Section 2: Properties of Matter

Preview

- Key Ideas
- Bellringer
- Physical Properties
- Math Skills
- Chemical Properties
Why are color, volume, and density classified as physical properties?

Why are flammability and reactivity classified as chemical properties?
Bellringer

Physical properties are characteristics of a substance that can be observed without changing the composition of the substance. Physical properties are often used to separate a mixture into its original components. Imagine that you have been given a mixture of sand, sugar, and iron filings. You know that iron is attracted to a magnet, sugar dissolves in water and sand does not, and sugar has a higher boiling point than water. Each of these properties is a physical property.

Think about how you can use these facts about the physical properties of the sand, sugar, and iron filings in order to separate them out of the mixture.
1. What do you separate in the first step? How?
2. What is separated out in the second step? How?
3. What happens in the third step?
Physical Properties

〉 Why are color, volume, and density classified as physical properties?

〉 Physical properties are characteristics that can be observed without changing the identity of the substance.
Physical Properties, continued

- Physical properties can help identify substances.
- Physical properties can be observed or measured.
  - Examples: shape, color, odor, texture, state, melting point, boiling point, strength, hardness, magnetism, the ability to conduct electricity or heat
  - **melting point**: the temperature and pressure at which a solid becomes a liquid
  - **boiling point**: the temperature and pressure at which a liquid becomes a gas
- Physical properties help determine uses.
Visual Concept: Solid, Liquid and Gas
Physical Properties, *continued*

- Density is a physical property.
  - **Density:** the ratio of the mass of a substance to the volume of the substance

  \[
  \text{density} = \frac{\text{mass}}{\text{volume}}, \quad \text{or} \quad D = \frac{m}{V}
  \]
  - Common unit of density is g/cm\(^3\)

- Density is different from weight.
Visual Concept: Equation for Density

\[ D = \frac{m}{V} \]

\[ \text{density} = \frac{\text{mass}}{\text{volume}} \]
Math Skills

Density
If 10.0 cm$^3$ of ice has a mass of 9.17 g, what is the density of ice?

1. List the given and unknown values.
   
   Given: $mass, m = 9.17$ g
   
   $volume, V = 10.0$ cm$^3$
   
   Unknown: $density, D = ?$ g/cm$^3$
Math Skills, continued

2. Write the equation for density.

\[ \text{density} = \frac{\text{mass}}{\text{volume}}, \text{ or } D = \frac{m}{V} \]

3. Insert the known values into the equation, and solve.

\[ D = \frac{m}{V} \quad D = \frac{9.17 \text{ g}}{10.0 \text{ cm}^3} \]

\[ D = 0.917 \text{ g/cm}^3 \]
Chemical Properties

Why are flammability and reactivity classified as chemical properties?

A chemical property describes how a substance changes into a new substance, either by combining with other elements or by breaking apart into new substances.
Chemical Properties, *continued*

- Flammability is a chemical property.
  - *flammability*: the ability to burn

- Reactivity is a chemical property.
  - *reactivity*: the capacity of a substance to combine chemically with another substance
Chemical Properties, *continued*

- Physical and chemical properties are different.
  - Physical properties can be observed without changing the identity of a substance.
  - Chemical properties can be observed only in situations in which the identity of the substance changes.
Visual Concept: Comparing Physical and Chemical Properties

<table>
<thead>
<tr>
<th>Physical property</th>
<th>Malleability</th>
<th>Red color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical property</td>
<td>Reactivity with oxygen</td>
<td>Reactivity with bleach</td>
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<tr>
<td>Red food color</td>
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Play