Chemical Reactions – when chemical combine together (or just react to each other) and make new chemicals. When chemical changes occur, chemical reactions take place. Chemicals are changes and rearranged when chemical bonds are broken and new ones are formed.

Physical vs. Chemical Changes

Physical change – a substance changes appearance, but it is still that substance.

Chemical change – a substance actually changes to something else.

Types of physical changes: melting; boiling; breaking; cutting; ripping; dissolving.

2H₂ + O₂ → 2H₂O

Your tongue and nose are VERY sensitive and accurate chemical detectors, BUT BE VERY CAREFUL: some chemicals can be harmful or even fatal.

Learning to recognize chemical changes is the most important thing you can learn in chemistry—it could save your life! People die every year from mixing ammonia and chlorine bleach (common cleaners) which cause a chemical change and make chlorine gas—a poison. If you notice a chemical change occurring, be safe, get out! You may have made something dangerous.

Evidence (Data) that a chemical change took place:

Bubbles – evidence that a new gas is formed (but soda pop fizzling is a physical change, though. Why?).

Turns cloudy – evidence that a new solid is forming.

Temperature changes – evidence that chemical bonds are breaking or forming.

Color changes – evidence that a new substance is forming.

Change in smell or taste – evidence a new substance formed. (SEE WARNING!)

<table>
<thead>
<tr>
<th>Physical or chemical change?</th>
<th>Evidence to support your conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt dissolved in water</td>
<td></td>
</tr>
<tr>
<td>Wood burning</td>
<td></td>
</tr>
<tr>
<td>Sugar dissolved in water</td>
<td></td>
</tr>
<tr>
<td>Water boiling</td>
<td></td>
</tr>
<tr>
<td>Baking soda and vinegar</td>
<td></td>
</tr>
</tbody>
</table>

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**Digestion—Physical or Chemical Change?**

Digestion is a multi-step process involving:
- the teeth; the tongue and mouth; the stomach;
- the small and large intestines.

<table>
<thead>
<tr>
<th><strong>Chewing</strong></th>
<th><strong>Saliva</strong></th>
<th><strong>Stomach</strong></th>
<th><strong>Intestines</strong></th>
<th><strong>Digestion</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>using the teeth to break food into smaller pieces</td>
<td>pre-digestion through enzymes in saliva; also for softening for swallowing.</td>
<td>acids in the stomach do most of the breaking down of food, which produces heat and nutrients for the body. The heat produced is part of how we keep warm.</td>
<td>additional chemicals continue to break down food into useable nutrients.</td>
<td>the entire process of chewing and digestion through the body.</td>
</tr>
</tbody>
</table>

### Reading the Chemical Reaction “Code”

Reactants are on the left: the chemicals that are “reacting”.

Products are on the right side—the chemicals that are “produced”.

- **Reactants**
  - A *coefficient* shows the number of molecules: 2H₂ means 2 hydrogen molecules for a total of 4 hydrogen atoms.

- **Products**
  - The arrow says “produces” or “yields” (or “turn into”). It always points from reactants to products.

- **A subscript** shows how many atoms (or ions) in a formula: in H₂O, the “2” says 2 atoms of hydrogen; in Be(NO₃)₂ the “2” means that there are 2 nitrate ions and a total of 1 Be, 2 N, and 6 O total.

**Example Reactions**

<table>
<thead>
<tr>
<th>Reaction</th>
<th>2H₂ + O₂ → 2H₂O</th>
<th>Li₂O + MgCl₂ → 2LiCl + MgO</th>
<th>2K₃N + 3CaCrO₄ → Ca₃N₂ + 3K₂CrO₄</th>
<th>Fe₂O₃ + 3C → 2Fe + 3CO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reactants</td>
<td>2H₂ + O₂</td>
<td>Li₂O + MgCl₂</td>
<td>2K₃N + 3CaCrO₄</td>
<td>Fe₂O₃ + 3C</td>
</tr>
<tr>
<td>Products</td>
<td>2H₂O</td>
<td>2LiCl + MgO</td>
<td>Ca₃N₂ + 3K₂CrO₄</td>
<td>2Fe + 3CO</td>
</tr>
</tbody>
</table>

**Exercise**

- **2H₂ + O₂ → 2H₂O**
  - Evidence to support your conclusion

- **Li₂O + MgCl₂ → 2LiCl + MgO**
  - **Name** the second reactant: ________________________
  - **Name** the first product: ________________________
  - How many Lithiums on the product side? __________

- **2K₃N + 3CaCrO₄ → Ca₃N₂ + 3K₂CrO₄**
  - **Give the formula** for the second reactant: __________
  - How many potassium atoms on the reactant side: ______
  - How many oxygen atoms on the product side? ______

- **2AlCl₃ + 3Na₂CO₃ → Al₂(CO₃)₃ + 6NaCl**
  - **Name** the first reactant: ________________________
  - How many sodium atoms on the reactant side? ______
  - How many Oxygen atoms on the product side? ______

- **Fe₂O₃ + 3C → 2Fe + 3CO**
  - **Name** the first reactant: ________________________
  - How many total atoms on the reactant side: ______
  - How many total atoms on the product side: ______