

Physical

CHANGE
CHANGE

Chemical

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



sugar dissolving
in water

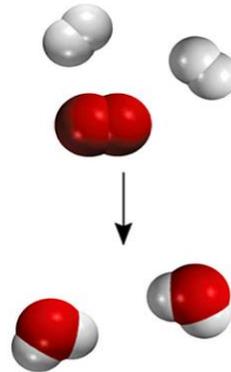


ice melting



VS

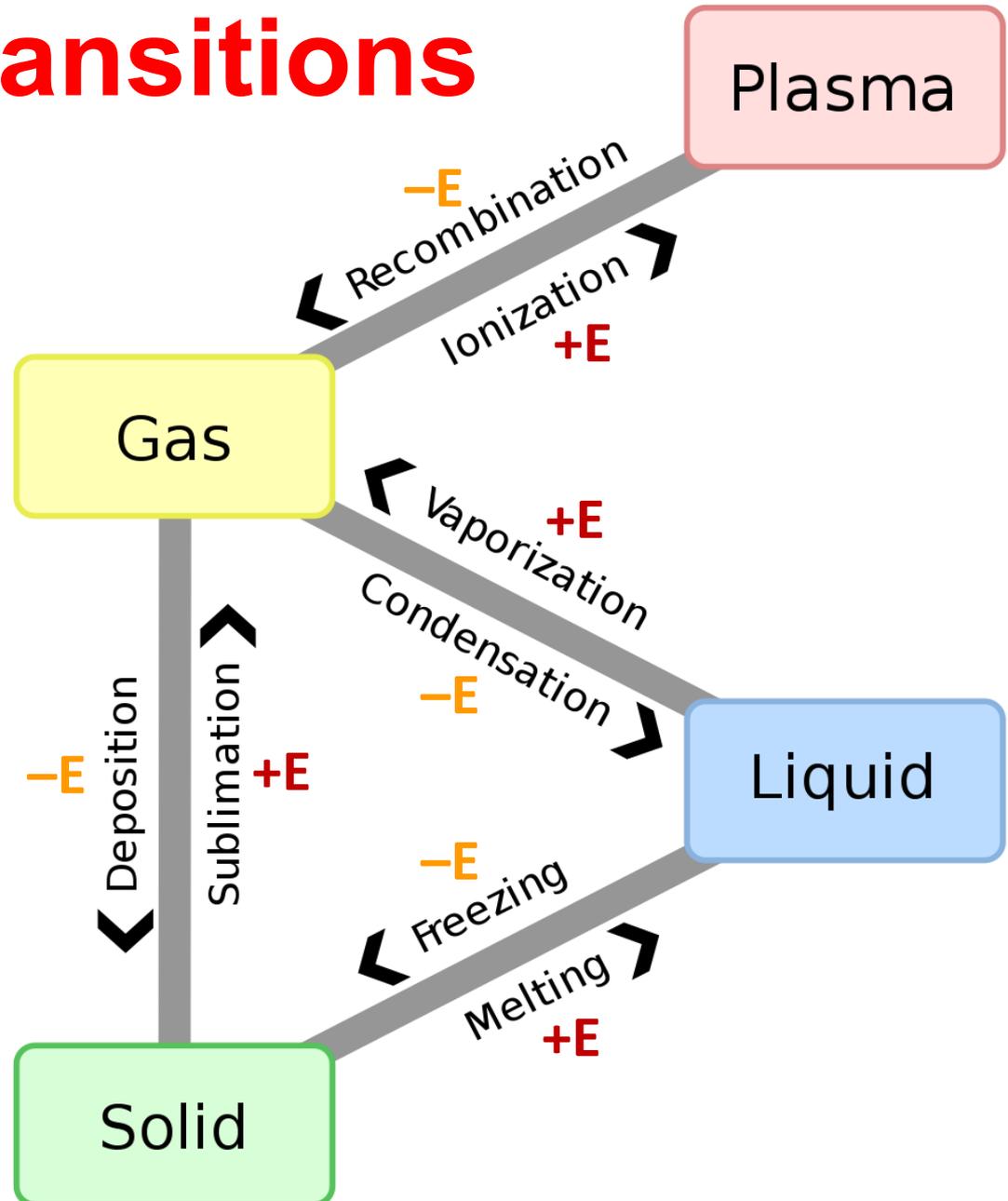
A *chemical change* does **alter** the composition or identity of the substance(s) involved.



hydrogen burns in
air to form water

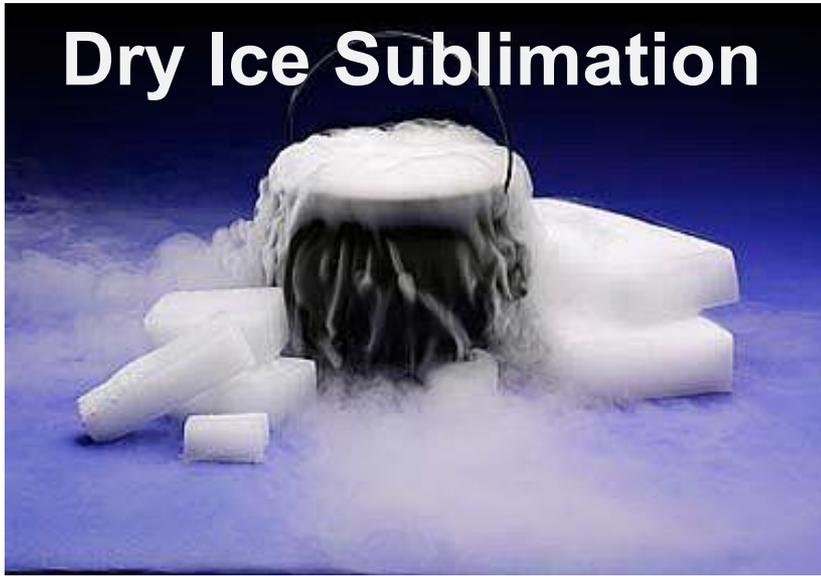
Phase Transitions

- 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 physical properties.



Phase Transition Examples

Dry Ice Sublimation



Freezing Lava



Frost Deposition



Dew Condensation



Chemical Change

AKA Chemical Reaction

- Often *impossible or difficult to reverse*.

- Matter changes **chemically** into an entirely different substance with different properties.

- Involves **joining, separation or rearrangement of atoms** of substances that react.

- Involves **forming or breaking chemical bonds**.

1. Combination or Synthesis Reaction



2. Decomposition Reaction



3. Single-replacement Reaction



4. Double-replacement Reaction



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

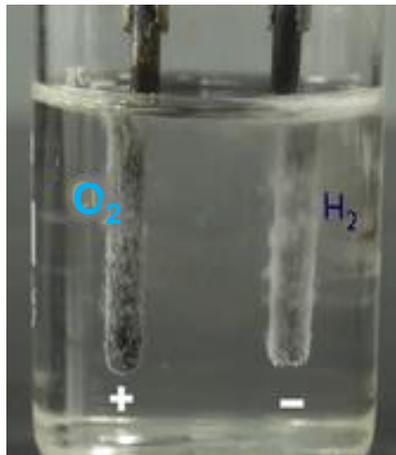
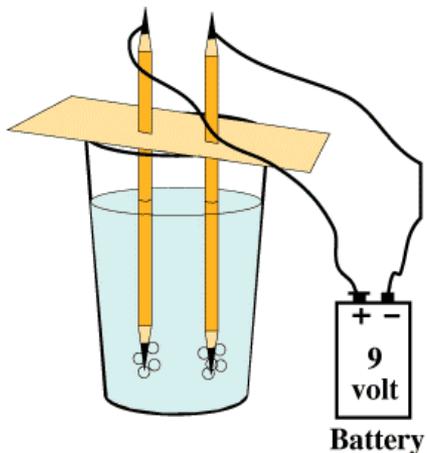


Gas Formation



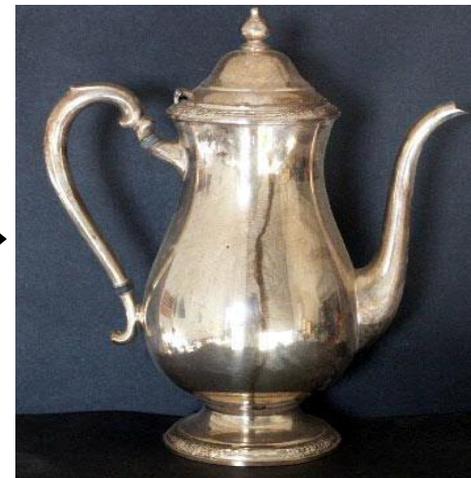
Chemical means (change) can be used to **separate a compound** into its pure components.

Chemical Reaction Examples



Electrolysis of water: when **electric current** is passed through liquid water (usually with some added *electrolyte* to increase conductivity as pure water is a poor conductor), **the water splits into oxygen and hydrogen gas.**

Tarnishing of silver: the solid silver reacts with sulfur in the air to make *solid silver sulfide*, the black material we call *tarnish*.



Chemical Reaction Examples



When vinegar (liquid) and baking soda (solid) combine, they form **carbon dioxide (gas that is denser than air)**, **water (liquid)** and **sodium acetate (a salt, which dissolves in water)**.

2015 Guinness World Record: the **largest baking soda and vinegar volcano was over 28 feet tall**, achieved by pupils, parents and staff of Elmfield Steiner School (UK) on 9 May 2015. The eruption was prepared using 100 liters of vinegar and 100 liters of a baking soda and water solution (colored with red dye).

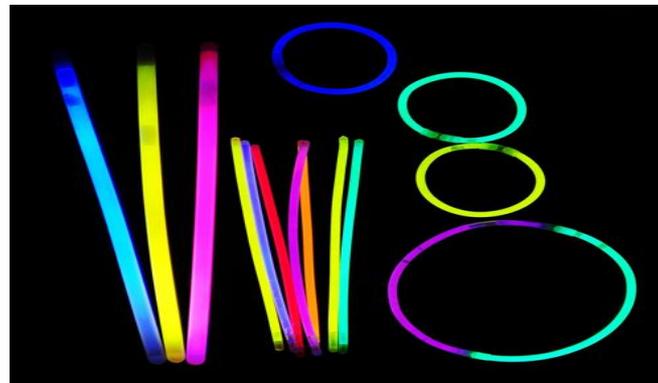


Chemical Reaction Examples

(needs oxygen and moisture)



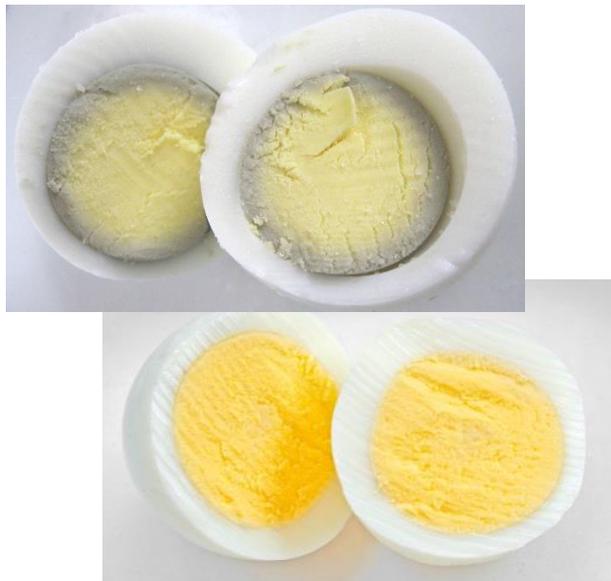
Rust: when exposed to “*elements*”, iron develops a red, flaky coating called rust, which is an example of an **oxidation reaction**.



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.

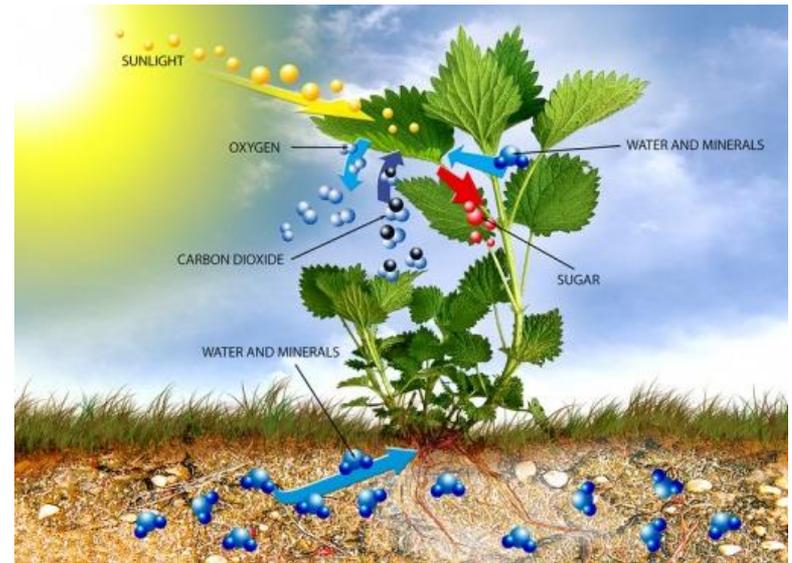


Boiling the egg: when you use **high heat** to boil an egg, it causes a chemical reaction between the yolk and the white that leaves a green film around the yolk. That film is iron sulfide, caused by **iron** in the yolk reacting with **hydrogen sulfide** in the white (*it won't hurt you to eat it, and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

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.