*14-1 From Molecules to Matter*

**property**- a way to describe matter, such as color, shape, odor, and hardness

**chemistry**- the scientific study of what matter is made of and how it reacts when it comes into contact with other matter

**physics-** the scientific study of what energy is and how it reacts when it comes into contact with other matter

**electron**- a part of an atom that has negative electrical charge and is found inside the atom’s nucleus

**neutron**- a part of an atom that has no electrical charge and is found inside the atom’s nucleus

**proton**- a part of an atom that has a positive electrical charge and is found inside the atom’s nucleus

\* What do you have in common with a sandwich? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* How about a racecar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* How about a tree? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* How about a goat? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* What you all have in common is that you are all made up of  **matter**, along with everything else on Earth that takes up space.

\* Matter has **properties**. This includes:

1.) Color

2.) Shape

3.) Odor

4.) Hardness

\* The scientific study of the properties of matter is *physical science.*

\* Physical science has two branches. Some study what matter is made of and how it reacts when it comes into contact with other matter. This is known as **chemistry**.

\* Other scientists focus on energy. They try to understand what energy is and how it reacts with matter. This is called **physics**.

\* These sciences are separate but similar. A chemist must know about physics and a physicist must know about chemistry.

\* All matter is made up of **elements**. Elements are substances that cannot be broken down into simpler substances.

\* There are 112 known elements. Eighty-eight of these are found in nature.

\* Twenty-four have been made in laboratories.

\* Another definition of elements is any of the four substances air, water, fire, and earth formerly believed to compose the physical universe

\* Gold, silver, helium, oxygen, and nitrogen are examples of elements found in nature.

\* Chemists use universal symbols to identify and write about elements. A ***symbol*** is a shorthand way of writing a name.

\* One that many of you have heard is H2O. This is the symbol for water. This is because there are 2 hydrogen atoms and one oxygen atom.

\* Some symbols do not seem to match the given symbol. For example, *Au* is the symbol for gold. Why couldn’t it just be *Go*?

\* We will complete several activities involving the periodic table of elements.

\* There are two main groups of elements: *metals* and *nonmetals*.

\* Gold and silver are no examples of metals. Helium, oxygen, and nitrogen are nonmetals.

\* Within the two main groups of elements are smaller groups called *families*. Families of elements share certain characteristics. The periodic table uses different colors to show the different families.

\* Not all substances that are made of the same elements have the same properties. For example, carbon is used make graphite (something used in pencils). Carbon, however, also is found in diamonds. Diamonds are the hardest natural substance known.

\* Alchemists believed they could turn common elements into rare elements such as gold. Obviously, they never did it.

\* For every successful experiment, there are many more failed ones.

\* Some alchemists thought they could find a “fountain of youth” or a way to keep people from aging and dying. Although associated with magic, alchemists contributed (helped) scientists by studying chemicals and helping develop the science of chemistry.

\* All elements are made up of atoms. Atoms have four main parts:

1.) Nucleus- the core or center of the atom

2.) Electrons- each atom has one or more electrons that travel at high speeds

3.) Neutrons- found inside of an atom’s nucleus that has no electrical charge

4.) Protons- found inside the nucleus but has a positive charge

\* Electrons and protons have opposite electrical charges. They attract each other like magnets. The attraction is what holds electrons close to the nucleus of the atom.

\* Because atoms contain equal numbers of negative and positive charges, the atom has no overall charge. However, atoms can gain or lose electrons, in which cases the atoms have become negatively or positively charged ions.

*14-2 More About Matter*

**density**- the measure of how much mass something has for its size

**solid**- matter that has a definite shape and volume

**liquid**- matter that has a definite volume but no definite shape

**gas**- matter that has no definite shape or volume

**compound**- a substance that is formed when the atoms of two or more elements join together chemically

**mixture**- a substance made of two or more elements or compounds that are mixed together but not chemically joined

**solution**- a kind of mixture in which one substance dissolves, or seems to disappear, into another substance

\* How can you tell the difference between a chicken leg and a t-bone steak?

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\* How can you tell the difference between a bluegill and a catfish? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* How about a walking stick (bug) and a branch from a tree? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Iron pyrite is often called “fool’s gold”. It has many of the same properties as gold. However, a few drops of acid will dissolve iron pyrite and give off a bad smell. Real gold will not change under the “acid test”.

\* Iron pyrite is made from iron and sulfur. The bad smell that results when the acid is added to the pyrite is from hydrogen sulfide. The hydrogen comes from acid, and the sulfur comes from pyrite.

\* The properties of a substance make it possible to tell it apart from another substance. Examples include color, shape, odor, and hardness.

\* Describe the objects provided by your teacher. Describe the color, shape, odor, and hardness. Also list any other distinguishable characteristics.

\* Another property of a substance is its mass. Mass is the amount of matter in an object.

\* What weighs more: A pound of feathers or a pound of rocks? Explain.

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\* A volleyball is about the same size as a bowling ball. Which weighs more? Which has more mass? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* There is much more matter in the bowling ball because the volleyball is filled with air that does not have much mass.

\* Another property of matter is **density**. Think of a loaf of bread. Imagine balling it up and squeezing it together as tightly as possible. The balled-up bread takes up less space than the original loaf. The volume of the bread is less now than before you balled it up. Does the amount of bread change? Explain. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Think of a rock in a glass of water. Now think of a marshmallow in the same glass. Draw a picture of where each would be in the glass.

\* All metals are denser than water, yet ships made of metal float. That’s because air is in the hull of the boat. The overall density of the ship and air is less than that of water.

\* Matter has three different states. Kentucky, Illinois, and Wisconsin….just kidding. Does anyone know the three different states of matter? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Matter can change between the different states. Explain water in the three states.

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\* When water turns to a colorless gas and then disappears is called *evaporation.*

\* When gas changes back to a liquid, it is called *condensation*.

\* When a cold window fogs up, the fog is water vapor that has turned back to a liquid.

\* Like liquids, solids have a definite volume. However, liquids do not have a definite shape. Describe how a glass of water would change if you poured it into a fishbowl.

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\* Now describe what would happen to the shape of an orange if it is take from a plate and set in the fishbowl. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Gas is also matter. That is, it takes up space. However, it does not have a definite shape or a definite volume. A gas will spread out over a container of any size or any shape. It tends to want to make its molecules as far apart as possible.

\* Describe what would happen to the water vapor if you took a hot shower in a small room? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Describe the water vapor if you took the shower in a room the size of Liberty’s gymnasium. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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\* Molecules in substances are constantly (always) moving. However, the molecules in solids are packed very tightly together. They move very little. The molecules in liquids have more room. They move around more freely. The molecules in gases have even more room to move.

\* Now we will discuss compounds, mixtures, and solutions.

\* Compounds combine elements. Water combines hydrogen and oxygen. Rust is iron and oxygen. Sugar, salt, and soap are all examples of compounds.

\* Mixtures are different from compounds. They do not chemically join. Think of soil and water. They truly do not combine. You can filter out the water to simply remove the dirt/soil.

\*A **solution** is a special kind of mixture. Salt water is a solution. The salt does not go away, it just spreads evenly throughout the other substance. If you boiled all of the water away, the salt would return. Also, if you leave it sitting for a period of time, some of the salt would drift to the bottom of the jar.