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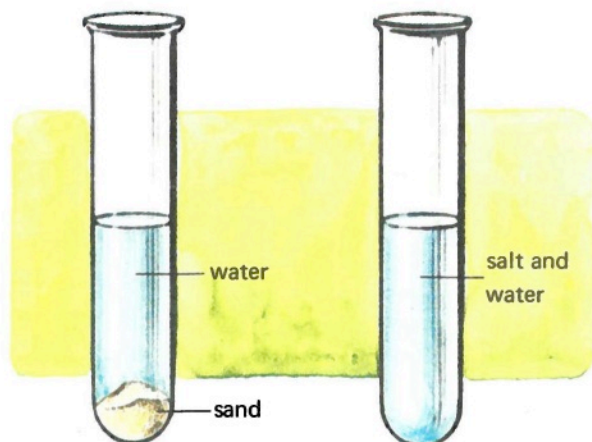
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What is a solution?

Disappearing chemicals. Fill two test tubes half full with water. Add $\frac{1}{4}$ teaspoon of sand to one of the test tubes. Add $\frac{1}{4}$ teaspoon of salt to the other test tube. Shake both test tubes. The sand can be seen at the bottom of its tube, but the salt has disappeared. Taste the water in the test tube to which salt was added. It tastes salty. The salt is still in the test tube, but we cannot see it. The salt is dissolved (dih-ZOLVED) in the water. The sand did not dissolve in the water.

► **What happens when salt is placed in water?**



Sand does not dissolve in water.

Salt dissolves in water.

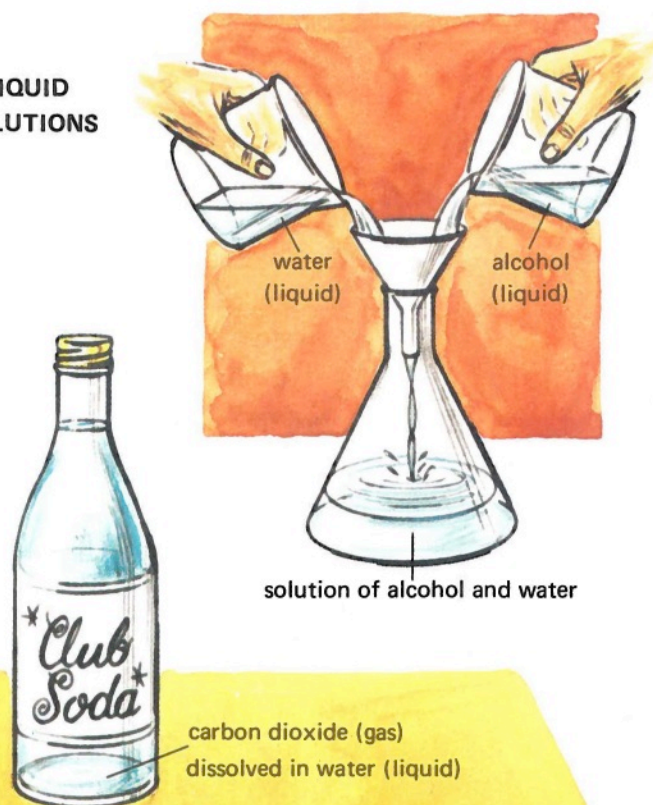
Solutions. Salt dissolves in water. Sand does not dissolve in water. A mixture of salt and water is called a solution (suh-LEW-shun). A solution is a special kind of mixture. Solutions are formed when substances dissolve in other substances.

► **How are solutions formed?**

Liquid solutions. Liquid solutions form when solids dissolve in liquids. Salt water is an example of this kind of solution. The salt, which is a solid, dissolves in the water, which is a liquid. Liquid solutions may also be formed when a gas dissolves in a liquid. Club soda is a solution of the gas carbon dioxide in the liquid water. The bubbles you see in club soda are carbon dioxide gas. Liquid solutions may also be solutions of liquids in liquids. Water and alcohol form this type of solution.

► **Give an example of a solution of a gas in a liquid.**

LIQUID SOLUTIONS



solution of alcohol and water

carbon dioxide (gas)
dissolved in water (liquid)

KINDS OF SOLUTIONS

SUBSTANCE	DISSOLVED IN	EXAMPLES
liquid	liquid	alcohol in water
	gas	water vapor in air
	solid	ether in rubber
gas	liquid	carbon dioxide in water (club soda)
	gas	nitrogen and oxygen mixed together (air)
	solid	hydrogen in palladium
solid	liquid	salt in water
	gas	iodine vapor in air
	solid	copper and zinc mixed together (brass)

Other types of solutions. Solutions are mixtures in which one or more substances are dissolved in another substance. These substances can be solids, liquids, or gases. You have already learned that solids, liquids, and gases can dissolve in a liquid. Solutions can also be formed by dissolving substances in solids and gases. The chart shows some examples of different kinds of solutions.

► **Why is air a solution?**

WHAT YOU LEARNED

1. Some substances dissolve in another substance. Some substances do not dissolve in the other substance.
2. When substances dissolve in other substances, solutions are formed.
3. A solution is a mixture of dissolved substances.

SCIENCE WORDS

dissolve (dih-ZOLV)

become part of a solution

solution (suh-LEW-shun)

a mixture of two or more substances that mix evenly with each other

ANSWER THESE

1. A solution is a _____ of two or more substances.
2. Solutions form when substances _____ in other substances.

3. Club soda is an example of a solution of a liquid and a _____.
4. Which of the following are solutions?

air	soda water	soup
alcohol	brass	coffee
salt water	sugar	tea

NOW TRY THESE

Unscramble the following groups of letters to form some chemical terms.

XMTIERU

SODSIVLE

IQLDIU

LTIUOSN

FINDING OUT MORE

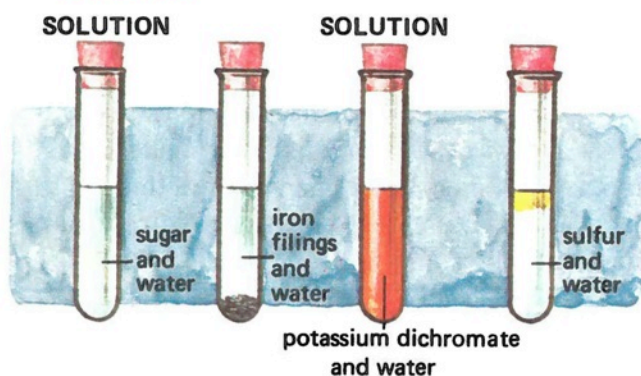
Pure metals are not usually used in industry. Alloys are used instead of pure metals. Some alloys are solutions of one metal in another. Steel, brass, and bronze are examples of common alloys. Alloys are used to make coins, tools, machinery, and many other things. In fact, almost all metal objects that you buy are made of alloys.

NAME OF ALLOY	METALS IN SOLUTION	USES
steel	iron, chromium, nickel	cars, bikes, appliances, construction
brass	copper, zinc	jewelry, doorknobs, plumbing
bronze	copper, tin	medals, statues

Do all substances dissolve in water?

Dissolving solids in water. Fill four test tubes half full of water. Into each test tube place $\frac{1}{4}$ teaspoon of one of the following substances: sugar, iron filings, potassium dichromate, and sulfur. Place a rubber stopper in each tube, and shake the tubes. The sugar and potassium dichromate dissolve. The iron filings and sulfur do not dissolve. When a substance can dissolve in another substance, it is said to be soluble (SOL-yuh-bul) in that substance. Sugar and potassium dichromate are soluble in water. A substance that does not dissolve is insoluble (in-SOL-yuh-bul). Iron and sulfur are insoluble in water.

- Name two substances that are soluble in water.



Mixing liquids with liquids. Mix $\frac{1}{4}$ of a test tube of each of the following liquids with $\frac{1}{4}$ of a test tube of water: alcohol, oil, vinegar, and benzene. Some of these liquids mix with the water to form solutions. These liquids are miscible (MIS-uh-bul) with water. Miscible liquids are liquids that mix together to form a solution. Alcohol and water are miscible. Vinegar and water

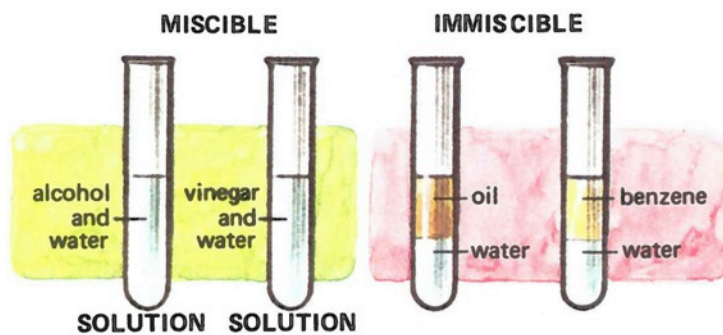


Luckily, many substances do not dissolve in water. How many insoluble substances can you find in this picture?

are miscible. Liquids that do not mix are immiscible (im-MIS-uh-bul). Oil and water do not mix. They are immiscible. Benzene and water are also immiscible.

Vinegar is miscible with water, but it is not miscible with oil. Vinegar forms a solution with water. It will not form a solution with oil. Liquids that are miscible with water may not be miscible with some other liquids.

- Name two liquids that are miscible with water.



Parts of a solution. Mix some sugar with water. The sugar dissolves in the water to form a solution of sugar and water. The sugar dissolved in the water. In a solution, the substance that dissolves is called the solute (SOL-yute). The substance in which the solute dissolves is called the solvent (SOL-vent). In the solution of sugar and water, the sugar is the solute and the water is the solvent.

- In a solution of salt and water, which substance is the solute and which is the solvent?

WHAT YOU LEARNED

1. Substances that dissolve in a liquid are soluble in that liquid.
2. Liquids that mix together to form a solution are miscible. Liquids that do not form a solution are immiscible.
3. The substance that dissolves in a solution is called the solute. The substance in which the solute dissolves is called the solvent.

SCIENCE WORDS

soluble (SOL-yuh-bul)

able to dissolve

insoluble (in-SOL-yuh-bul)

not able to dissolve

miscible (MIS-uh-bul) **liquids**

liquids that are able to mix together to form a solution

immiscible (im-MIS-uh-bul) **liquids**

liquids that are not able to mix together to form a solution

solute (SOL-yute)

the substance that is dissolved in a solution

solvent (SOL-vent)

the substance in which a solute dissolves

FINDING OUT MORE

Weathering is the breaking up of rocks and minerals by natural forces, such as wind and water. Water can cause changes in rocks. Many rocks contain minerals that can dissolve in water. As water passes over or through the rocks, the minerals are dissolved and are carried away in the water. This can cause the breaking up of the rocks.

Water may also contain chemicals that react with minerals in rocks. When such reactions occur, new substances are formed. These new substances may be soluble in water. For example, water may have carbon dioxide dissolved in it. This solution can react with minerals containing calcium. The new substance that is formed by the reaction is calcium carbonate, which is soluble in water. The dissolving of these soluble minerals can lead to the formation of caves. Oxygen may also be dissolved in water. The dissolved oxygen will cause minerals containing iron to oxidize and rust. Rocks containing such minerals will crumble away.

ANSWER THESE

1. Which of the following substances are soluble in water?
 - a. sugar
 - b. iron filings
 - c. salt
 - d. sulfur
 - e. potassium dichromate
 - f. glass
 - g. sand
 - h. wood
2. Which of the following mixtures are miscible?
 - a. water and oil
 - b. vinegar and oil
 - c. water and vinegar
 - d. water and alcohol
 - e. water and benzene
3. In a solution of carbon dioxide and water, the water is the (**solute, solvent**) and the carbon dioxide is the (**solute, solvent**).

NOW TRY THESE

1. A solid that dissolves in water is _____.
2. A liquid that is miscible with water is _____.
3. A gas that dissolves in water is _____.

Many rocks contain minerals that can dissolve in water. When the minerals dissolve, a cave sometimes forms.

