

# Physical or Chemical???

- *Properties of matter* are either physical or chemical...
  - **Chemical properties** are about the breaking or forming of chemical bonds... nothing else! If it involves reactions and forming new substances, it's a chemical property.
  - **Physical properties** are anything else, even if it does involve other substances. For example, the amount of salt you can dissolve in water is a physical property: even after you've made the solution, it's still just a *mixture* of salt and water. There's no chemical reaction and neither substance has been changed into a new substance.
    - *Examples:* Density, color, solubility, texture, hardness, odor, shape.
- *Changes to matter* follow the same rules...
  - **Chemical changes** are about the breaking or forming of chemical bonds. If it's going to form a new substance, it's a chemical change.
    - *Examples:* burning fuel, rusting metal, digesting sugars
  - **Physical changes** are anything else, even if the substance seems pretty different afterward, like when water changes from a liquid to a gas. *Examples:*
    - change the shape or arrangement of the substance (breaking, spreading, etc.)
    - heat or cool the substance (it may change color or even start glowing if hot)
    - change the state of matter of the substance (melting, freezing, boiling, etc.)
    - combine with other substances to make a mixture (like dissolving sugar in your tea/coffee)
    - separate from other substances to remove from a mixture (filtering, drying, distilling, etc.)
- Possible signs of a chemical change...
  - color and/or texture is different
  - temperature goes up or down
  - a different state of matter appears (gas is released, solid grains or flakes form, etc.)
  - none of these are a sure thing: they can happen during physical changes too!
- Reversing a change:
  - *Chemical changes are difficult to reverse.*
    - Once you burn a piece of paper, taking the ash, smoke, and carbon dioxide to rebuild the paper is going to be basically impossible.
    - Certain well-contained reactions can be undone, but you might have to do several carefully-managed reactions to get your matter back to its original state.
  - *Physical changes can often be reversed with a little patience.* In particular, there are several ways of separating mixtures back into their original form. Some examples:
    - If the pieces are big enough, separate and sort them by hand!
    - Pass the mixture through a cloth or a wire mesh. This catches the larger pieces while letting the smaller ones through. This is called **filtering**.
    - Let the solvent boil or evaporate, leaving the solute behind. If the solute is a solid, this is just "**drying**". If the solute and solvent are both liquid, this is called **distillation**.
    - Spin the mixture at high speeds in a centrifuge to separate the components by density.