Big Idea 8 Properties of Matter

Florida Next Generation Sunshine State Standards:

SC.5.P.8.1 – Compare and contrast the basic properties of solids, liquids, and gases, such as mass, volume, color, texture, and temperature.

SC.5.P.8.3 – Demonstrate and explain that mixtures of solids can be separated based on observable properties of their parts such as particle size, shape, color, and magnetic attraction.

Terms

English	Spanish	Haitian Creole
1. accurate	preciso	egzat
2. balance	balanza/báscula	balans
3. Celsius	Centígrado	Santigrad
4. centimeter	centímetro	santimèt
5. Fahrenheit	Fahrenheit	Farennhayt
6. gas	gas	gaz
7. graduated cylinder	cilindro graduado/probeta	silend kalibre
8. gram	gramo	gram
9. gravity	gravedad	pezantè/gravite
10. inch	pulgada	pous
11. length	largo	longè
12. liquid	líquido	likid
13. liter	litro	lit
14. mass	masa	mas
15. matter	material	matyè
16. measure	medida	mezire
17. meniscus	menisco	menisk
18. meter	metro	mèt
19. milliliter	mililitro	mililit
20. mixture	mezcla	melanj
21. ruler	regla	règ
22. spring scale	balanza de muelles	balans
23. solid	sólido	solid
24. states of matter	estados de la materia	eta matyè yo
25. temperature	temperatura	tanperati
26. thermometer	termómetro	tèmomèt
27. volume	volumen	volim
28. weight	peso	pwa

Does This Matter to Me?

Matter is all around you, so properties of matter should matter to you. You could get by in life using words like heavy and light, hot and cold, long and short, even though these words mean different things to different people. However, in science, to study matter and its properties, we describe observations with measurements. Using observations and measurements, the experiment or model can be repeated the same way the next time. Knowing about measurement and properties of matter can help you in areas besides science, such as to be a good cook, to make a recipe the right way every time, or to fix cars or motorcycles. Even fun activities like fishing and shopping require you to take measurements and compare them carefully. Let's learn about properties of matter so that you have skills that will help you to do these activities and more.

Every day you interact with matter in solid, liquid, and gas forms. Fill in the table with different types of matter you have observed since you woke up this morning. Where did you observe this matter? What sense did you use to observe it? Was it a solid, liquid or gas? What properties do you remember, such as color, texture (hard, soft, squishy), shape, etc.?

Matter	Place	Sense(s) Used	Solid, Liquid, or Gas?	Properties (color, texture, shape, etc.)
Example: milk	*at home*	*sight, touch*	*liquid*	*white, opaque, in glass, cool*

Describing and Comparing Basic Properties of Matter
(SC.5.P.8.1)

All objects and substances are **matter**. Matter takes up space and has **mass**. Matter can also take three different forms or states: **solid**, **liquid**, and **gas**. Matter has basic properties, such as mass, volume, color, texture, and temperature. Each of these properties can be observed, described, **measured**, and recorded. Describing the properties of matter allows you to compare and contrast different types of matter.

Just as we use various tools to measure things at home, we use various tools to measure when we are doing scientific investigations. The following table lists some examples of measurement. What types of measurements have you made at home? What types of measurements have you made at school?

Properties...	Tools…	At home…	At school…
Length (Height)		…we use a yard stick or a meter stick to measure our height, fabric for sewing clothes, or wood before cutting and building	…we use similar tools (e.g., rulers, meter sticks, tape measures) to measure distance
Volume		…we use teaspoons and tablespoons to measure volumes of wet and dry ingredients when cooking	…we use graduated cylinders and beakers to measure volume
Temperature		…we use indoor/outdoor thermometers to measure air temperature, and digital thermometers to check for a fever	…we use laboratory grade thermometers to measure temperature

Throughout the entire world, people measure using the metric system whether they are at home or at school in the science lab. The metric system uses units like the **meter**, **gram, liter**, and degrees **Celsius (°C)**. The United States is one of only three countries in the world where most people use the older customary system on a daily basis like the yard, gallon, and ounce. Only some people in the U.S. use the metric system for science-related work such as engineers, medical doctors, nurses, biologists, geologists, etc.

Length

You will measure the **lengths** of objects using the customary **inch** (in) and the metric **centimeter** (cm). The units for measuring length in the customary system are inches, feet, and yards. There are 12 inches in one foot, and 3 feet in one yard. In the metric system, the standard unit of length is the meter (m). There are 100 centimeters in a meter. Each centimeter is divided into 10 parts called millimeters (mm). Measure the lengths to the nearest ¼ inch (in), 0.1 centimeter (cm), or 1 millimeter (mm). An inch is divided into 16 parts, and a centimeter is divided into 10 parts. Which unit of measurement do you think would be easier to use in science? Explain your reasoning.

_____

_____

To measure the length of an object, we use a **ruler** or meter stick. These instruments are best for measuring straight lines and surfaces. For example, you could measure the edge of a piece of paper with a ruler, or the length of a wall with a meter stick. If you were trying to measure the length of a piece of string, you would need to straighten it before measuring it. Be sure to line up the "0" marked on your ruler with the end of the object you are measuring.

Mass

Mass is the amount of matter in an object. To find the mass of an object you would use a **balance** like the one shown here.

A balance compares two objects. Notice there are no numbers on this instrument. There is a little arrow between the two pans. The balance shows whether one side is heavier than the other. If the masses on both sides are equal, the arrow sits in the middle and we could say, "The two sides are in balance." To find the mass of an object, we use standard masses in one of the pans of the balance. The plastic pieces in the picture are standard masses.

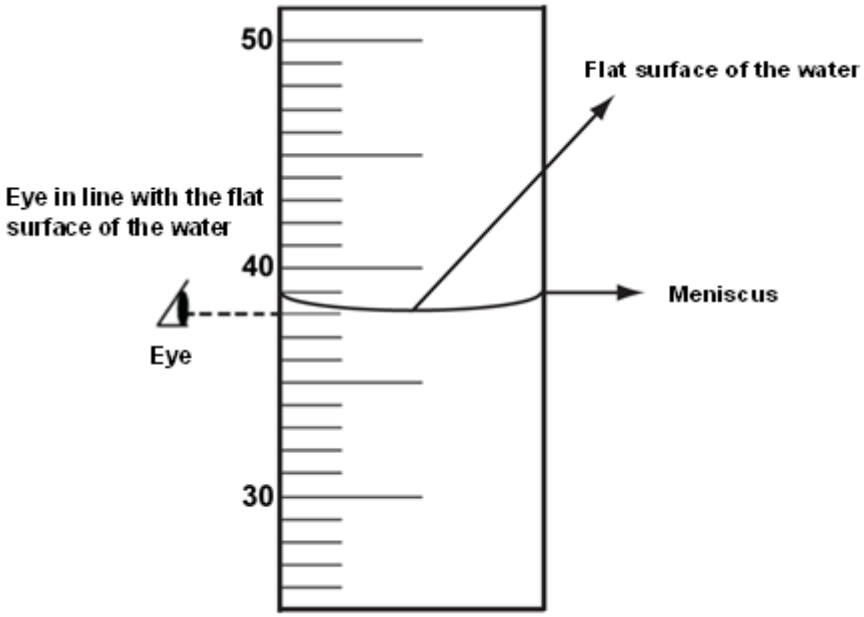
The unit of mass in the metric system is a gram (g). Grams can be divided into 1,000 parts called milligrams (mg). For the following activity, you will be using the unit gram to measure mass (for example, 15 g).

Volume

Volume is one physical property of matter. It is a measure of how much space an object takes up.

A **graduated cylinder** is a tool that is used to measure the volume of a liquid. The unit for measuring the volume of a liquid in the metric system is the **liter** (L). The liter is divided into 1,000 parts or **milliliters** (ml). To obtain **accurate** measurements, it is important that you place the graduated cylinder on a flat surface. It is also important to observe the liquid at eye level and read the marking at the bottom of the curve. This curve is called the **meniscus**.

Look at the model of a section of a graduated cylinder.



What is the volume of the liquid in the graduated cylinder? This liquid's volume is 38 milliliters (ml). We can measure volume of liquids with tools like a graduated cylinder because liquids retain their volume regardless of the shape of the container. A box of juice has the same volume when you pour it into your glass.

The volume of a regular solid can be calculated using a ruler. For example, using a ruler, the volume of a rectangular object can be measured by calculating length x width x height. The volume of an irregular solid (for example, an eraser or a toy car) can be calculated using the water displacement method you just used to measure the volume of two balls.

Temperature

Let's think about the weather.

Is it hot outside today? _____

Is it usually hotter in winter or summer? _____

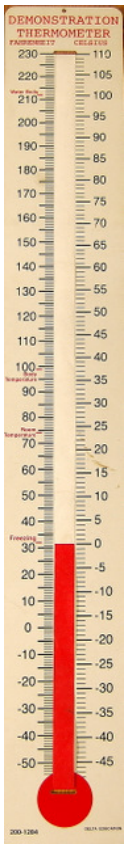
Is it usually cooler on a cloudy day or a sunny day? _____

Where are the coldest places on Earth? _____

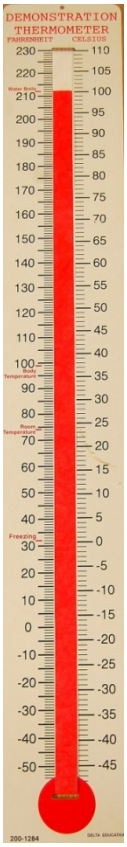
Where are the hottest places on Earth? _____

We use the word **temperature** when we talk about how cold or hot something is. Look at the pictures of the **thermometers**. You will see that each thermometer has two measurement systems. One unit for measuring temperature is called **Fahrenheit (°F)** and the other is called **Celsius (°C).** Fahrenheit is part of the customary system and Celsius is part of the metric system. When reading thermometers like the ones shown, the top of the red liquid indicates the temperature. The left thermometer shows the temperature at which water freezes, 32 °F or 0 °C. Although these are two very different numbers, they represent the same temperature on two different scales. The right thermometer shows the temperature at which water boils, 212 °F or 100 °C. Again, these temperatures are the same, but they are recorded as two very different numbers on two very different scales, Fahrenheit and Celsius.

Fahrenheit (°F)



Celsius (°C)



As the temperature increases, the liquid rises or goes up in the tube. As the temperature decreases, the liquid in the tube falls or goes down. You can see why it is important to keep your finger off the bulb of the thermometer when you are measuring the temperature

of something. When you measure the temperature of various objects, it is important to wait about 2 minutes to allow the thermometer to adjust to its new environment. When the liquid in the bulb of the thermometer is adjusted, the liquid in the capillary stops moving up or down and you can read the temperature. In addition, it is important to read the red line on this type of thermometer at eye level.

Look at the 0-point on the Celsius scale and the 0-point on the Fahrenheit scale on the thermometer. The numbers below the 0 point are called negative numbers. The further below 0 the red liquid gets, the colder the sample is. For example, -30 (minus 30) degrees Celsius is colder than -10 degrees Celsius. Numbers below zero are read, for example, as 10 degrees below 0 or -10 (minus 10) degrees.

Three States of Matter
(SC.5.P.8.1)

We want to answer the questions:
a. What is matter?
b. What are the three states of matter? How can you tell one state from another?

To determine whether an object is matter or not, you need to examine the object by considering two questions. First, does it have mass? Second, does it take up space? **Matter** has mass and takes up space.

Matter exists in three basic states: solid, liquid, and gas. To classify each object as one of three **states of matter,** you need to examine its shape along with its volume. Does it have a definite shape, or does it change its shape? Shape, like volume, is a physical property of matter. Solids have a definite volume and a definite shape. Liquids are fluid; they have a definite volume but not a definite shape and take the shape of the container. Gases have no fixed volume or shape.

Is It Matter?

For each of the substances in the table, answer the questions in the first two columns.





Use those answers to decide if the substance is matter or not. For the substances that are matter, decide what state of matter they are at room temperature.

Substance	Does it have mass? Yes or No?	Does it take up space? Yes or No?	Is it matter? Yes or No?	If it is matter, what state is it? (solid, liquid, or gas)
Water				
Light				
Rock				
Ice cubes				
Music				
Chocolate bar				
Air				

Mixtures
(SC.5.P.8.3)

A **mixture** is made from two or more kinds of matter that are physically blended together.

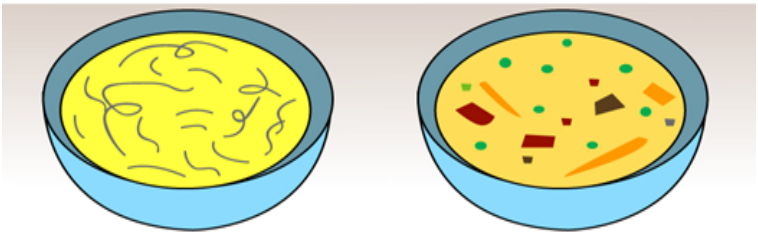
Some mixtures are made of solid ingredients, and they are called solid mixtures. Breakfast cereal made of flakes, raisins, nuts, and bananas is a solid mixture. A bowl of nuts containing cashews, macadamia nuts, almonds, and pecans is also a solid mixture. In these mixtures, you can easily separate its components by picking them out.

Breakfast Cereal

Bowl of Nuts

Mixtures can be a combination of two or more liquids. For example, if you combine oil and water for a salad dressing, you can see drops of oil suspended in the water as you begin to stir these liquids together. If you shake the mixture vigorously, the oil droplets are made smaller and smaller and the mixture starts to look homogeneous. However, if you leave the mixture undisturbed, the oil and water will separate again.

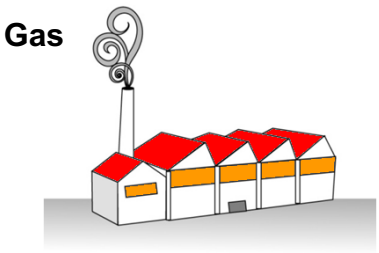
Mixtures can be a combination of solids and liquids. Chicken noodle and vegetable soups are mixtures of both solid and liquid ingredients. Are you able to separate the vegetables from the broth in a soup?



Chicken Noodle Soup

Vegetable Soup

Mixtures can be made of gases. For example, the air in the Earth's atmosphere is a mixture of nitrogen, hydrogen, oxygen, carbon dioxide, water vapor, and other gases. Are you able to tell the different gases apart with the naked eye?



When you physically combine two or more materials, you make a mixture. Mixtures can also be taken apart or separated back into their original ingredients. Substances in a mixture may retain separate physical properties. Physical properties are characteristics of a substance, like size, color, texture, or magnetism.

Properties of Matter

You learned that in science many kinds of tools are used to carry out investigations. Some of these tools help you measure physical properties of matter.

The world around us is made of matter. Matter has mass and takes up space. Your body, trees, the oceans, air, and clouds are examples of matter. These all have mass and take up space. Anything that has no mass and does not take up space is not matter, including forms of energy, such as electricity, heat, light, and sound.

On Earth, most matter we commonly experience exists in three basic forms or states: solid, liquid, and gas.

You learned that a mixture is created when two or more kinds of matter are physically mixed. There are many kinds of mixtures. Trail mix, a tossed salad, a bag of assorted candy, and breakfast cereal are all examples of mixtures of solids. Air is a mixture of gases.

You learned that because mixtures are physically but not chemically combined, they can be separated back into their parts. Some mixtures can be separated using your hands. Other mixtures can be separated with magnets. Some mixtures can be separated using a filter. Mixtures can also be separated by using nets, strainers, and evaporation.