

Physical

CHANGE
CHANGE

Chemical

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



sugar dissolving
in water

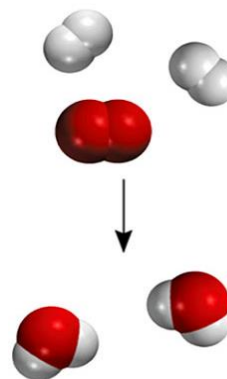


ice melting



VS

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



hydrogen burns in
air to form water

Chemical Change

AKA Chemical Reaction

- Involves joining, separation or rearrangement of atoms of substances that react.
- Involves forming or breaking chemical bonds.
- Often *impossible or difficult to reverse*.

1. Combination or Synthesis Reaction



2. Decomposition Reaction



3. Single-replacement Reaction



4. Double-replacement Reaction



Chemical Change

AKA Chemical Reaction

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

- **Silver *tarnishes*.**
The **solid silver** reacts with **sulfur in the air** to make **solid silver sulfide**, the black material we call *tarnish*.



- **Polishing** (scrubbing away the top layer) **removes tarnish temporarily**, but with time polished silver will tarnish again.

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).

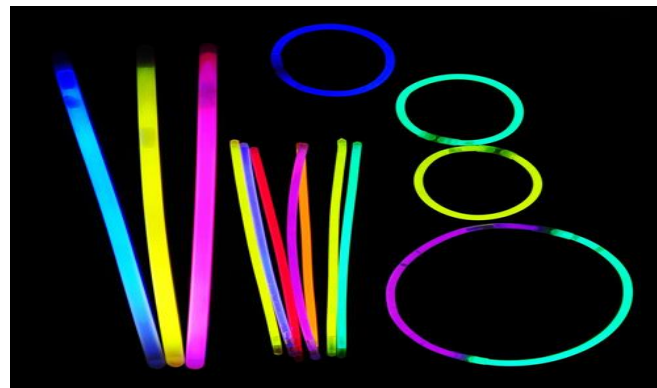


Chemical Reaction Examples

(needs oxygen and moisture)



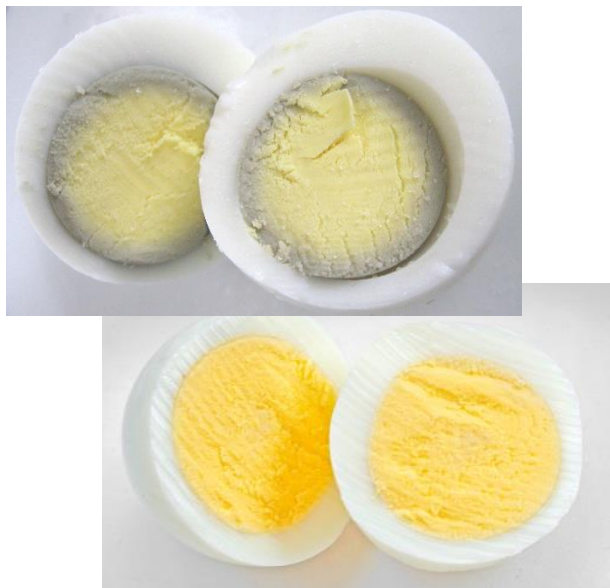
Rust: when exposed to “*elements*”, iron develops a red, flaky coating called rust, which is an example of an **oxidation reaction**.



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.

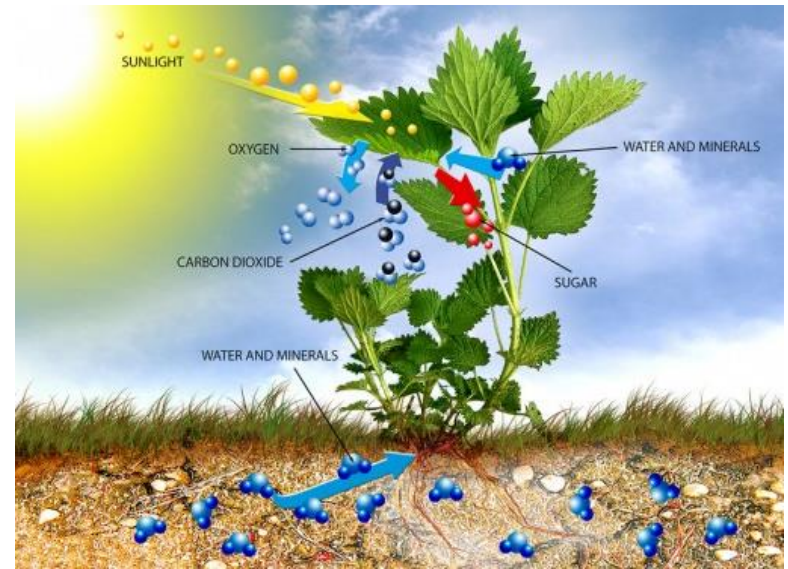


Boiling the egg: when you use **high heat** to boil an egg, it causes a chemical reaction between the yolk and the white that leaves a green film around the yolk. That film is iron sulfide, caused by **iron** in the yolk reacting with **hydrogen sulfide** in the white (*it won't hurt you to eat it, and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