



Science in Action Textbook (pgs. 157-169)
Unit 2 Matter and Chemical Change

4.0 Substances undergo a chemical change when they interact to produce different substances.

4.1 Chemical Reactions (pgs. 157-161)

A **chemical reaction** takes place when two or more substances combine to form new substances. Different [types of chemical reactions](#) can occur, including **combination**, **decomposition**, **displacement** and **exchange** reactions. The substances at the beginning of the reaction are called **reactants**. The new materials produced by the reaction are called **products**. Chemical reactions can be written as **word equations** which gives the names of all the reactants (separated by a "plus" sign +) followed by an arrow which points to the names of all the products (separated by a 'plus' sign +)

[Chemical Reaction Movies](#)

(So Cool!)

eg. (**iron + oxygen + water ---> rust**)
(Iron plus oxygen plus water produces rust)

A **chemical change** results from a chemical reaction. Evidence that a chemical change has occurred include:

- A change on colour
- The formation of an odour
- The formation of a solid or a gas (bubbles)
- The release or absorption of energy
 - A chemical change, which **releases** energy, is called **EXOTHERMIC**.
 - A chemical change, which **absorbs** energy, is called **ENDOTHERMIC**

Chemical Reactions Involving Oxygen

Combustion is a chemical reaction that occurs when oxygen reacts with a substance to form a new substance and gives off energy.

Identification Tests:

➢ for **OXYGEN**

[Examples of Chemical Reactions](#)

Light a wooden splint. Blow out the flame, allowing the splint to continue glowing. Hold the glowing splint in a small amount of the unknown gas. If the splint bursts into flame, then the gas being tested is oxygen.

➢ for **HYDROGEN**



Light a wooden splint. Hold the glowing splint in a small amount of the unknown gas. If you hear a "**pop**", then the gas being tested is Hydrogen.

➢ for **CARBON DIOXIDE**

If you put a burning splint into Carbon Dioxide, the flame will go out and you will know the gas is not oxygen or hydrogen, but you will not know for sure that it is Carbon Dioxide.

The test for Carbon Dioxide is not a combustion test, but rather uses a liquid called **limewater** (a clear colorless solution of calcium hydroxide, or slaked lime) Bubble the unknown gas through the limewater solution, or add a few drops of the limewater solution to the gas and swirl it around. If the limewater turns **milky**, the gas is Carbon Dioxide

Corrosion is a slow chemical change that occurs when oxygen in the air reacts with a metal. Corrosion is a chemical reaction in which the metal is decomposed (eaten away), when it reacts with other substances in the environment.

The corrosion of iron is called '**rusting**'.



Many metals can corrode. The green roofs of the parliament buildings are an example of corrosion. The red-brown copper color is replaced with the green color because copper corrodes. Gold does not corrode. Solid solutions of metals (alloys) resist corrosion. Corrosion protection involves protecting the metal from contact with the environment and the factors that affect the reaction rate of this chemical reaction (e.g. painting the metal)

[Cellular Respiration](#)

Cellular Respiration is a chemical reaction that takes place in the cells in your body.

[Animations of cellular respiration](#)

4.2 Conservation of Mass in Chemical Reactions (pgs. 163-165)

The Law of Conservation of Mass

In a chemical reaction, the total mass of the reactants, is always equal to the total mass of the products.

[Chemistry Tutorials](#)

This law ties in well with the atomic theory, which states that atoms are never created or destroyed. In a chemical reaction the atoms and molecules are simply rearranged.

[Chemistry Dictionary](#)

This law of conservation of mass however does not apply to nuclear reactions, because there is some loss of mass: **the mass is changed into energy**. This was first suggested by **Albert Einstein** in his famous equation:

Law of Definite Composition

$$E = MC^2$$

Law of Multiple Proportions

(**E** is Energy, **M** is Mass, **C²** is a large number)

A very tiny amount of mass is equal to a very large amount of energy

In an **open system** some of the mass seems to disappear, when it is in the form of a gas.

4.3 Factors Affecting the Rate of a Chemical Reaction (pgs. 166-169)

Reaction Rate

The speed of a chemical reaction is called the **reaction rate**.

- **Temperature** of the reactants affects the rate of all reactions (The higher the temperature the faster the reaction rate)
- **Surface Area** of the reactants affects the reaction rate (The more surface in contact, the faster the reaction rate)
- **Concentration** of the reactants affects the reaction rate. (The higher the concentration, the faster the reaction rate)
- **The presence of a Catalyst** affects the reaction rate (Catalysts are substances that help a reaction proceed faster).

Catalysts

Catalysts are not consumed in the reaction. Types of reactions involving catalysts can be found in living and non-living things. **Enzymes** help in the reactions in the body, which break down food. They also get rid of poison in the body. [Catalase](#) (an enzyme found in plant and animal cells) speeds up the breaking down of hydrogen peroxide into harmless oxygen and water.

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