

Chemical and Physical Properties of Matter

Physical Properties

- A **physical property** of matter can be observed or measured without changing the matter's identity.
- Some physical properties are **color, odor, mass, volume, magnetism, ability to conduct current, strength, flexibility.**
- Ex – Will your books fit into your backpack?
You are using the physical property of volume.

Physical property definitions

- Thermal conductivity – is the rate at which a substance transfers heat. Ex. Styrofoam is a poor conductor.
- State of Matter – solid, liquid, or gas
- Density – the mass per unit of volume.
Ex. Lead is very dense so it is used to make an anchor.

Physical Property definition cont.

- **Solubility** – is the ability of a substance to dissolve in another substance.
Ex. Kool-Aid powder dissolves in water.
- **Ductility** – is the ability of a substance to be pulled into a wire.
Ex. Copper is often used to make wiring because it is ductile.
- **Malleability** – is the ability of a substance to be rolled or pounded into thin sheets.
Aluminum can be rolled into sheets to make foil.

Chemical properties

- Chemical properties describe matter based on its ability to change into new matter that has different properties.
- Ex. – burning wood

Some chemical properties

- Flammability – is the ability of a substance to burn. (wood can burn, but ash and smoke cannot)
- Reactivity – is the ability of two or more substances to combine and form one or more new substances.

Physical Properties vs. Chemical Properties

- A nail will bend – physical property being changed is shape
- A nail will rust – chemical property being changed is composition (iron is reacting with oxygen to make iron oxide - **rust**)
- Alcohol will evaporate – physical change of state
- Alcohol will burn – chemical change – it is not alcohol any more.

Physical Changes

- A **physical change** is a change that affects one or more physical properties of a substance.
- Ex. A piece of silver is pounded and molded into a heart-shaped pendent. (it is still silver)
- Ex. – changing from a liquid to a solid (or any phase change)
- Ex. – crushing an Aluminum can. It is still aluminum, just the shape has changed.
- Ex – Sawdust – it is still wood – only in smaller pieces.

Chemical Changes

A **chemical change** transforms one type of matter into another kind, which may have different properties

Ex. - Fireworks exploding

Ex. – food spoiling

Ex. – a pan rusting

Ex – Burning a log of wood

How do I know that a chemical change is taking place?

- There will be a change in odor, color, heat will be either absorbed or released, the substance will bubble or fizz, light or sound may be given off.
- Ex. Soured milk
Alka-Seltzer tablets fizzing
car rusting
cake baking
chemical reaction going on in your body.

Can physical and chemical changes be reversed?

- Physical changes are easily reversed. You can melt ice and then freeze it again.
- Chemical changes are not easily reversed. When a firework explodes it would be almost impossible to put the materials back together.

Volume

Volume of a regularly shaped object

$V = \text{length} \times \text{width} \times \text{height}$ ($v = l \times w \times h$)

Irregularly shaped object

Fill graduated cylinder halfway with water.

Add object. Subtract where the water level was from where it is

Density

Density (ρ) is mass (m) divided by volume (V), and then reduced to a single unit of volume.

$$\rho = m / V$$