

SECTION 1 (PP. 41-49): MATTER HAS OBSERVABLE PROPERTIES.

Georgia Standards: S8P1d – Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility); S8P1e – Distinguish between changes in matter as physical (i.e., physical change) or chemical (i.e., development of a gas, formation of a precipitate, and change of color).

1. Physical properties describe a substance.

Physical properties of a substance can be observed without changing the identity of the substance. *Density, mass, color, size, volume, and texture* are examples of physical properties.

- *Density* is the relationship between the mass and volume of a substance.
- Density can be calculated by dividing mass by volume, as shown in the sample problem below.

A glass marble has a volume of 5 cm³ and a mass of 13 g. What is the density of the glass?

What do you know? Volume = 5 cm³; mass = 13 g

What do you want to solve for? Density

Write the formula: $D = m/v$

Substitute numbers into the formula: $D = 13\text{g} / 5\text{cm}^3$

Calculate and simplify: $D = 2.6 \text{ g} / \text{cm}^3$

Any change in a physical property of a substance is a **physical change**. The identity of the material remains the same during the change. Examples of a physical change include cutting a material, breaking it, or changing its physical state.

2. Chemical properties describe how substances form new substances.

To observe **chemical properties** in a substance, you must see a **chemical change**.

- To observe the flammability of a piece of paper, for example, the paper must burn. The products that result from burning the paper differ in identity from the paper itself.
- Signs of a chemical change include the production of an odor, a gas, or a solid (precipitate) or a change in temperature or color.
- Other examples of chemical properties include reactivity, tendency to corrode, and toxicity.

SECTION 2 (PP. 50-57): CHANGES OF STATE ARE PHYSICAL CHANGES.

Georgia Standards: S8P1c - Describe the movement of particles in solids, liquids gases, and plasma states; S8P1e – Distinguish between changes in matter as physical (i.e., physical change) or chemical (i.e., development of a gas, formation of a precipitate, and change of color).

1. Matter can change from one state to another.

Matter has three common states – solid, liquid, and gas. Matter can physically change from one state to another.

- A solid has a fixed volume and a fixed shape.
- A liquid has a fixed volume, but assumes the shape of its container.
- Both the volume and shape of a gas depend upon the volume and shape of its container.

2. Solids can become liquids and liquids can become solids.

When a substance *melts*, added energy as heat breaks the tight bonds between particles. This process occurs at a temperature called the *melting point* of the substance. For some substances, the melting point is not a well-defined temperature. *Freezing* is the process by which particles of a liquid lose energy and bond tightly to form a solid. The *freezing point* of a substance is the same as its melting point. While a substance with a well-defined melting point is freezing or melting, the temperature will not change.

3. Liquids can become gases and gases can become liquids.

During *condensation*, a gas is changed to a liquid. Energy is removed from the gas and the particles from loose bonds.

- High-energy particles can escape from the surface of a liquid through the process of *evaporation*.
- If energy is added to a liquid, bubbles of gas can form throughout the liquid in a process called *boiling*.
- *Sublimation* is the process by which solids become gases. *Deposition* is the process by which gases become solids. Sublimation and deposition occur only under certain pressure and temperature conditions.

SECTION 3 (PP. 58-63): PROPERTIES ARE USED TO IDENTIFY SUBSTANCES.

Georgia Standards: S8P1d - Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility); S8CS6a – Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.

1. Substances have characteristic properties.

The physical and chemical properties of a substance can be used to identify it. Although a substance may share properties with another substance, no two substances have identical sets of properties. The following properties can be used to identify substances because they are the same for every sample of a particular substance:

- *Density*
- *Heating properties*
- *Solubility*
- *Conductivity*
- *Magnetic properties*

2. Mixtures can be separated by using the properties of the substances in them.

Substances can be separated by using differences in physical properties.

- A magnet can separate materials that have *magnetic properties* from those that does not.
- *Filtration* can separate solids from liquids and can separate solids that differ in particle size.
- *Evaporation* can separate a liquid and the substances dissolved in it.