

## Observing Chemical Change - 5.1

### Vocabulary:

Physical change -

Chemical change -

Reactant –

Product –

Precipitate –

Exothermic reaction -

Endothermic reaction -

### Properties of matter:

Two kinds of properties of matter: physical properties and chemical properties.

A physical property is a characteristic of a substance that can be observed without changing the substance into another substance.

Temperature of melting point, boiling point, color, texture, density, and conductivity are physical properties of matter.

A chemical property is a characteristic of a substance that describes its ability to change into other substances. To observe the chemical properties, you have to try to change it into another substance.

When a shiny penny turns green, the color change demonstrates a chemical property of the penny's copper coating. When copper is exposed to air, it reacts over time to form a dull, crusty solid.



Another chemical property is a material's ability to burn in the presence of oxygen (flammability).

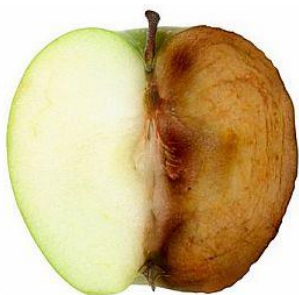


Changes in matter: Two types of changes in matter

Changes in matter can be described in terms of physical changes and chemical changes.

A physical change is any change that alters the form or appearance of a substance but does not change it into another substance: bending, crushing, and cutting. Changes in the state of matter: freezing, boiling, and melting are physical changes.

A change in matter that produces one or more new substances is a chemical change, or chemical reaction. In a chemical change, atoms rearrange to form new substances, which results in different physical properties, as well. Burning, rusting, and even when an apple slice left out in the air turns brown - the cut reacts with oxygen in the air to form new compounds.



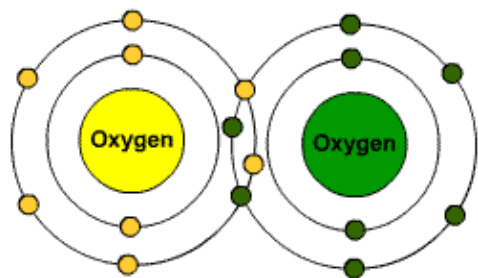
Substances that undergo the chemical changes are called reactants.

The new substances that form are the products.

### Bonding and Chemical Change

Chemical changes occur when existing bonds break and new bonds form. New substances are produced. Atoms form bonds when they share or transfer electrons.

Example: Oxygen gas (O<sub>2</sub>) in the air consists of molecules made up of two oxygen atoms bonded together.



These bonds break when oxygen reacts with magnesium (Mg) and a new ionic bond forms. The compound magnesium oxide (MgO) is produced. Magnesium oxide, a white powder, has properties that differ from those of either shiny magnesium or invisible oxygen gas. And magnesium melts at 650°C, but magnesium oxide melts at 2,800°C.



One way to detect chemical reactions is to observe changes in the physical properties of the materials.

Formation of a precipitate, gas production, and a color change are all possible evidence that a chemical reaction has taken place. Many times, physical properties such as texture and hardness may also change.

Example: sodium (Na) and chlorine (Cl) react to form an ionic compound, sodium chloride (NaCl). Both reactants are very reactive elements, but the product, sodium chloride, is very stable.



**Precipitate** - a solid that forms from liquids during a chemical reaction. The mixing of two liquids may form a solid.



**Gas production can be seen as bubbles.** Bread dough rises from gas bubbles produced when yeast reacts with sugar. What evidence in a slice of bread shows the presence of gas?

Cakes rise when baked...



**A color change can signal that a new substance has formed.**

Leaves changing color in the fall...

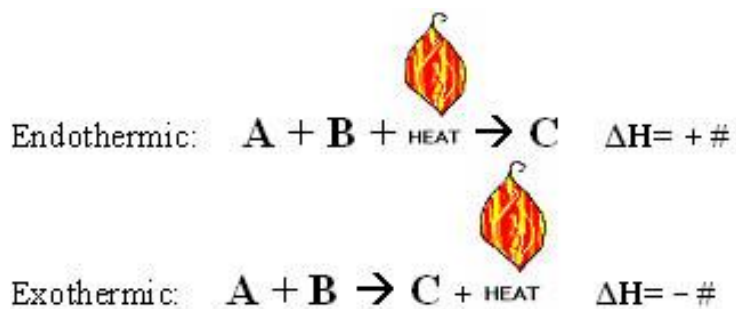
Bananas turning brown in the air...

## Changes in Energy -

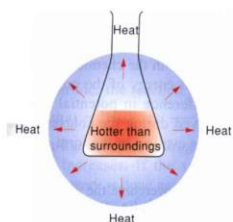
**Exothermic reaction** – The energy released as the products form is greater than the energy required to break the bonds of the reactants - usually released as heat, but can also be released as light

**Endothermic reaction** – more energy is required to break the bonds of the reactants than is released by the formation of the products. The energy can be absorbed from nearby matter. When energy is absorbed, it causes the surroundings to become cooler.

For example, in baking soda undergoes an endothermic reaction when it is mixed with vinegar. The reaction absorbs heat from its surroundings, so the reaction feels cold. Not all endothermic reactions result in a temperature decrease. Many endothermic reactions occur only when heat is constantly added, as when you fry an egg. Heat must be applied throughout the entire process in order for the reactions that cook the egg to continue.



### Exothermic



### Endothermic

