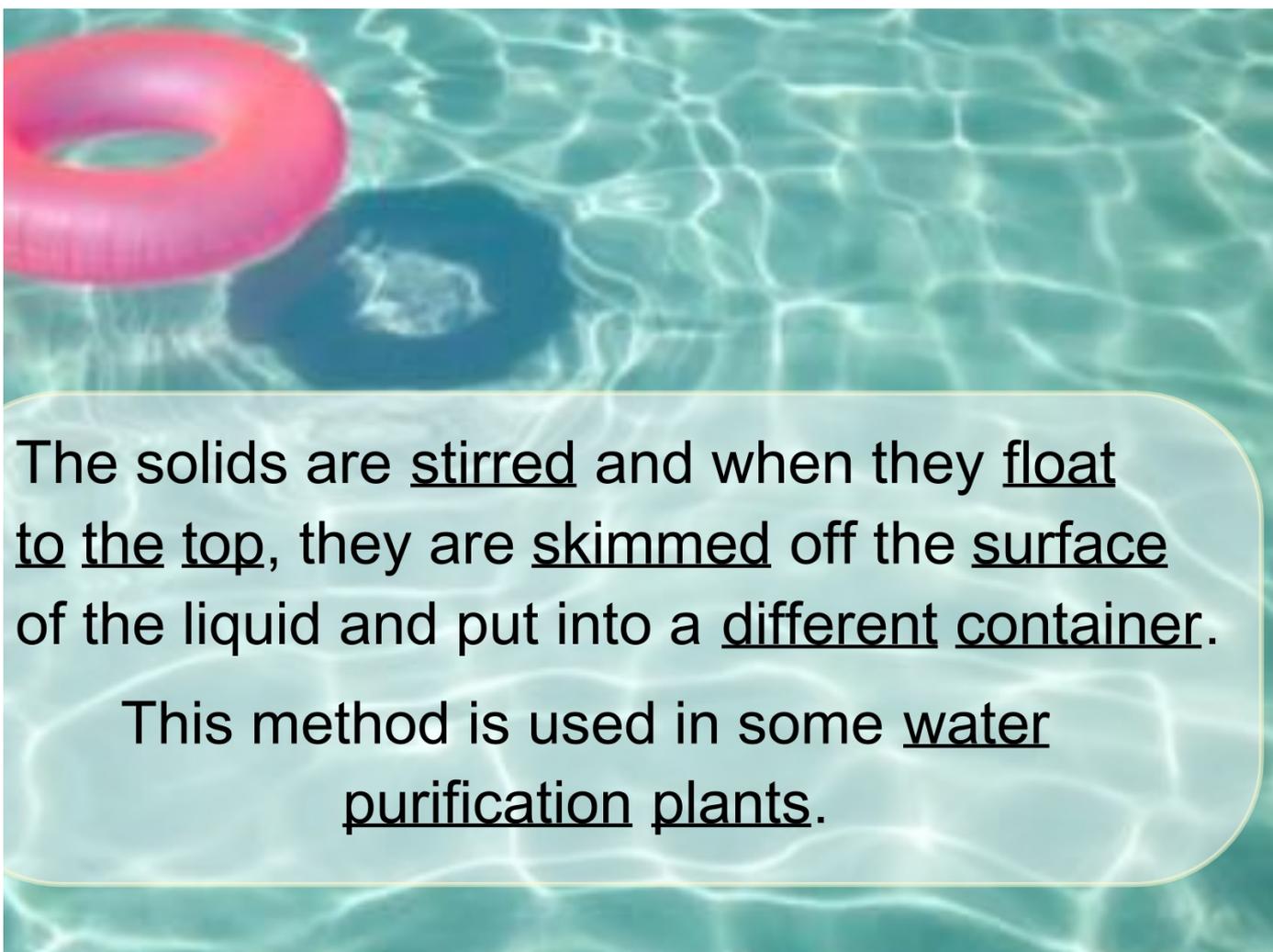
Salt in salt water or ocean water is separated by heating the solution until all the water evaporates leaving the solid behind.



A photograph of a swimming pool with a red inflatable ring and a dark object floating on the water. The water is clear and blue, with ripples visible. The red ring is on the left, and the dark object is in the center. A white text box with a rounded border is overlaid on the right side of the image, containing the word "Floatation".

## Floatation

Floatation is used to separate solids that float from the remaining liquid in the mixture.



The solids are stirred and when they float to the top, they are skimmed off the surface of the liquid and put into a different container.

This method is used in some water purification plants.



**Which of the following separation methods is best to separate iron filings from sand? (1 mark)**



screen



magnet



evaporation



floatation



**When evaporation is used to separate a solution, which of the following substances evaporate?**

- A** all solvents
- B** all solutes
- C** water only
- D** all dissolved solutes



**If you are trying to separate a mixture of iron filings and beans, which of the following is the best method to use?**

**A** magnet

**B** screen

**C** evaporation

**D** separating by hand



**In order to separate sand and salt, which following methods would be best to get t completely apart?**

- A** Use a screen to separate the sand and the salt.
- B** Use a magnet to separate the sand and the salt.
- C** Add water to the mixture. Stir. Use a screen to separate the sand and salt.
- D** Add water to the mixture. Stir. Use a filter to separate the sand from the saltwater.



**Floatation is used to separate a mixture in which two or more objects will float.**

**A** True

**B** False



**I have a mixture of flour and sugar. If I add it to water, which of the following will occur?**

- A** The sugar will dissolve.
- B** The sugar and flour will dissolve.
- C** The sugar will dissolve, and the flour can be filtered out.
- D** The sugar will dissolve, and the flour can be sifted out.



**Which of the following methods would be used to separate large pebbles from grains of sand?**

- A** sifting
- B** magnet
- C** floatation
- D** hand separation