

Learning Objectives

- 1) Know that matter is anything that takes up space and has mass; it has properties that can be observed and described.
- 2) Understand what an element is. Elements are often called the “building blocks” of matter. An element is a substance made up of only one type of matter. It cannot be broken down into something else and cannot be changed into another element. Also, the properties of a large or small piece of an element are the same.
- 3) Know that most elements are solids at room temperature, some are gases, and only two (mercury and bromine) are liquids.
- 4) Realize that elements are made of small particles called atoms. Atoms are so small they cannot be seen—even through a microscope. The atoms that make up one element are slightly different from the atoms that make up another element. An atom is the smallest particle of an element. For example, if a single atom is taken from a nugget of gold, that single atom is still gold.
- 5) Realize that atoms are made up of even smaller particles called subatomic particles. These are protons, neutrons, and electrons. Protons and neutrons make up the nucleus—the tiny, dense center of an atom. Electrons rapidly dart around and encircle the nucleus.
- 6) Understand that atoms can group together to form molecules. A molecule of an element consists of two or more atoms that are alike, such as carbon. Other molecules are made of two or more different atoms. A water molecule has two atoms of hydrogen and one atom of oxygen.
- 7) Understand some of the ways to determine the volume of matter.
 - a) The volume of solids can be determined by measuring the length, width, and height of the object, then multiplying the numbers.
 - b) Sometimes the volume of solids is determined by water displacement. Taking the volume of a liquid with an object in it and subtracting the volume of the liquid by itself reveals the volume of the object.
 - c) Graduated cylinders (beakers or tall cylinders with measuring marks on the side) are often used by scientists to measure the volume of liquids.
- 8) Know that density compares the mass of an object to its volume. When the molecules that make up matter are more tightly packed together, the density is greater.
- 9) Understand that buoyancy is an indicator of the density of an object. An object will float in water if its density is less than water's density. Buoyancy is the upward push on an object by the liquid or gas the object is placed in.
- 10) Know that matter can exist in three states: solid, liquid, or gas. The state of matter is determined by the position or location of its particles (molecules or atoms).
 - a) In a solid, the molecules are usually very close together. Solids have a definite shape and volume.
 - b) In liquids, molecules are not packed together as tightly as in solids, so they move more freely. Liquids take on the shape of their container (they have no definite shape), and they have a definite volume.
 - c) Gas molecules are usually very spread apart, and they do not have a definite shape or volume.
- 11) Realize that temperature is the main cause of changes in states of matter and that different substances change states at different temperatures.
 - a) The temperature at which a solid changes to a liquid is called its melting point.
 - b) The temperature at which a liquid changes state into a gas is called its boiling point; however, sometimes a liquid can slowly change to a gas without boiling—a process called evaporation.
 - c) A substance changing from a gas to a liquid is called condensation.
 - d) The temperature at which a liquid becomes a solid is called the freezing point.

Suggested Activities

- 1) Have the students demonstrate the changes between solids, liquids, and gases. Make sure you have a clear area to work with. Start out by having the students stand close together, holding hands. This represents a solid. Then, while they are still connected to each other, have them spread out a little bit and slowly move around. This represents a liquid. Next, the students should disconnect and spread far apart, moving more rapidly, representing a gas. To reinforce the changes of states, have the students start in one state (e.g., liquid) then call out one of the changes in state (e.g., boiling). The students should then change to the proper

state of matter for that term. Keep doing this, changing from one state to another, until it's clear the students have a firm grasp of the concepts.

- 2) Demonstrate some of the different ways to measure the volume of a substance. Start out with a solid, and measure its dimensions (length, width, and height). Multiply to find the volume. Next, take the same solid and find its volume by water displacement. Also demonstrate the proper use of a graduated cylinder.

Vocabulary

Matter — Anything that takes up space and has mass.

Element — A substance made up of only one type of matter, having atoms that are different from the atoms of another element.

Density — A comparison of the mass of an object to its volume; D (density) = M (mass) / V (volume).

Buoyancy — The upward push on an object by the liquid or gas the object is placed in.

Melting point — The temperature at which a solid changes into a liquid.

Boiling point — The temperature at which a liquid changes into a gas.

Evaporation — The process of a liquid slowly changing into a gas without boiling.

Condensation — The process of a gas changing into a liquid.

Freezing point — The temperature at which a liquid changes into a solid.

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