



MORE ABOUT MATTER:

PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

- d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
- e. Distinguish between changes in matter as physical (i.e. physical change) or chemical (development of a gas, formation of a precipitate, and change in color).

PHYSICAL PROPERTIES OF MATTER

- A physical property is a characteristic that can be observed or measured without changing the sample's composition.

Substance	Color	State at 25 °C	Melting Point (°C)	Boiling Point (°C)	Density (g/cm ³)
Oxygen	colorless	gas	−218	−183	0.0014
Mercury	silver	liquid	−39	357	13.5
Water	colorless	liquid	0	100	1.00
Sucrose	white	solid	185	decomposes	1.59
Sodium chloride	white	solid	801	1413	2.17

PHYSICAL PROPERTIES OF MATTER (CONT.)

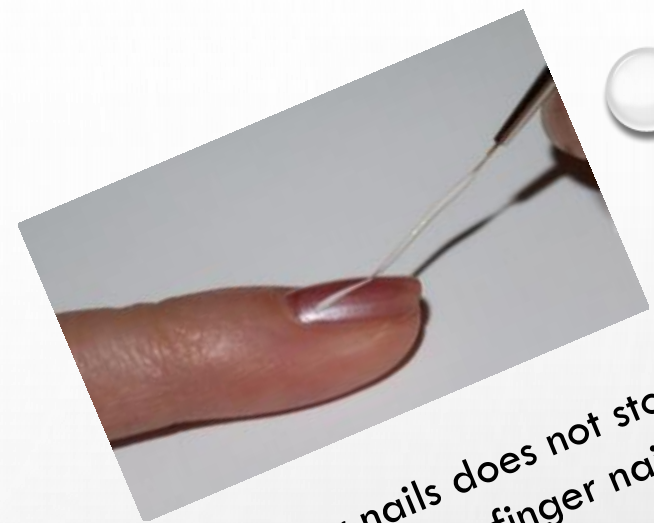
- COLOR
- SIZE
- SHAPE
- STATE OF MATER
- **BOILING POINT**- THE TEMPERATURE AT WHICH A SUBSTANCE BOILS
- **MELTING POINT**-THE TEMPERATURE AT WHICH A SUBSTANCE MELTS
- **SPECIFIC GRAVITY**-RATIO OF THE DENSITY OF A SUBSTANCE COMPARED TO FRESH WATER AT 4°C (39° F)

PHYSICAL PROPERTIES OF MATTER (CONT.)

- DENSITY-THE AMOUNT OF MATTER IN A GIVEN SPACE OR VOLUME
 - DENSITY = $\frac{\text{MASS}}{\text{VOLUME}}$ $D = \frac{M}{V}$
 - WATER'S DENSITY = 1.00 G/ML
 - GOLD'S DENSITY = 19.93 G/ML
 - DENSITY < 1 – THE OBJECT WILL FLOAT IN WATER
 - DENSITY >1 – THE OBJECT WILL SINK IN WATER

PHYSICAL CHANGES

- A change that alters a substance without changing its composition is known as a physical change.
- A phase change is a transition of matter from one state to another.
- Boiling, freezing, melting, and condensing all describe phase changes in chemistry.



Polishing your nails does not stop them from being a finger nails.



Ice melting is still H₂O.

CHEMICAL PROPERTIES OF MATTER

- The potential for a substance to combine with or change into one or more other substances is called a chemical property.
 - Combustibility or how easily it will react/explode with another substance
 - Reactions with oxygen, acid, and water



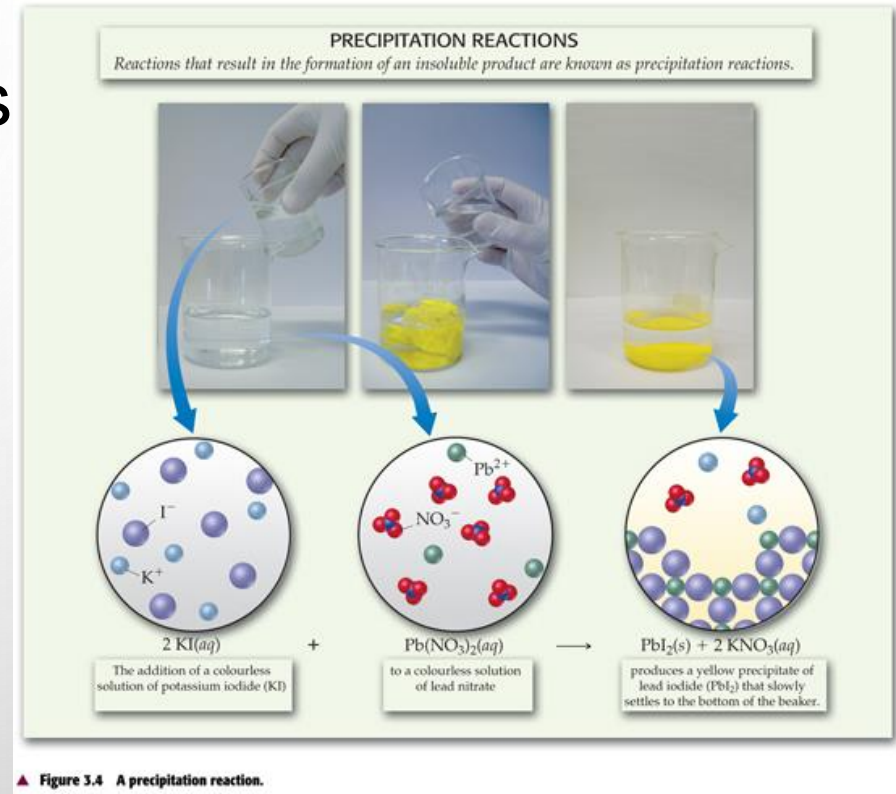
A piece of wood is flammable even when it is not burning.

CHEMICAL CHANGES

- A change that involves one or more substances turning into new substances is called a chemical change.

- How to Identify a Chemical Change

- Color change
- Odor or smell
- Formation of gas
- Formation of a precipitate or a solid found in a solution during a chemical reaction

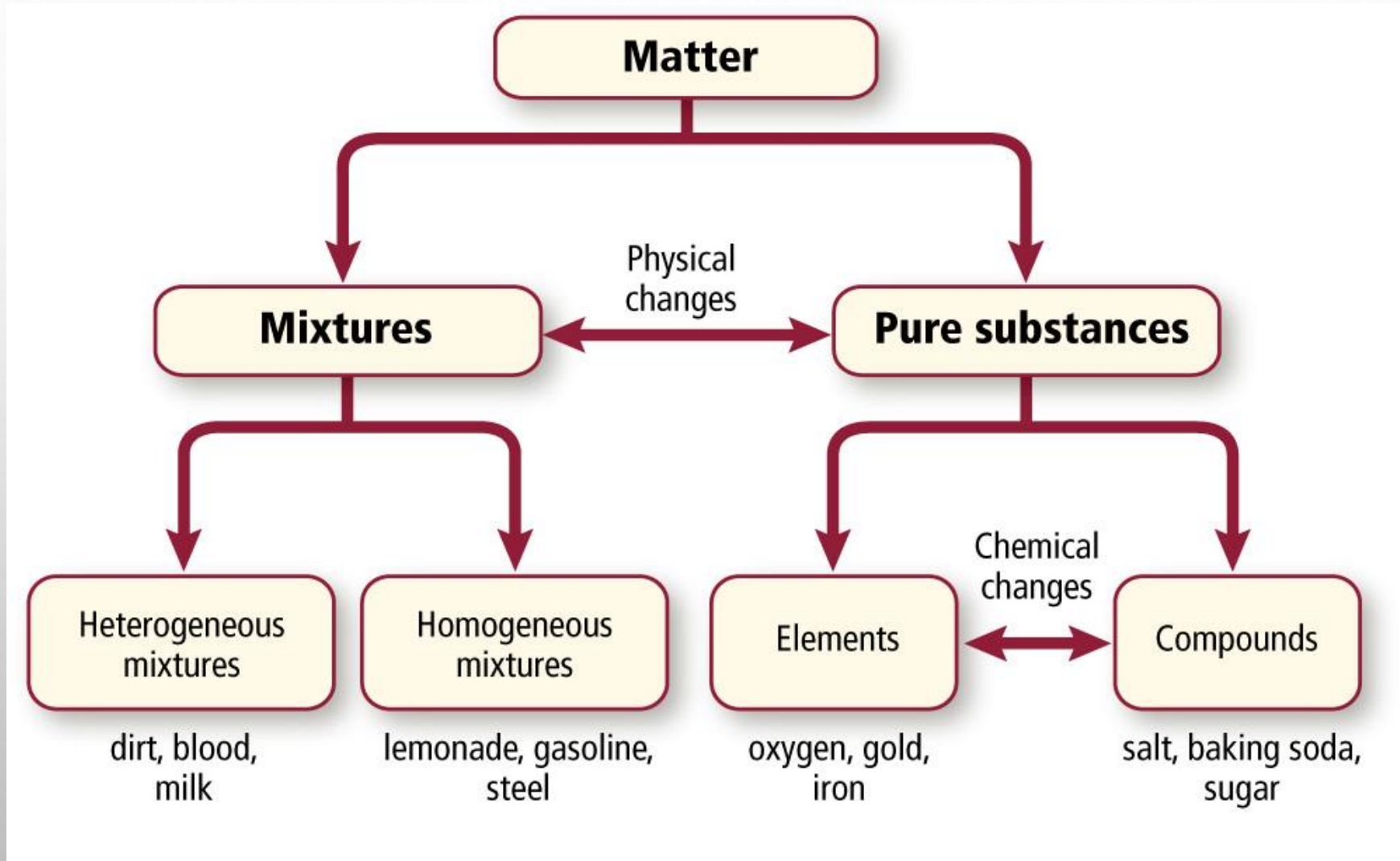


- *Decomposing, rusting, exploding, burning, or oxidizing* are all terms that describe chemical changes.

Table 3.2**Properties of Copper**

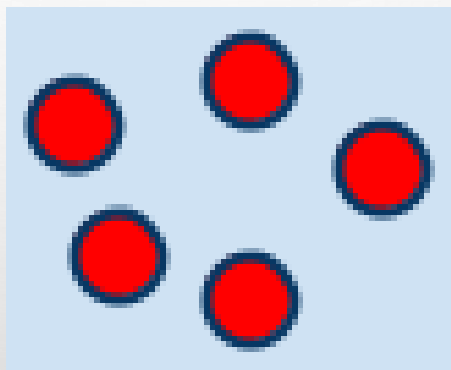
Physical Properties	Chemical Properties
<ul style="list-style-type: none">• reddish brown, shiny• easily shaped into sheets (malleable) and drawn into wires (ductile)• a good conductor of heat and electricity• density = 8.92 g/cm^3• melting point = 1085°C• boiling point = 2570°C	<ul style="list-style-type: none">• forms green copper carbonate compound when in contact with moist air• forms new substances when combined with nitric acid and sulfuric acid• forms a deep-blue solution when in contact with ammonia

Classification of Matter

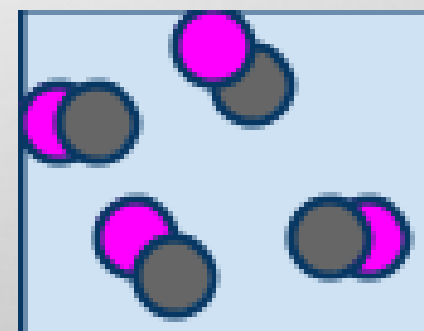


PURE SUBSTANCES

- Matter that has a **constant composition** and has **consistent properties** throughout the matter sample.
- Two types
 - Elements
 - Compounds



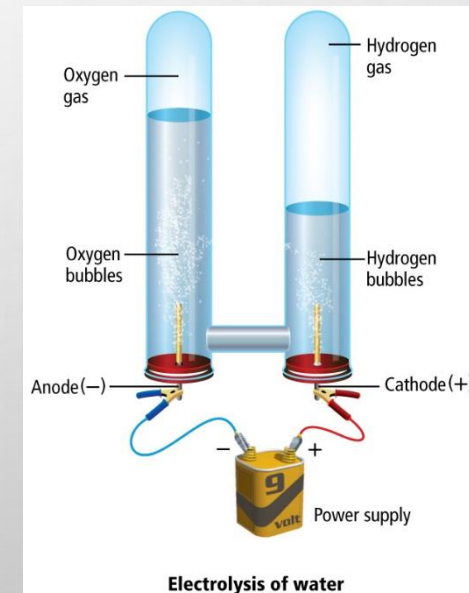
Pure Substance—one type of element



Pure Substance—one compound of two different elements

PURE SUBSTANCES (CONT.)

- **PURE SUBSTANCES** MELT AND BOIL AT A **FIXED TEMPERATURE**
- THEIR **COMPOSITION IS FIXED**, I.E. THE SAME ATOMIC RATIO OR MOLECULAR FORMULA
- IT IS **NOT EASY TO SEPARATE** THE ATOMS WHETHER IT IS AN ELEMENT MOLECULE OR A COMPOUND.



• Compounds can be broken into components by chemical means.

MIXTURES

- A mixture is a combination of two or more substances in which each substance retains its individual chemical properties.



MIXTURES (CONT.)

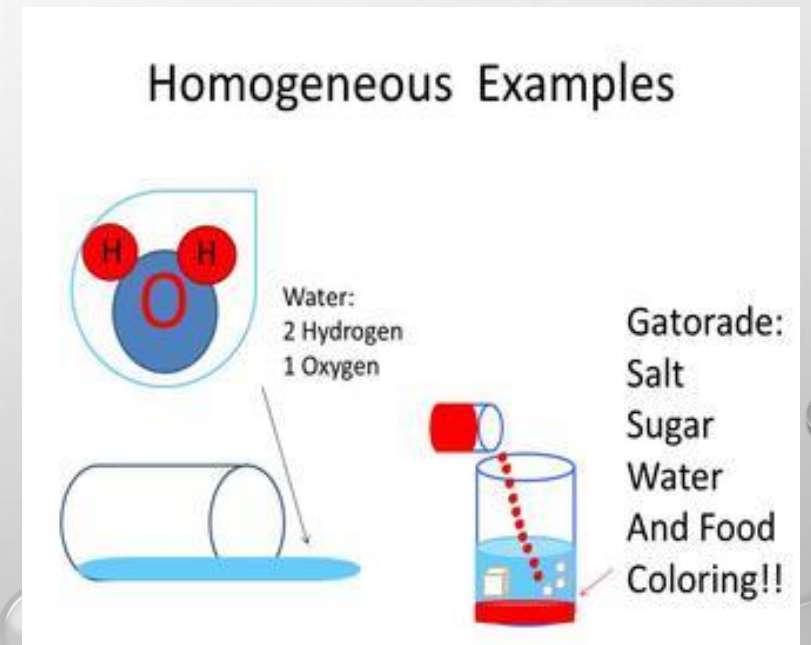
- IN A **MIXTURE**, THE MELTING AND **BOILING POINTS VARY** DEPENDING ON THE PROPORTIONS OF THE COMPONENTS (ELEMENTS OR COMPOUNDS)
- THE PROPORTIONS OF THE COMPONENTS ARE **NOT FIXED** AND VARY
- THE COMPONENTS ARE **READILY SEPARATED** FROM EACH OTHER
- THE MIXTURE **PROPERTIES** ARE OFTEN **SIMILAR TO** THOSE OF THE **COMPONENTS** THEMSELVES.

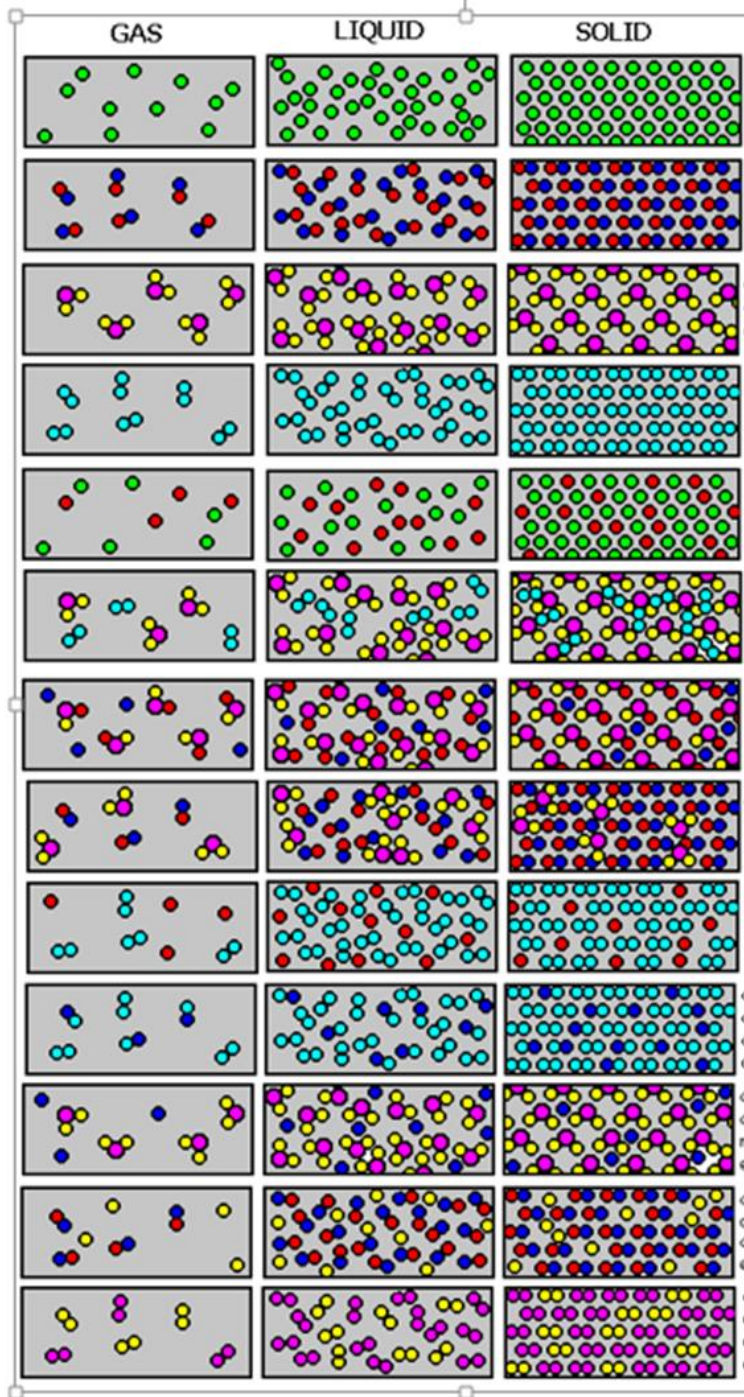
MIXTURES (CONT.)

Table 3.3	Types of Solution Systems
System	Example
Gas-gas	Air in a scuba tank is primarily a mixture of nitrogen, oxygen, and argon gases.
Gas-liquid	Oxygen and carbon dioxide are dissolved in seawater.
Liquid-gas	Moist air exhaled by the scuba diver contains water droplets.
Liquid-liquid	When it is raining, fresh water mixes with seawater.
Solid-liquid	Solid salts are dissolved in seawater.
Solid-solid	The air tank is made of an alloy—a mixture of two metals.

MIXTURES (CONT.)

- A **HOMOGENOUS MIXTURE** IS A MIXTURE WHERE THE COMPOSITION IS CONSTANT THROUGHOUT.
 - HOMOGENEOUS MIXTURES ARE ALSO CALLED **SOLUTIONS**.
 - EXAMPLES:
 - AIR
 - SUGAR SOLUTION
 - SALT SOLUTION
 - METAL ALLOYS
 - SOFT DRINKS





One Pure Element of Single Atom

One Pure Compound Substance Diatomic Molecules

One Pure Compound Substance

One Pure Element of Diatomic Molecule

Mixture of two Elements

Mixture of a Compound and a Diatomic Molecule

Mixture of a Compound and an Element

Mixture of two Compounds

Mixture of Elemental Atoms and Elemental Molecule

Mixture of an Elemental Atom and a Compound, both Diatomic

Mixture of Compound Molecules and Elemental Atoms

Mixture of Compound Molecule and Atoms

Mixture of two Diatomic Elements

Definitions

- **Solution** - homogeneous mixture

Solute - substance
being dissolved

Solvent - present in
greater amount

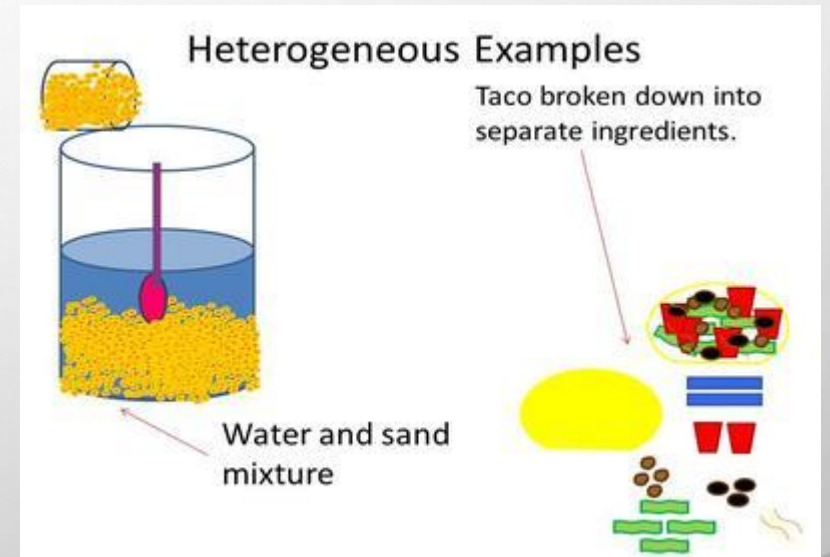


MIXTURES (CONT.)

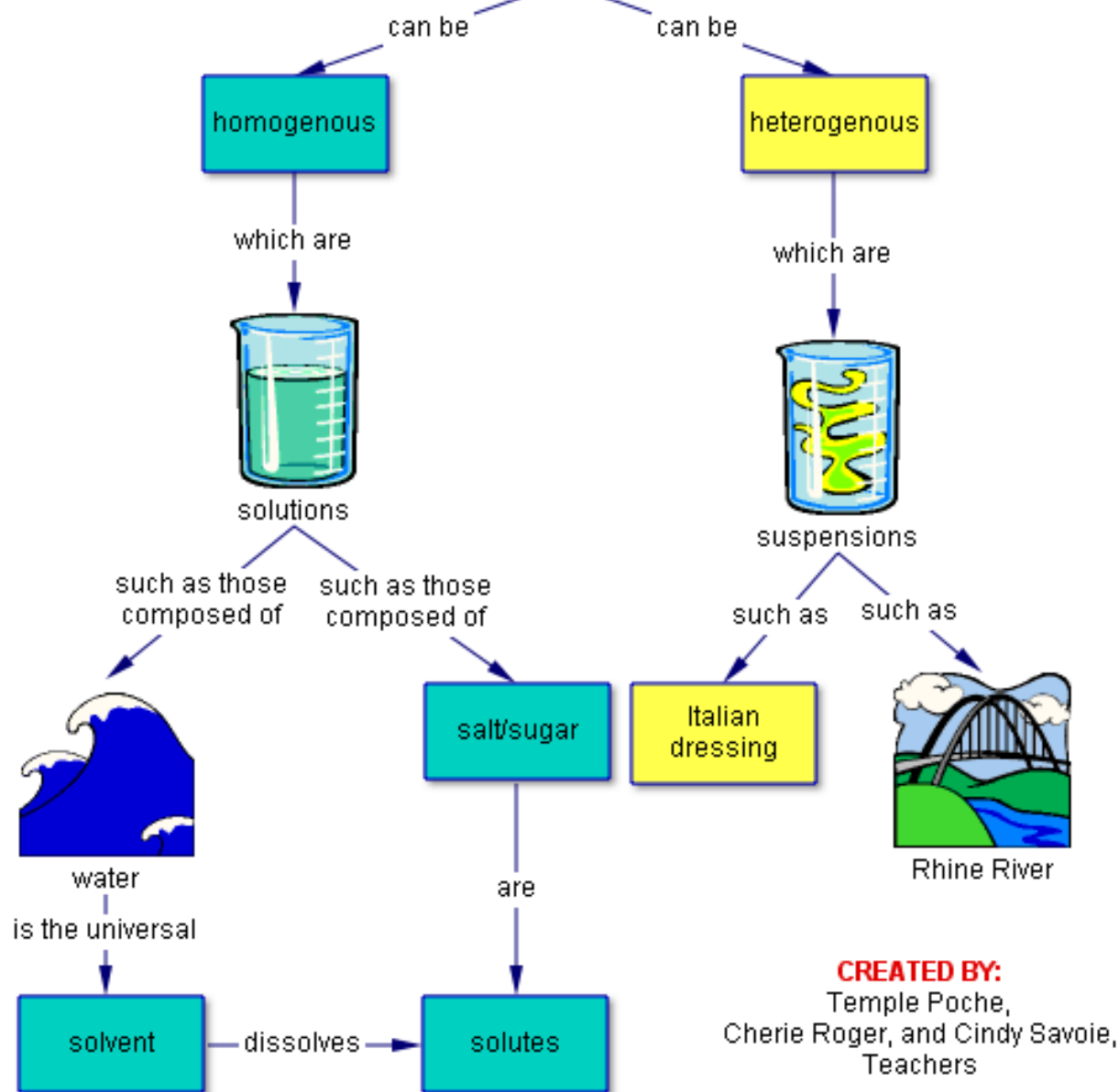
- 2. A HETEROGENEOUS MIXTURE IS A MIXTURE WHERE THE INDIVIDUAL SUBSTANCES REMAIN DISTINCT.

- EXAMPLES

- TRAIL MIX
- SOIL
- ROCKS
- LUCKY CHARMS AND RAISIN BRAN CEREALS

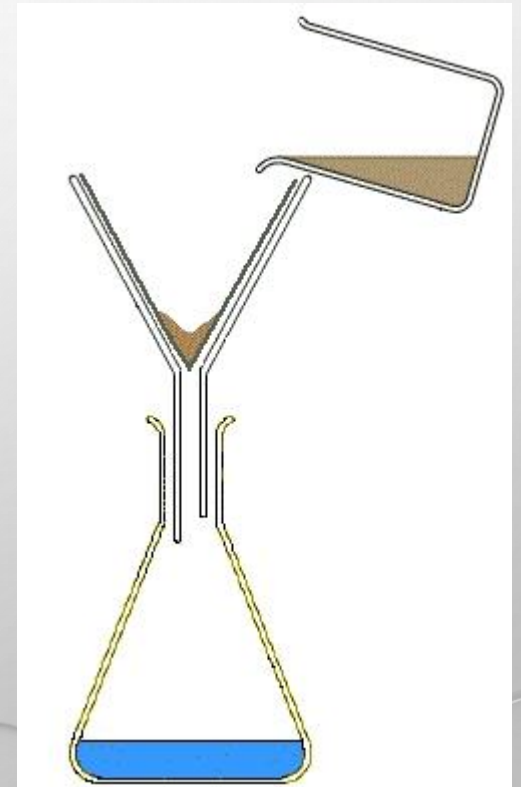


Mixtures



SEPARATING MIXTURES

- **Filtration** is a technique that uses a porous barrier to separate a solid from a liquid in a heterogeneous mixture.



SEPARATING MIXTURES

- **DISTILLATION** IS A SEPARATION TECHNIQUE FOR HOMOGENEOUS MIXTURES THAT IS BASED ON THE DIFFERENCES IN BOILING POINTS OF SUBSTANCES.



SEPARATING MIXTURES

- Crystallization is a separation technique for homogenous mixtures that results in the formation of pure solid particles from a solution containing the dissolved substance.



SEPARATING MIXTURES (CONT.)

- Sublimation is the process of a solid changing directly to a gas, which can be used to separate mixtures of solids when one sublimates and the other does not.



SEPARATING MIXTURES (CONT.)

- **Chromatography** is a technique that separates the components of a mixture (called the mobile phase) based on the ability of each component to travel across the surface of another material (called the stationary phase).

