

Chemical Versus Physical Changes/Properties

A **chemical change** breaks the bonds of compounds and turns them into different compounds and/or elements. Or, a chemical change may combine elements into compounds. The products of chemical reactions behave differently from the original reactants. Chemical changes in everyday life include burning, rusting, paint drying (because it combines with oxygen and actually gains weight) souring of milk, and digestion of food.

A **physical change** rearranges the same atoms or molecules. When ice melts, H₂O molecules break up their hexagonal pattern and start to roll around, but still as H₂O molecules. Whether you add a piece of sodium to ice or liquid water, you still get hydrogen gas released. Both ice and water behave in the same way towards other substances. All changes of state (melting, freezing, sublimation (solid to gas), evaporation and condensation are physical changes. So is sawing wood or tearing a piece of paper.

A **physical property** describes a substance in the absence of chemical change. It is related to its appearance and not its behaviour. Physical properties include density (= mass / volume), melting point, boiling point, and specific heat (how much heat it takes to raise the temperature of 1 g of a substance by 1°C).

A **chemical property** describes how a substance behaves in the presence of another substance, more specifically how it reacts with other elements or compounds. Examples include:

- Sodium causes a fire when added to water
- Sulfur reacts when mixed with saltpetre and charcoal (reaction of gunpowder)
- Protein breaks down when mixed with stomach acid

Analogy: Chemical and Physical Properties in People:

Personal Characteristic	Property Type
Joe wears red sandals.	physical
Joe combed his hair differently.	physical
Joe gets an ulcer when he doesn't get enough physical science homework.	chemical

Joe learns a lot when his classmates are serious.	chemical
Joe caught chicken pox from his kid sister Joe Anne.	chemical