



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



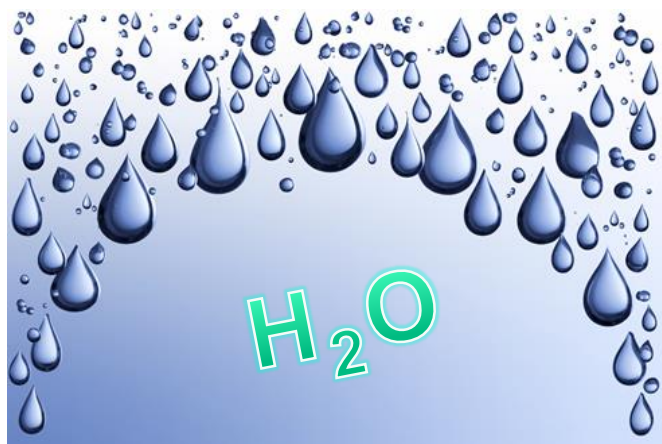
chopping wood

IT'S A MATTER OF

CHANGE

CHANGING

# Element, Compound, or Mixture?



**Pure Water**



**Copper**



**Diamond**



**Jelly Beans**

# Element, Compound, or Mixture?



**Rocks**



**Neon Gas**



**Table Sugar**



**Tea**

# Physical and Chemical Changes

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

ice melting

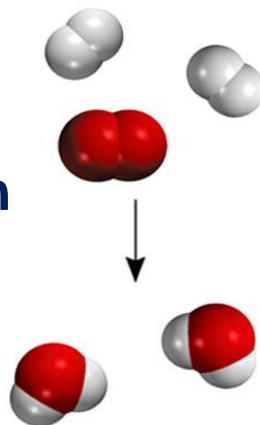


sugar dissolving  
in water



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

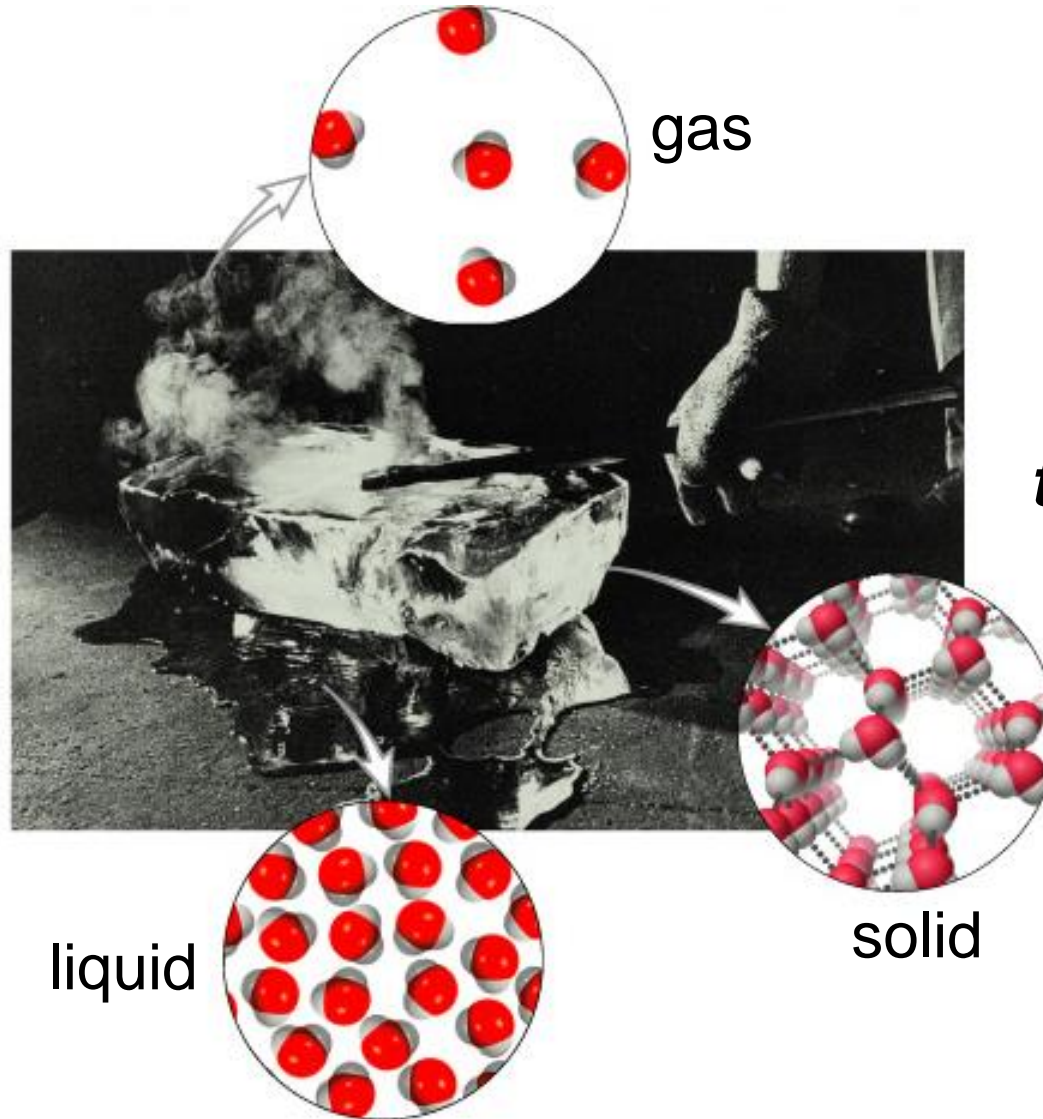
hydrogen burns in  
air to form water



# Physical 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.***

# Phase Transitions

- A phase transition is the transformation from one phase or state of matter to another one by heat transfer.
- The term is most commonly used to describe transitions between solid, liquid and gaseous states of matter.
- A phase transition indicates a **change in structure** and can be recognized by an **abrupt change in properties**.

Description of transition	Term	Heat transfer direction during transition
<b>Solid to liquid</b>	<b>Melting</b>	Heat goes into the solid as it melts
<b>Liquid to solid</b>	<b>Freezing</b>	Heat leaves the liquid as it freezes

# Phase Transitions

<b>Description of transition</b>	<b>Term</b>	<b>Heat transfer direction during transition</b>
<b>Liquid to gas</b>	<b>Vaporization</b> <i>(includes boiling and evaporation)</i>	Heat goes into the liquid as it vaporizes.
<b>Gas to liquid</b>	<b>Condensation</b>	Heat leaves the gas as it condenses.
<b>Solid to gas</b>	<b>Sublimation</b>	Heat goes into the solid as it sublimates.
<b>Gas to solid</b>	<b>Deposition</b>	Heat leaves the gas as it is being deposited.

# Phase Transition Examples

**Dry Ice Sublimation**



**Freezing Lava**



**Frost Deposition**

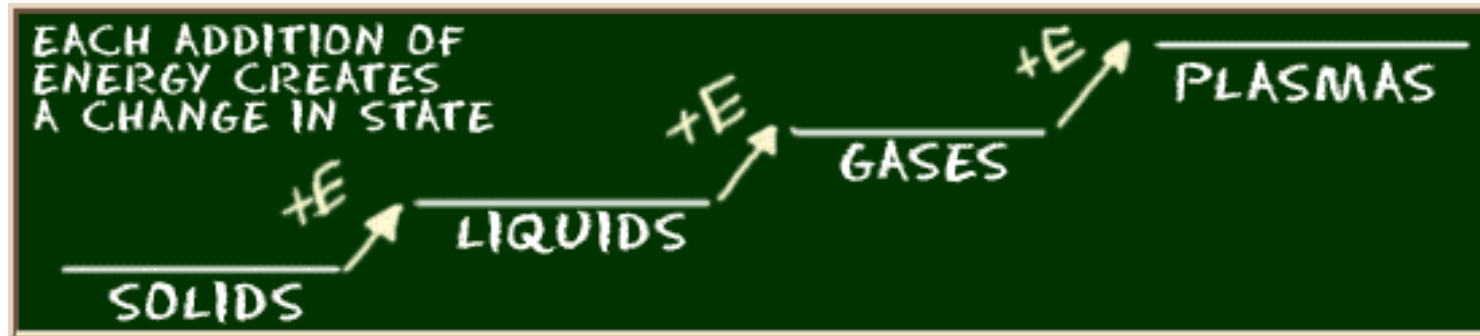
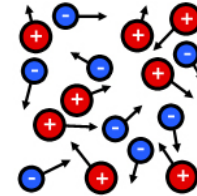
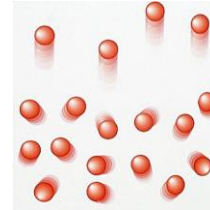
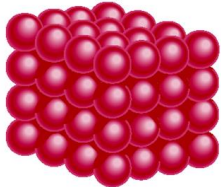


**Dew Condensation**





# 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

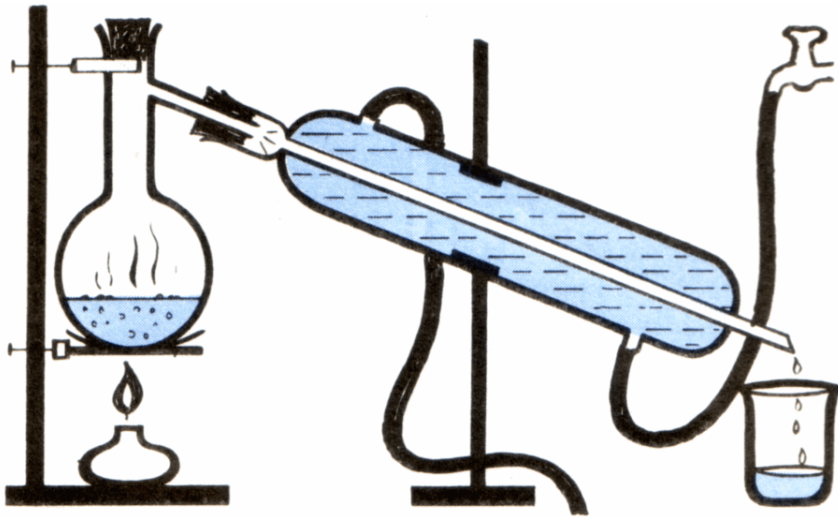
Well separated with no regular arrangement. Vibrate and move freely at high speeds.

PLASMA

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

# Mixtures: Physical Change

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



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?**

# Chemical Change

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

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

# Chemical Reactions

To separate a **compound** into its pure components it is necessary to initiate a **chemical reaction**. No universal approach exist; every type of compound requires its own method.

How do you know when a chemical reaction takes place?

**Color Change**



**Solid Formation**



**Odor**



**Temperature Change**



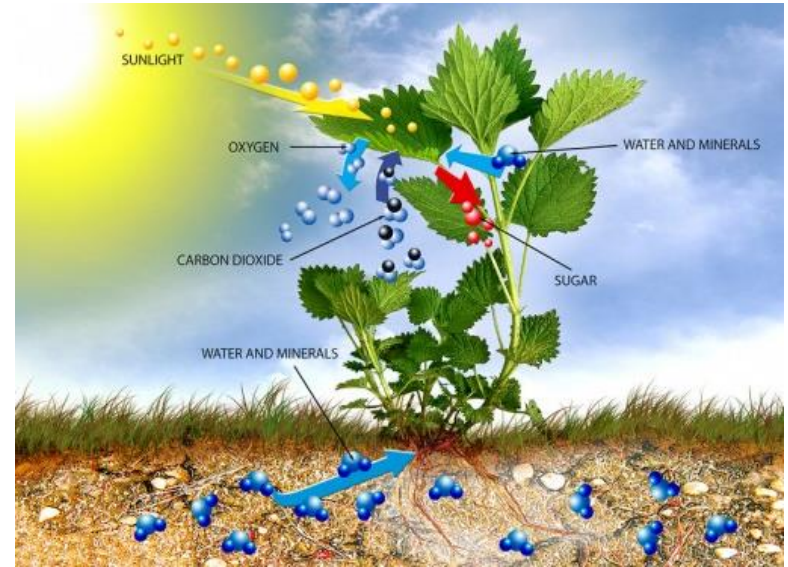
**Gas Formation**



# 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.

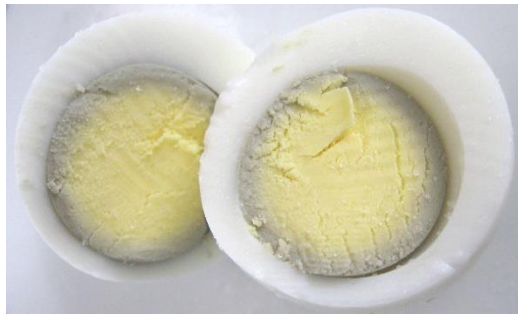


**Photosynthesis**: plants apply a chemical reaction called photosynthesis to convert carbon dioxide and water into food (glucose sugar) and oxygen.

# Chemical Reaction Examples

## Cleaning with soap:

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

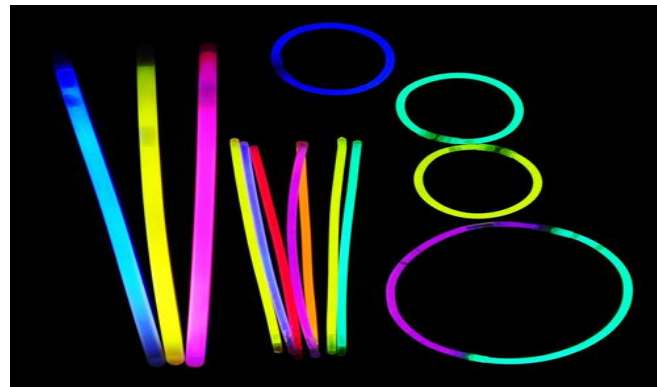


Boiling the egg: when you use **high heat** to boil an egg, it causes a chemical reaction between the yolk and the white that leaves a green film around the yolk. That film is iron sulfide, caused by **iron in the yolk reacting with hydrogen sulfide in the white** (it won't hurt you to eat it, and the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

# 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.