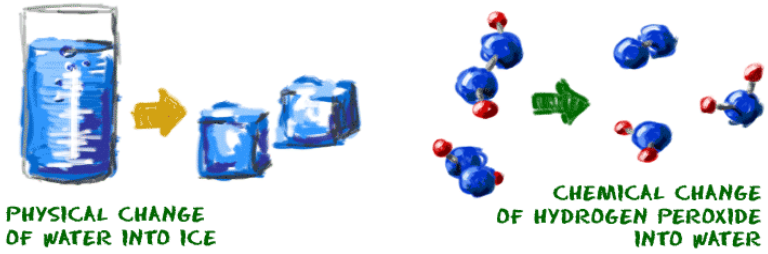
Chemical Changes Versus Physical Changes



It is important to understand the difference between **chemical** and **physical** changes.

No Change to Molecules

When you step on a can and crush it, you have forced a **physical change**. However, you only changed the shape of the can. The molecules in the can are still the same molecules. No chemical bonds were created or broken.

When you melt an ice cube (H_2O), you have a physical change. In this example, you added enough energy to create a phase change from solid to liquid. Physical actions, such as changing temperature or pressure, can cause physical changes. No chemical changes took place when you melted the ice. The water molecules are still water molecules.

A simple list of Physical Changes:

-Any change of state
-Dissolving to form a homogenous mixture, such as a solution
-Crushing, crumpling, breaking, or other physical manipulation of the matter that does not change the molecules into new matter

Changing the Molecules

Chemical changes happen on a much smaller scale. While some experiments show obvious chemical changes, such as a color change, most chemical changes are not visible. The chemical change of hydrogen peroxide (H_2O_2) becoming water cannot be seen since both liquids are clear. However, behind the scenes, billions of chemical bonds are being created and destroyed. In this example, you may see bubbles of **oxygen** (O_2) gas. Those bubbles are evidence of the chemical changes.

Melting a sugar cube is a **physical change** because the substance is still sugar. Burning a sugar cube is a **chemical change**. Fire activates a chemical reaction between sugar and oxygen. The oxygen in the air reacts with the sugar and the chemical bonds are broken.

Iron (Fe) rusts when it is exposed to oxygen gas in the air. You can watch the process happen over a long period of time. The molecules change their structure as the iron is **oxidized**, eventually becoming iron oxide (Fe_2O_3). Rusty pipes in abandoned buildings are real world examples of the oxidation process.

A list of observations that would indicate a Chemical Change:

- bubbles of gas are formed
- precipitate forms (a solid "suddenly" appears in a liquid)
- Colour changes (be careful…this can happen in physical changes as well)
- An odour is emitted
- Release of energy as heat or light or sound

For each of the following, write “P” for physical change and “C” for chemical change.

	1. Crushing a can
	2. Iron rusting
	3. The combustion (or burning) of wood
	4. Dissolving sugar in coffee
	5. Metabolism of food in your body
	6. Melting an ice cube
	7. Boiling water
	8. Mixing and acid such as HCl and a base such as NaOH
	9. Cooking an egg
	10. Mixing sand and water
	11. Breaking a beaker
	12. The digestion of carbohydrates by the enzyme amylase
	13. Shredding paper
	14. Chopping wood
	15. Mixing baking soda and vinegar
	16. Mixing red and green M&M’s
	17. Dry ice sublimating to create a spooky Halloween “fog”
	18. Baking a cake
	19. Electroplating a metal (eg. Silverware)
	20. Using a chemical Battery

PHYSICAL CHANGES

1. crushing a can
2. melting an ice cube
3. boiling water
4. mixing sand and water
5. breaking a glass
6. dissolving sugar and water
7. shredding paper
8. chopping wood
9. mixing red and green marbles
10. sublimating dry ice

CHEMICAL CHANGES

11. Rusting of iron
12. combustion (burning) of wood
13. metabolism of food in the body
14. mixing an acid and a base, such as hydrochloric acid (HCl) and sodium hydroxide (NaOH)
15. cooking an egg
16. digesting sugar with the amylase in saliva
17. mixing baking soda and vinegar to produce carbon dioxide gas
18. baking a cake
19. electroplating a metal
20. using a chemical battery