



breaking a window



baking bread



rolling bread



crushing a soda can



frying an egg



melting ice



using batteries



exploding fireworks



burning fire



crashing cars



rusting chains



chopping wood

IT'S A MATTER OF

CHANGE

CHANGING

Physical and Chemical Changes

- A ***physical change*** does not alter the composition or identity of a substance.

ice melting

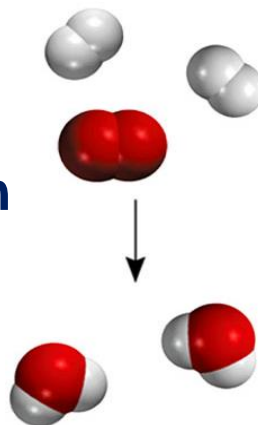


sugar dissolving
in water

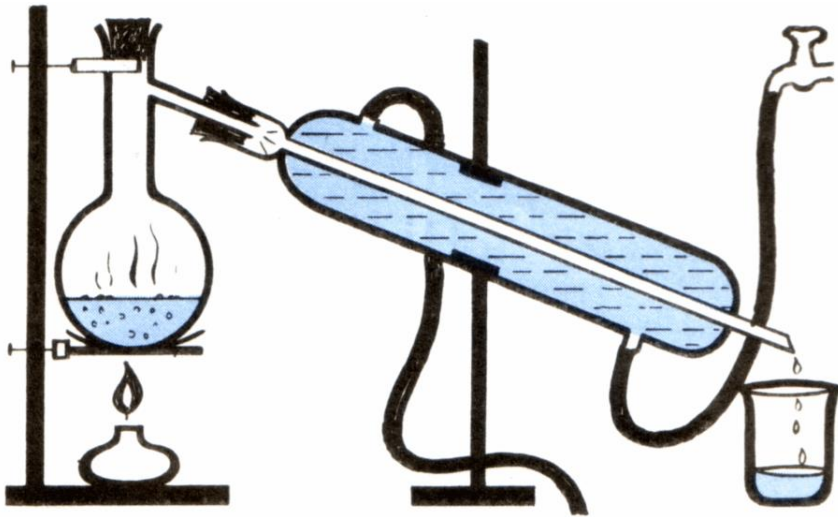


- A ***chemical change*** alters the composition or identity of the substance(s) involved.

hydrogen burns in
air to form water



Physical means (change) can be used to **separate a mixture** into its components by exploiting their ***different physical properties***.



To separate **sweet water** (water with sugar dissolved in it):
boil the water,
collect the vapor

To separate **iron particles from sand mixture**: use a magnet.

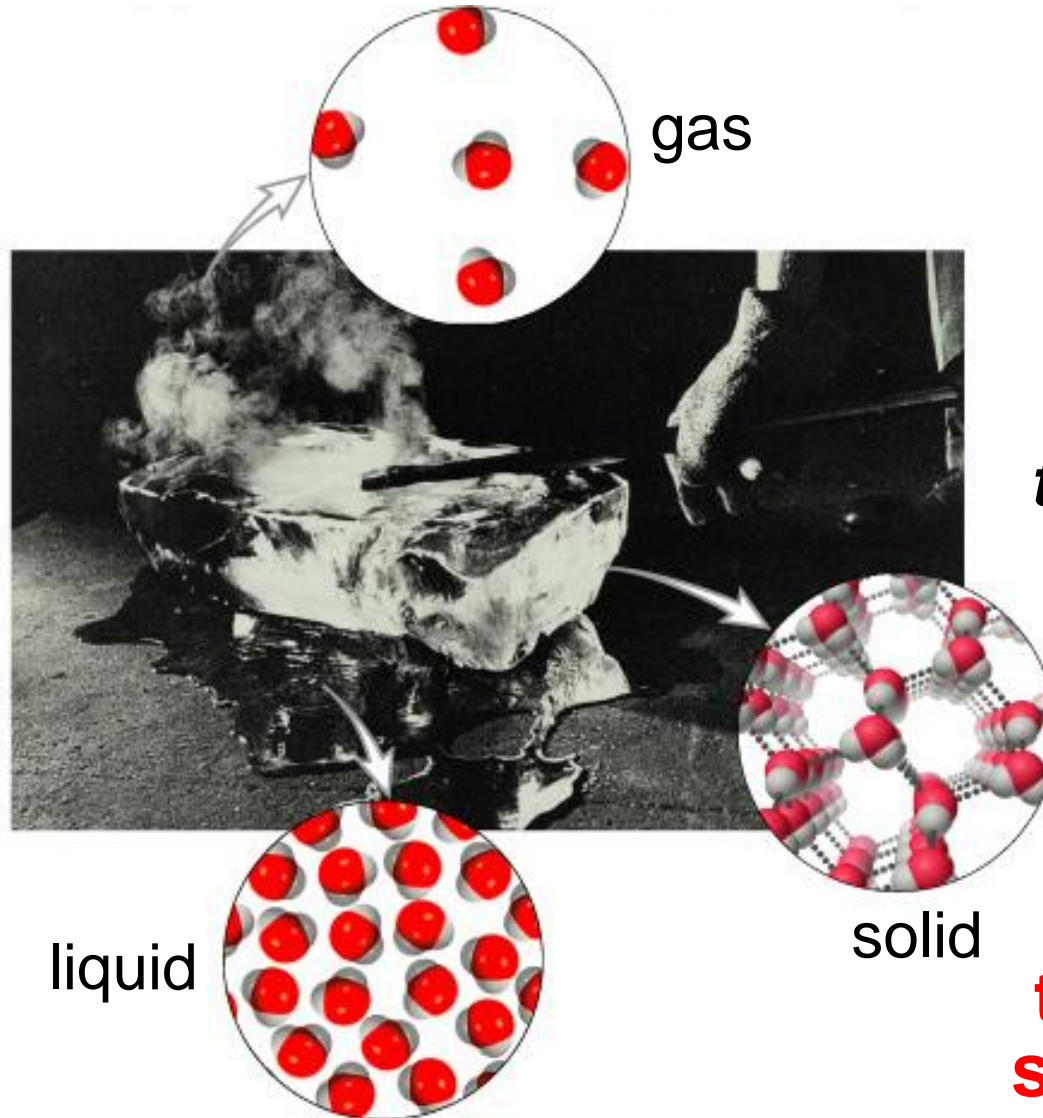


What kind of mixtures are these?

Physical Change:

Effect of a Hot Poker on a Block of Ice

A change from **one state of matter to another...**

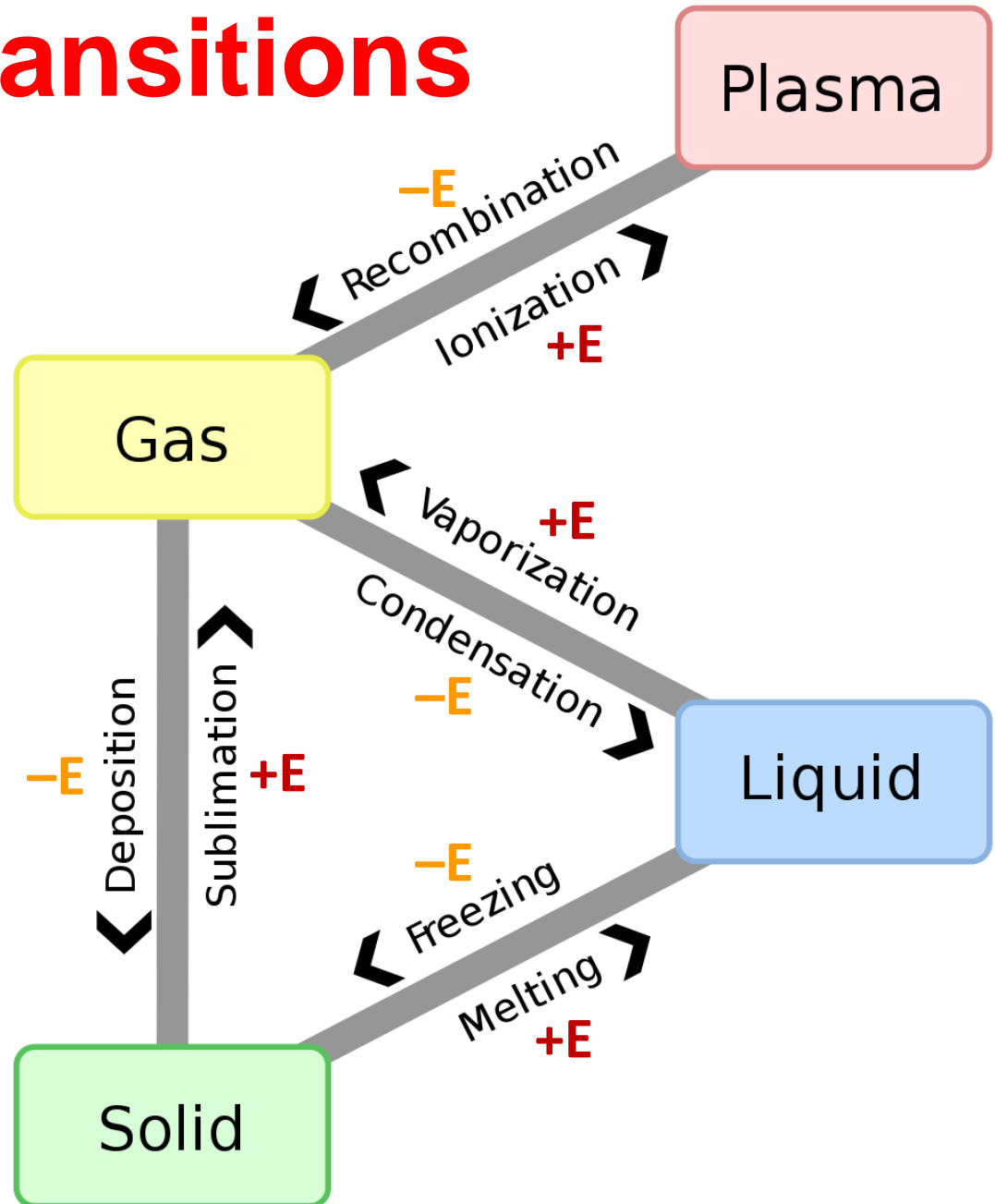


...is called a ***phase transition.***

But it's all the SAME substance!

Phase Transitions

- A phase transition is the transformation from one phase or state of matter to another one by heat transfer.
- Heat can be absorbed (+E) or released (-E) by a substance as it changes structure.
- A phase transition can be recognized by an abrupt change in properties.



Phase Transition Examples

Dry Ice Sublimation



Freezing Lava



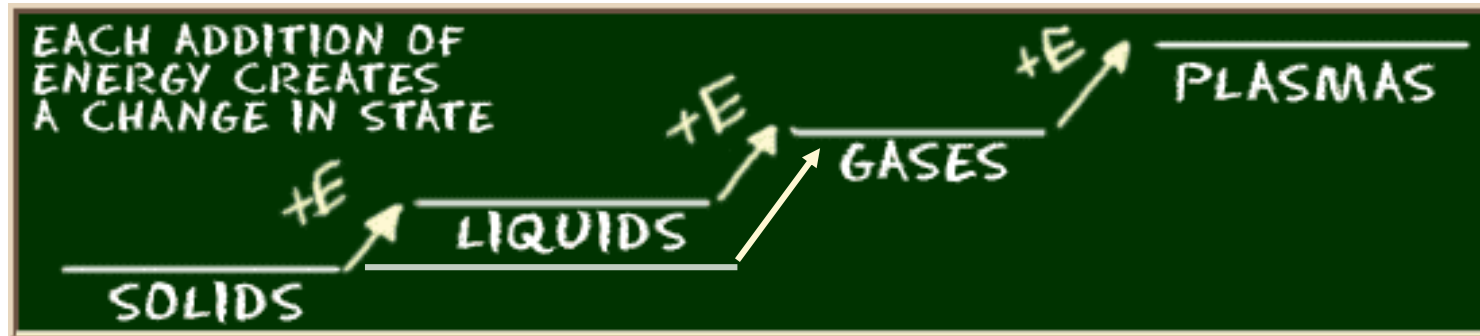
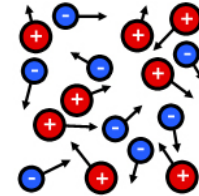
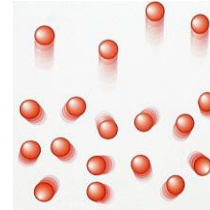
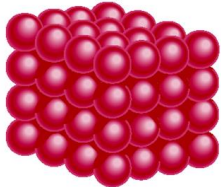
Frost Deposition



Dew Condensation



States of Matter Summary



SOLID

Tightly packed, often in a regular pattern. Vibrate, but do not move from place to place.

LIQUID

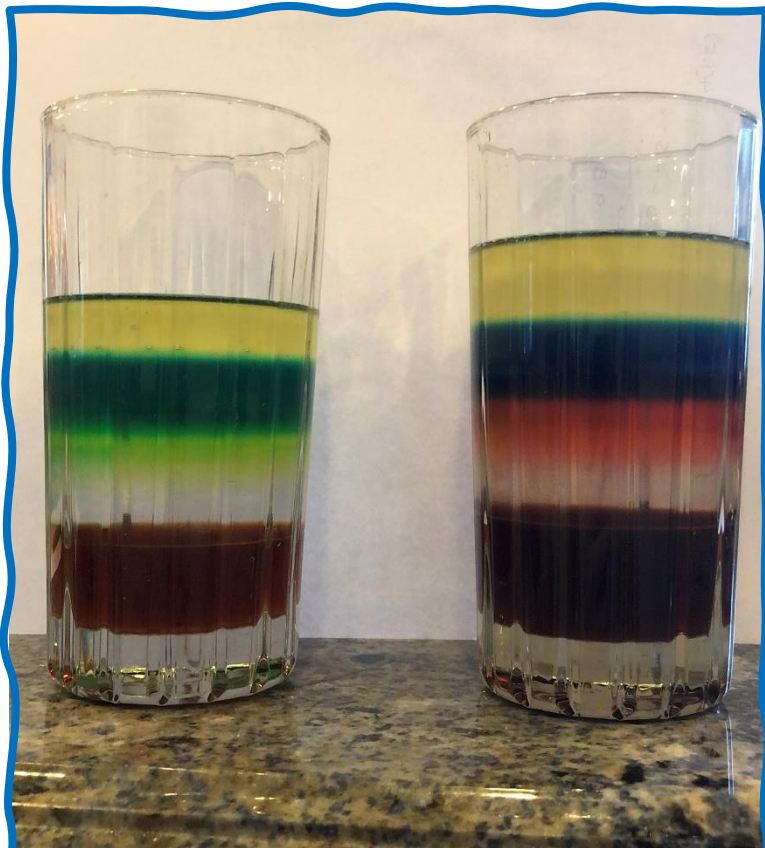
Close together with no regular arrangement. Vibrate, move about, and slide past each other.

GAS

Well separated with no regular arrangement. Vibrate and move freely at high speeds.

PLASMA

Has no definite volume or shape and is composed of electrically charged particles.

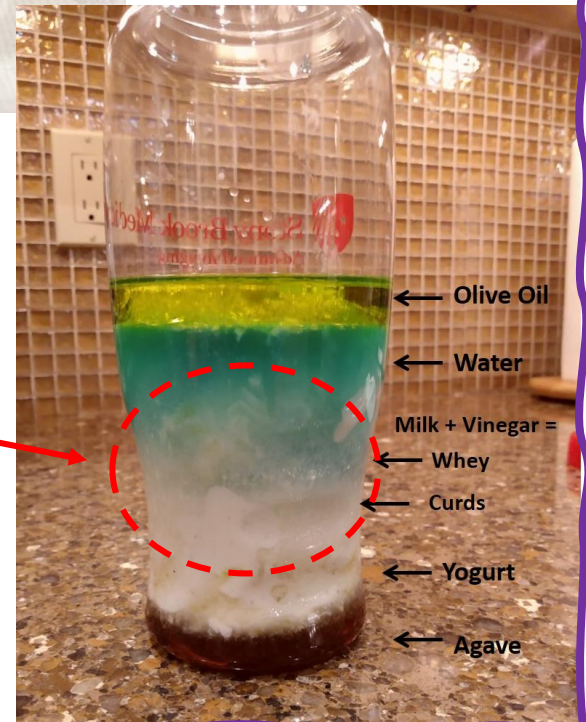


“From bottom to top I used honey (brown), dish soap (clear), water (green in left cup; red in right cup), rubbing alcohol (blue), and vegetable oil (yellow).”



What is going on here?

About 6 hours later...



Chemical Change

A chemical change occurs when matter changes chemically **into an entirely different substance** with different properties.

- Chemical change **is also called a chemical reaction.**
- When vinegar (liquid) and baking soda (solid) combine, they form **carbon dioxide (gas)**.
- **Silver *tarnishes*.** The **solid silver** reacts with **sulfur in the air** to make **solid silver sulfide**, the black material we call *tarnish*.



Chemical change is often **difficult or impossible to reverse.**

Chemical Reaction Evidence

A chemical reaction can be recognized by a **change in properties** and, often, by an **appearance of a different state of matter**.

Color Change



Solid Formation



Odor



Temperature Change



Gas Formation

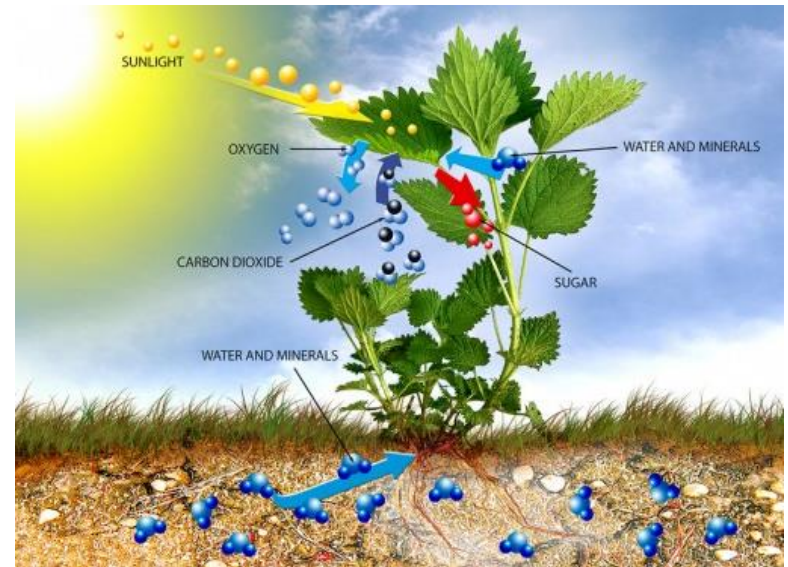


Chemical means (change) can be used to **separate a compound** into its pure components.

Chemical Reaction Examples



Combustion: every time you strike a match, burn a candle, build a fire, or light a grill, you see the combustion reaction; it combines energetic molecules of fuel with oxygen to produce carbon dioxide and water.

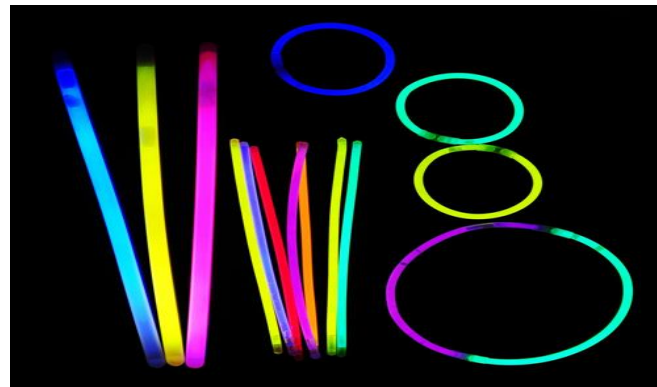


Photosynthesis: plants apply a chemical reaction called photosynthesis to convert carbon dioxide and water into food (glucose sugar) and oxygen.

Chemical Reaction Examples



Rust: over time, iron develops a red, flaky coating called rust, which is an example of an **oxidation reaction**.

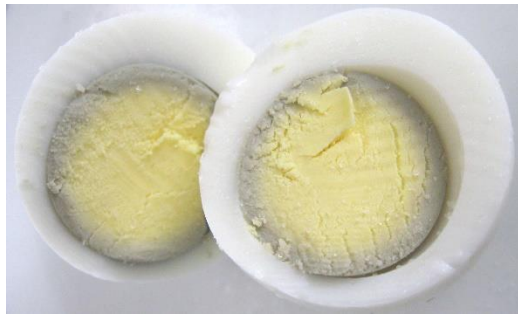


Glow stick is a plastic tube with a glass vial inside. When you bend it, the glass vial breaks allowing the chemicals that were inside the glass to mix with the chemicals in the plastic tube. Once these substances combine, a **light-releasing reaction** starts taking place.

Chemical Reaction Examples

Cleaning with soap:

soap emulsifies grime, which means **oily stains bind to the soap** so they can be lifted away with water.



Boiling the egg: when you use **high heat** to boil an egg, it causes a chemical reaction between the yolk and the white that leaves a green film around the yolk. That film is iron sulfide, caused by **iron in the yolk reacting with hydrogen sulfide in the white** (it won't hurt you to eat it, and the egg will taste the same).