Week 5:

- [ ] Properties of Matter (SC.5.P.8.1)
- [ ] Separating Mixtures (SC.5.P.8.3)
- [ ] Changes in Matter (SC.5.P.9.1)
- [ ] Forms of Energy (SC.5.P.10.1)

Week 6:

- [ ] Energy Can Cause Change (SC.5.p.10.2)
- [ ] Heat an Electricity (SC.5.10.4)
- [ ] Forces (SC.5.P.13.1)
- [ ] Force, Mass, and Motion (SC.5.P.13.2)

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

Properties of Matter

What Is Matter?

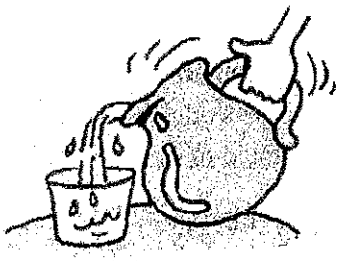
Anything that has mass and takes up space is **matter**. All physical objects are made of matter. Mass is the amount of matter in something. **Volume** is the amount of space something takes up. If you could view an object through the most powerful microscope, you would see that matter is made of tiny particles called atoms. Each of these particles has mass even though they are so small you cannot see them. Different types of matter are made of different arrangements of atoms. Each type of matter has physical properties that you can see, smell, touch, taste, measure, and study.

States of Matter

Aluminum, water, and helium are all examples of matter that are very easy to tell apart. Each one exists in a different state. One is a solid, one is a liquid, and one is a gas. Do you know which is which?

Gold is a solid at room temperature. A solid is the state of matter that holds its own shape and has a fixed volume. A nugget of gold will neither change its shape nor change volume at room temperature.

Water is a liquid at room temperature. A liquid is the state of matter that has a fixed volume but not a definite shape. A liquid takes the shape of its container. You can pour liquid water from a pitcher into a glass.



At room temperature, helium is a gas. A gas is the state of matter that expands to fill its container. A gas does not have a definite shape or volume. Helium gas is used to fill balloons.

Other Physical Properties

You can use your senses to observe some of the properties of solids, liquids, and gases. You can use your sense of sight to observe the color, shape, and general size of an object. You can use your sense of touch to observe a material's texture. Your sense of smell tells you what a substance smells like, and your sense of taste tells you what it tastes like. Even your sense of hearing can help you observe the properties of objects. Can you tell the difference between a tennis ball, a pin, and a rock, just by hearing each one drop to the floor? Can you tell if a substance is a liquid or a solid using your hearing? Of course!

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Benchmark Review SC.5.P.8.1

Using Tools

Other properties can be measured using tools. You can also observe whether a substance is attracted to a magnet. If you bring a magnet near various objects, you will observe that objects containing the metals iron, nickel, and cobalt will be drawing toward the magnet. Objects made of glass or wood will not be attracted to the magnet.

You can measure the temperature of a substance using a thermometer. Temperature is a measure of how warm a substance is. A substance with a higher temperature is warmer. You can also find out how much matter is in an object by measuring its mass, and you can measure how much space an object takes up by measuring its volume.

Student-Response Activity

Use the data table below to answer the questions.

Substance	Mass	Volume	Magnetic	Color	State at Room Temperature
A	27 g	10 cm^3	No	metallic, silver	solid
B	50 g	6.36 cm^3	Yes	metallic, gray	solid
C	40 g	40 mL	No	clear	liquid

❶ Which substance most likely contains iron? Use evidence to support your choice.

_____

_____

_____

❷ Which substance is most likely aluminum? Use evidence to support your choice.

_____

_____

_____

_____

❸ Which substance is most likely water? Use evidence to support your choice.

_____

_____

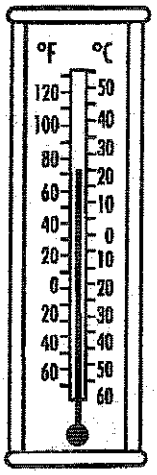
_____

_____

Benchmark Assessment SC.5.P.8.1

Fill in the letter of the best choice.

1. Study this thermometer.



Which properties does water have at this temperature?

Ⓐ It would fill its container.
Ⓑ It would hold its own shape.
Ⓒ It would not have a shape.
Ⓓ It would take the shape of its container.

2. Which is a property of solids?

Ⓕ takes the shape of its container
Ⓖ keeps its shape
Ⓗ fills its container
Ⓘ can be poured

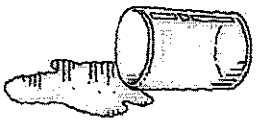
3. This chart shows the state of four substances.

Substance	State at Room Temperature
A	solid
B	gas
C	liquid
D	solid

Which substance is water?

Ⓐ A
Ⓑ B
Ⓒ C
Ⓓ D

4. Which characteristic of a liquid does the illustration show?



Ⓕ It is wet.
Ⓖ It has a fixed volume.
Ⓗ It does not have a definite shape.
Ⓘ It has a fixed volume and a fixed shape.

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.

Separating Mixtures

Mixtures and Solutions

A **mixture** is a combination of two or more substances that keep their identities. The parts of a mixture do not undergo a chemical change to form a new substance. Making a mixture is a physical change.

A fruit salad is an example of a mixture of different solids. The pieces of fruit are all mixed all together, but the apples are apples, the melon is melon, and the blueberries are blueberries. Each ingredient keeps its original properties.

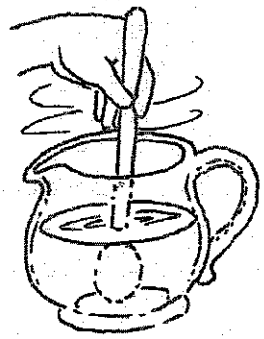
And solids and gases? Mixtures can also be made up of solids and liquids, liquids and liquids, gases and liquids, or gases and gases. Air, for example, is a mixture of various gases. Granola with milk is a mixture of solids and a liquid.

Solutions

Sometimes one substance mixes evenly and completely, or dissolves, in another substance. A **solution** forms when one substance dissolves into another. A solution is a mixture that has the same composition throughout.

When you mix sugar or salt into water, you cannot see the sugar or salt grains anymore. Yet the parts of these mixtures still retain many of their original properties. Salt water and sugar water both look the same, but if you taste them, you can easily tell the difference.

Certain conditions cause a substance to dissolve more quickly in water. For example, salt and sugar will dissolve much more easily in warm water than in cold water. Crushing a substance into smaller pieces also causes it to dissolve more quickly, as does stirring the mixture.



Not all substances will dissolve in water. Sand does not dissolve in water, and neither does oil.

Separating Mixtures

Separating a mixture is not always easy, but since it is a physical change each part of a mixture keeps its individual properties. You can use these properties to separate them. For example, if you have a mixture of different beads, you can easily pick out the beads and sort them by color, size, or shape.

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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.

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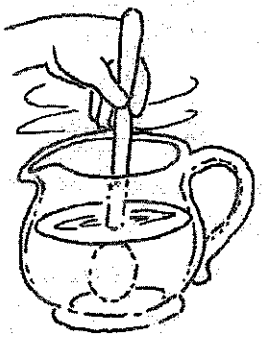

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What other physical properties can be used to separate mixtures? Every substance has its own density. A less-dense substance will float on a more-dense substance. For example, some salad dressings separate naturally because oil floats on top of water or vinegar. Objects will float in water if they are less dense than water and will sink if they are more dense than water. A mixture of rocks and table tennis balls can be separated by adding water—the balls will float, but the rocks will not.

You can also sift mixtures to separate parts by their particle size. Sifting a mixture of rocks and sand through a screen will separate the two parts by allowing only the sand to pass through. You can also use a filter to separate some solids from a liquid they are in. For example, muddy water can be filtered to remove the soil particles.

You can use magnetism to separate a mixture if one of its parts is attracted to a magnet. For example, you can separate a mixture of sand and iron filings by passing a magnet close over the mixture. The iron filings will be attracted to the magnet, and the sand will be left behind.

Boiling is when a liquid rapidly changes to a gas at the boiling point of a liquid. Evaporation also changes a liquid to a gas, but it occurs at temperatures below the boiling point. During these processes, only the liquid particles leave the solution. The dissolved particles stay behind. For example if you allow sugar water to sit in a warm location, the water will evaporate into the air, leaving the sugar behind.

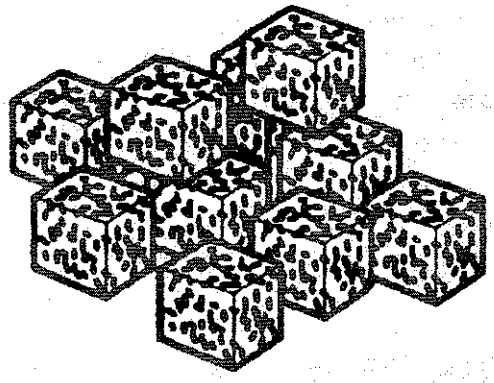
Student-Response Activity

1. Explain how you would separate a mixture of salt and sand.

Name _____ Date _____

2 Explain how you would separate a mixture of soil, pebbles, and iron filings.

3 Sara wants to dissolve these sugar cubes in water.



List three ways she could speed up the process of dissolving the sugar cubes.

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Benchmark Assessment SC.5.P.8.3

Fill in the letter of the best choice.

1. Which mixture would be **best** separated using a magnet?
   - Ⓐ iron filings and iron nails
   - Ⓑ iron nails and sawdust
   - Ⓒ sawdust and wood chips
   - Ⓓ salt and soil

2. Which mixture would be **best** separated using evaporation?
   - Ⓕ sawdust and wood chips
   - Ⓖ iron filings and iron nails
   - Ⓗ salt and soil
   - Ⓘ sugar and salt

3. Which mixture would be **best** separated using a filter?
   - Ⓐ sugar water
   - Ⓑ saltwater
   - Ⓒ sand in water
   - Ⓓ honey in water

4. Jed wants to dissolve oil in water. Which statement is **true**?
   - Ⓕ He should stir the water to help the oil dissolve.
   - Ⓖ He should raise the temperature of the water to help the oil dissolve.
   - Ⓗ The oil will not dissolve, because water must dissolve in oil.
   - Ⓘ The oil will not dissolve, because oil cannot dissolve in water.

5. Max has made a mixture of different sizes of rocks for a landscaping project. Data about the rocks are in the table below.

Rock Type	Diameter of Rock Particles (cm)
pea gravel	0.5
pond pebbles	1.0
river rock	2.5

Max decides that the river rocks are too large and wants to separate them out. Which is the best option?

- Ⓐ Sift them out with a screen with 1-cm openings.
- Ⓑ Sift them out with a screen with 2-cm openings.
- Ⓒ Sift them out with a screen with 3-cm openings.
- Ⓓ Sift them out with a screen with 4-cm openings.

Name _____ Date _____ Benchmark Review SC.5.P.9.1

SC.5.P.9.1 Investigate and describe that many physical and chemical changes are affected by temperature.

Changes in Matter

Matter can go through physical and chemical changes. Matter has physical properties that can be observed without change the type of matter. Matter can also change in ways that do not affect the type of matter. This type of change is called a **physical change**. When paper is cut, shredded, or torn, it is still paper. This is an example of a physical change.

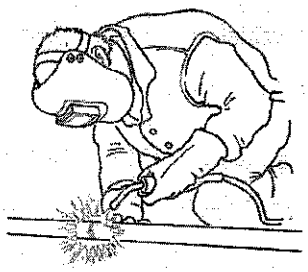
Matter has other properties that cannot be observed without changing the identity of the matter. These properties are chemical properties. A **chemical change** results in a change in the identity of matter and results in the formation of a new substance. When paper is burned, it turns new forms of matter—hot gases and ash. This is an example of a chemical change.

Physical Changes

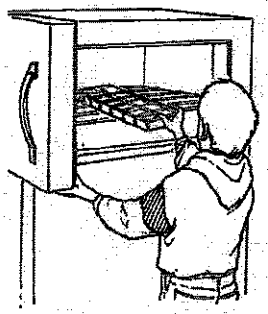
Changes in temperature can cause physical changes to take place. Did you know that each type of matter can exist as a solid, a liquid, or a gas? Some types of matter are solids at room temperature. Others are liquids or gases at room temperature. The temperature of matter determines its state. When enough heat is added or taken away, matter can change state.

For example, aluminum foil will change from its solid state to a liquid if its temperature reaches 660°C (1,220°F). It is still aluminum, but it is no longer a solid. This is a change in state. Changes in state are physical changes.

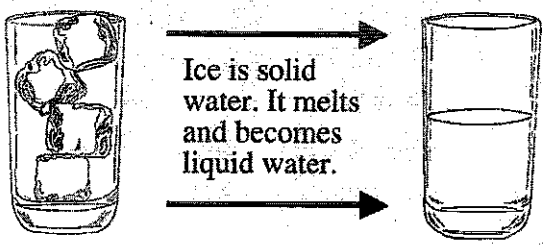
To form a seal between two metal pipes, a welder heats metal so it turns into a liquid that can be formed into a certain shape.



Water is a liquid at room temperature. If you put it in a freezer, its temperature decreases. At temperatures below 0°C (32°F), water freezes. Freezing is the change from a liquid to a solid. Solid water is called ice.



If you remove an ice cube from the freezer, it slowly warms. Eventually, the ice will begin to turn into liquid water. At temperatures above 0°C, ice melts. Melting is the change from a solid to a liquid.



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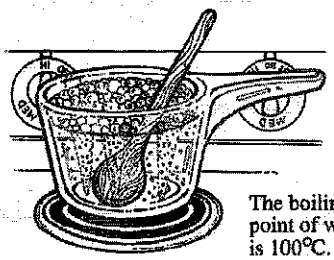
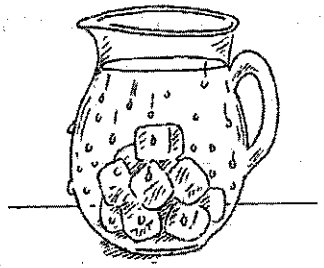
Place a pot of liquid water on a hot stove, and the water gets warmer. When it reaches 100°C (212°F), it boils. Boiling is the rapid change from a liquid to a gas. Sometimes, liquid near the surface will become a gas, even if the temperature is not at the boiling point. This is called evaporation, which occurs slowly and only at the surface of a liquid.



The boiling point of water is 100°C.

When a gas turns to a liquid, the process is called condensation. You have seen this process occur when water drops form on the outside of a cold glass. It might look like the glass is leaking, but that's not the case. Water in the form of a gas is called water vapor. It's in the air all around you, but you can't see it. The air's temperature is lowered by the cold glass. The decrease in temperature causes the water vapor to condense and form droplets of liquid water.



Condensation is the process of turning a gas into a liquid. We also call the physical drops of liquid that form *condensation*.

Chemical Changes

Changes in temperature can also cause chemical changes to take place. Many chemical changes happen when a substance's temperature rises. For example, when you place wood in a fire, the wood heats up and burns. The process of burning causes new substances to form, such as ash and smoke.

Cooking provides many examples of chemical changes that occur when the temperature of a substance increases. Frying an egg causes chemical changes that cause the transparent egg to turn white. Heating bread dough changes its texture and causes it to form a golden crust.

Student-Response Activity

1. Describe how an increase in temperature can change each of the following materials. Classify each change as physical or chemical.

ice _____

_____

liquid water _____

_____

wood _____

_____

Name _____ Date _____

Benchmark Review
SC.5.P.9.1

2. Suppose an ice cube is taken out of the freezer. Predict how it will change over several hours.

_____

_____

_____

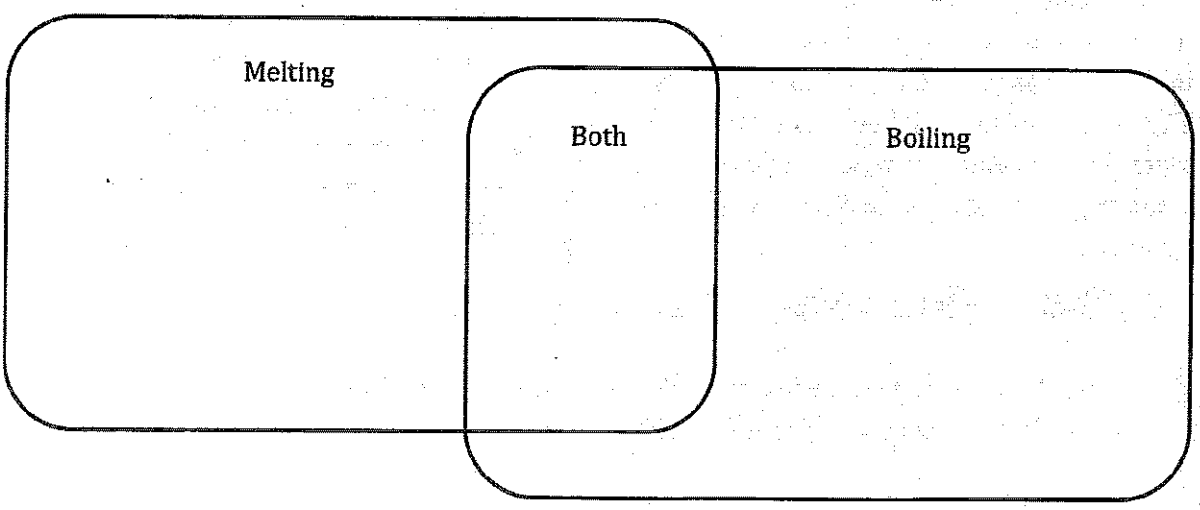
_____

_____

3. Complete the cause-and-effect graphic organizer below.

Cause	→	Effect
		The liquid evaporates.

4. Complete the Venn diagram below to compare and contrast melting and boiling.



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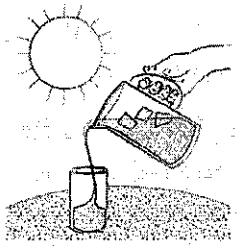
Benchmark Assessment SC.5.P.9.1

Fill in the letter of the best choice.

1. Which process involves a decrease in temperature?
   - (A) evaporation
   - (B) boiling
   - (C) condensation
   - (D) melting

2. Look at the drawing below.



Which prediction is **most likely**?

- (F) The ice will melt, and condensation will form on outside of the glass.
- (G) The ice will evaporate before it finishes melting.
- (H) The ice will boil, and water will spill on the outside of the glass.
- (I) The ice will condense and stick to the outside of the glass.

3. Which is correct?
   - (A) Only water can change states.
   - (B) The solid form of water is called water vapor.
   - (C) At the right temperatures, any kind of matter can change states.
   - (D) A change of state is a chemical change because a new kind of matter is formed.

4. You place a piece of bread in the toaster. A minute later, the toast pops up. What evidence tells you an increase in temperature caused a chemical change?
   - (F) The toast changed size.
   - (G) The toast changed shape.
   - (H) The toast changed state.
   - (I) The toast changed color.

SC.5.P.10.1 Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.

Forms of Energy

Energy is the ability to cause changes in matter. It is involved when matter moves or changes its shape. A change in temperature also involves energy. Energy can transform, or change, from one form to another. Energy is never used up. It just changes from one form to another. Energy can be classified into two groups—potential energy and kinetic energy.

Potential and Kinetic Energy

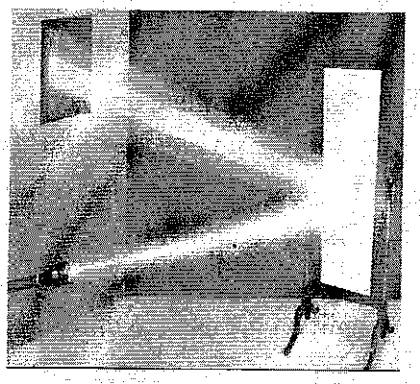
Potential energy is energy that an object has because of its position or condition. It is stored energy that can be used later. An object can have potential energy because of its position. For example, a ball at the top of a hill has gravitational potential energy because of its position and the force of gravity acting on it. Potential energy can also be stored in objects by stretching or compressing them. A stretched rubber band has potential energy, and a spring has potential energy when it is compressed or stretched.

Kinetic energy is the energy of motion. Any object that is in motion has kinetic energy. For example, if a ball begins to roll downhill due to gravity's pull, its potential energy will be changed to kinetic energy. Likewise, if the rubber band or spring is released its potential energy changes to the energy of motion.

Light

Light is a type of kinetic energy that we can see with our eyes. Light waves travel away from a source, such as the sun or a lamp, in a straight path in all directions. Light does not require matter to move from place to place; it can travel through empty space. This is how light from the sun travels through the vacuum of space to Earth. Light can also move through some matter, such as air or glass.

Light waves behave in different ways when they encounter materials. Some materials absorb the light, while others reflect it.



Light reflects easily off smooth, shiny surfaces such as a mirror.

Certain materials can also bend light. When light waves pass from one material to another, the light changes direction at the border between the materials.

Thermal Energy

Thermal energy is the total kinetic energy of the particles that make up a substance and is measured using a thermometer. Substances with a higher temperature are warmer. Heat is the flow of thermal energy from one object or substance to another.

What happens when you rub your hands together? They become warm—their temperature increases. Friction between surfaces produces heat.

Many objects that produce light also produce heat. Fire, for example, is hot and it gives off a great deal of light, too. Light bulbs, candles, and stove burners also give off both light and heat.

Sound

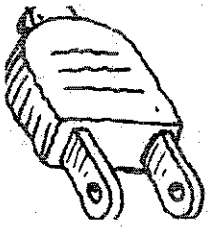
Sound is a form of energy we hear. Unlike light, it cannot travel through empty space; it requires a material such as air or water. Sound is produced when an object vibrates, or moves quickly back and forth. Each particle of the air nearby then begins to moves back and forth, bumping into other nearby air particles. This causes the sound to move as a wave. Sound energy moves, making it a type of kinetic energy.

Pitch is how high or low a sound is. A triangle makes a high-pitched sound, while a gong makes a low-pitched sound. When objects vibrate fast, they make a high-pitched sound. When objects vibrate slowly, they make a sound with a low pitch. Volume is how loud a sound is. Volume increases when more energy is used. Bang a drum softly for a soft sound and hard for a louder sound.

Electrical Energy

Electrical energy is the energy caused by the movement of electric charges. When you use electricity, you are using electrical energy. Protons and electrons have electrical charges. Protons have a positive electrical charge, and electrons have a negative charge.

Electrons are outside the nucleus of an atom. The electrons of some substances can flow. The flow of electrons along a path is called electrical current. You can use this electrical energy to make electrical devices work. When you plug them into a wall outlet, electrical current flowing through wires can flow into the device.

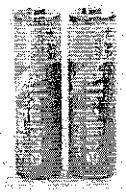


Mechanical Energy

Mechanical energy is the total energy of motion and position of an object. As a ball rolls down a hill, its potential energy decreases, and its kinetic energy increases. Its mechanical energy, though, stays the same.

Chemical Energy

There is also energy stored in substances, such as fuel, that is released when the substances are burned. This stored energy is called chemical energy. For example, wood contains **chemical energy.** When wood burns, it releases the energy as light and heat.



Batteries contain chemical energy.

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Student-Response Activity

1. Identify an example for each form of energy.

Form of Energy	Example
Light Energy	
Thermal Energy	
Sound Energy	
Chemical Energy	
Electrical Energy	

2. How are potential energy, kinetic energy, and mechanical energy related?

3. Can sound travel through empty space? Why or why not?

Benchmark Assessment SC.5.P.10.1

Fill in the letter of the best choice.

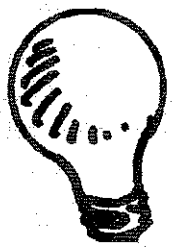
1. What form of energy is in a battery?
   - (A) light energy
   - (B) kinetic energy
   - (C) chemical energy
   - (D) electrical energy

2. Which has the least amount of potential energy?
   - (F) a ball at the top of a hill
   - (G) a roller coaster going down a hill
   - (H) a child at the top of a slide
   - (I) a car parked in a parking lot

3. Which are forms of kinetic energy?
   - (A) light, sound, chemical
   - (B) electrical, chemical, sound
   - (C) sound, potential, thermal
   - (D) light, thermal, sound

4. What form of energy can be absorbed, reflected or bent by different materials?
   - (F) sound
   - (G) electrical
   - (H) light
   - (I) mechanical

5. What forms of energy does this object give off?



   - (A) light energy and thermal energy
   - (B) light energy and sound energy
   - (C) light energy and electrical energy
   - (D) light energy and chemical energy

SC.5.P.10.2 Investigate and explain that energy has the ability to cause motion or create change.

Energy Can Cause Change

Motion

Where are you located right now? Are you at your desk? Under a light? To the right of a door, or 2 meters (6 feet) away from the board? These types of words describe your position. Position is the location of an object. Every object has a position. The position of your nose is the center of your face.

When an object's position changes, the object is in motion. Motion is a change of position of an object. There are many types of motion. You can walk forward or backward. An elevator goes up and down. A pendulum swings from side to side. Things may move quickly or slowly. They may follow a straight, curved, or circular path. All types of motion involve a change in position.

Speed

How fast can you run? If you run faster than your friend, your speed is greater. Speed measures the change in the position of an object changes over a certain amount of time.

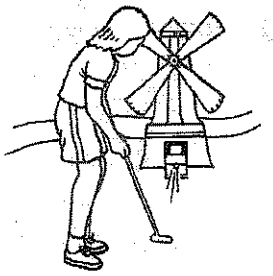
You can use words such as *fast* and *slow* to describe speed. Fast-moving objects change their position quickly. Slow-moving objects change their position slowly. You can be more precise if you use numbers such as 20 kilometers per hour or 5 meters per second.

To find an object's speed, you need to measure two things—distance and time. Distance is how far an object traveled. You also need to measure how long it takes the object to move that distance.

A cheetah is the fastest land animal. It can reach speeds of 112 km/hr (70 mi/hr)!

Energy and Motion

Energy is the ability to cause changes to matter. A force—a push or a pull—can cause an object to move. In other words, a push or a pull to cause an object change position—to be in motion. A push or a pull transfers energy from one object to another, which causes the object to move. For example, if you swing a golf club and hit a golf ball off the tee, the energy of the moving club is transferred to the ball, and so the ball begins to move.



When ocean waves crash onto the beach, energy of flowing water can flatten a sandcastle. The energy of moving air—wind—can move a sailboat across the surface of a lake.

An object's speed is also related to energy. When an object is in motion, it has kinetic energy. An object moving at a faster speed has more energy than it has at a slower speed. So a running cheetah has more kinetic energy than a walking cheetah.

Light

Energy does not always need matter to cause change. Light energy is a form of energy that can travel from one place to another without matter. It travels from the sun through areas of space where there is no matter. Some of this light reaches Earth. There, the light causes objects to be visible. Light from the sun also causes objects to warm up.

Student-Response Activity

1. Which statements about energy are true? Circle all correct statements.
   a. Energy is the ability to cause changes to matter.
   b. Energy can only be transferred when one object pushes or pulls on another.
   c. Energy can be transferred from objects that touch as well as through empty space.
   d. An object moving at high speed has more energy than the same object moving slowly.
   e. An object moving at high speed has the same amount of energy than the same object moving slowly.

2. Explain how energy from the sun can cause ice cream to change.

3. How can energy of moving water and moving wind cause changes? Give an example of each.

4. Describe two ways you could use energy to cause a wagon to move.

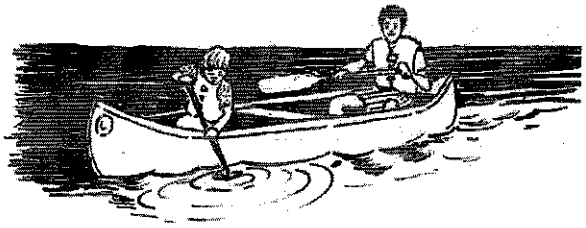
Benchmark Assessment SC.5.P.10.2

Fill in the letter of the best choice.

1. Which is **not** an example of energy causing motion?
   - (A) picking up a box
   - (B) holding a box
   - (C) placing a box on a shelf
   - (D) placing a box on the floor

2. Which describes a change caused by the sun's energy?
   - (F) A marshmallow toasts over a fire.
   - (G) Water for tea is boiled on a stove.
   - (H) Water in a rain puddle evaporates.
   - (I) A light bulb glows when the switch is turned.

3. Which description applies to the picture below?



   - (A) Energy from the paddle and the moving water moves the canoe.
   - (B) Energy from the paddle and the wind moves the canoe.
   - (C) Energy from the wind and the moving water moves the canoe.
   - (D) Energy from the wind and gravity moves the canoe.

4. Zelie used an electric fan to power four identical toy sailboats across a bowl of water. The data table shows how the distance and time for each sailboat.

Boat	Time (seconds)	Distance (inches)
F	42	24
G	34	24
H	27	24
I	31	24

Which boat traveled with the **most** kinetic energy?

- (F) F
- (G) G
- (H) H
- (I) I

Name _____ Date _____ Benchmark Review SC.5.P.10.4

SC.5.P.10.4 Investigate and explain that electrical energy can be transformed into heat, light, and sound energy, as well as the energy of motion.

Heat and Electricity

Heat is the flow of thermal energy from one object to another. Heat always flows from a warmer object to a cooler object, which causes the objects to change temperature.

Conduction

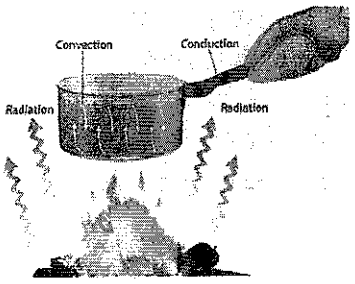
Conduction is the movement of thermal energy between particles of matter that collide, or crash together. Conduction transfers heat through solids or from a liquid or gas to a solid. In order for heat to be conducted from one object to another, the two objects must touch. Particles of one object can collide with particles of another object only when the two objects are touching.

Convection

Heat can also move by convection. **Convection** is the transfer of heat through a moving liquid or gas. Think again about water heated in a pot on a stove. The water gets heated where it touches the metal pot by conduction. The heated water particles move faster and then spread farther apart. As a result, the heated water becomes less dense and rises. Cooler water sinks beneath it. This flow causes currents of warmer rising water and cooler sinking water to transfer heat throughout all of the water.

Radiation

Light travels from the sun to Earth's surface through space. These waves cause objects they strike to warm up. Heat transfer by conduction or convection needs particles of matter to carry energy. However, heat transfer by radiation can occur in empty space where there is no matter.



Conductors and Insulators

Materials that allow heat to flow easily through them are called **conductors**. Metals such as aluminum and copper conduct heat well. An **insulator** is a material that heat does not move through easily. Materials such as glass, wood, and plastic are good insulators.

Electricity

Static electricity and current electricity are two types of electricity. Static electricity is what causes socks from the dryer to stick together. Clothes in the dryer gain and lose electrons by rubbing against other fabrics. Some of the clothes obtain a negative charge by gaining electrons, and other clothes obtain a positive charge by losing electrons. Objects with opposite electrical charges attract each other, so some clothes stick together. Clothes with the same charge will repel each other, even if they are not touching.

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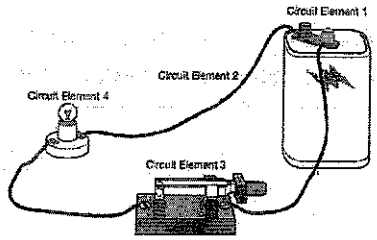
Using Electricity

Electrical devices, such as computers, toasters, and lamps, are useful because they transform electrical energy into other forms of energy, such as sound, light, thermal, and mechanical energy. When you plug one of these devices into a wall outlet, electrical current flows from the wires inside the outlet to the device. When you turn the device on, you close the circuit, and the device powers on.

Electrical Circuits

An **electric circuit** is a path along which electric charges can flow. For electricity to flow, the circuit must form a complete, unbroken, loop. A circuit with no breaks in it is called a closed circuit. If the path is broken, charges cannot flow. A circuit with a break in the path is called an open circuit. A switch on a circuit controls the flow of electrical current by opening and closing the circuit.



Electricity flows through the closed circuit. When the circuit is closed, the light bulb will light up.

In general, materials that conduct heat also conduct electricity. Copper wire, a metal that conducts heat well, is commonly used in electrical circuits. Plastic, an insulator, is used to enclose the wires to contain the electrical current in the circuit.

Student-Response Activity

1 Classify these materials as *conductors* or *insulators*.

glass plastic copper gold aluminum

silver iron wood rubber steel

Conductors	Insulators

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2 Describe the energy transformation performed by each device.

toaster _____

light bulb _____

electric guitar _____

television _____

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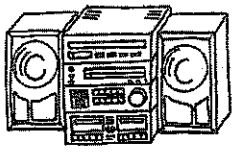
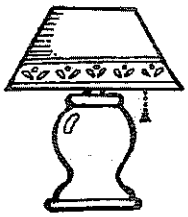
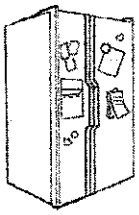
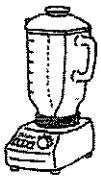
Fill in the letter of the best choice.

1. Which shows a device designed to transform electrical energy into mechanical energy?

Ⓐ 

Ⓑ 

Ⓒ 

Ⓓ 

2. What energy transformation takes place inside a toaster?

Ⓕ electrical to light energy
Ⓖ electrical to sound energy
Ⓗ electrical to light and thermal energy
Ⓘ electrical to sound and thermal energy

3. Sandy built a circuit that would light a light bulb. When she connected the wire to the battery, however, the light bulb did not light. What is the most likely reason the light bulb would not light?

Ⓐ The circuit was not continuous.
Ⓑ The wire was made of copper.
Ⓒ The switch was closed.
Ⓓ The battery was not powerful enough.

4. What energy transformation takes place inside a oven?

Ⓕ electrical to light energy
Ⓖ electrical to sound energy
Ⓗ electrical to light and thermal energy
Ⓘ electrical to sound and thermal energy

5. Which is a conductor?

Ⓐ glass
Ⓑ plastic
Ⓒ silver
Ⓓ wood

Name _____ Date _____ Benchmark Review SC.5.P.13.1

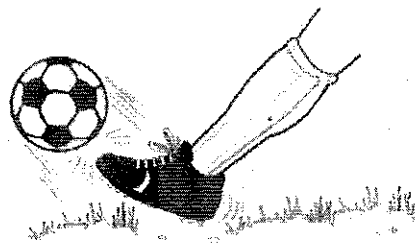
SC.5.P.13.1 Identify familiar forces that cause objects to move, such as pushes or pulls, including gravity acting on falling objects.

Forces

Pushes and Pulls

Push a door, and it moves. Pull the door, and it moves the other way. Pushes and pulls of all kinds are called forces. Forces are measured in newtons (N). The larger the force, the greater the change it can cause to the motion of the object. Smaller forces cause smaller changes. Sometimes more than one force can act together in a way that does not cause a change in motion.

Forces can cause changes in the speed and direction of motion of an object. Forces can cause objects to move, and they can cause objects to slow down and stop moving. They cause changes in the speed and direction of motion. If a soccer ball is still, it stays still until a force moves it. If you kick a soccer ball, it keeps moving in the same direction until another force changes its motion. The direction in which an object moves depends on the direction of the force that is applied to the object. If there is more than one force, the forces work together.



Balanced and Unbalanced Forces

Forces do not always cause motion. When two forces have the same size but work in opposite directions, they cancel each other out. These are called **balanced forces**. For example, if you and a friend push with the same amount of force on a desk but push in opposite directions, the desk will not move. However, if one of you decides to push with more force, however, the forces become unbalanced and the desk will move.

Friction

Friction is a force that opposes motion. It slows down objects that are moving, eventually causing them to stop. Friction occurs when two surfaces touch or rub against each other. For example, if you roll a ball across the floor, friction between the ball and the floor slows the motion of the ball. The friction acts in the opposite direction of the motion of the ball. Rough surfaces create more friction than smooth ones. So it is more difficult to push a box across a carpeted floor than a smooth wood floor because more friction is resisting the box's motion.

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Gravity

When you push or pull on an object, you usually touch the object to exert a force on it. Friction is also a force that requires two surfaces to touch. But not all forces require contact. **Gravity** is a force of attraction between two objects. Gravity pulls objects toward each other without touching them. For example, Earth's gravity pulls objects toward the center of the planet. This constant pulling keeps objects on Earth's surface from flying off into space. It also causes objects to fall toward the ground.

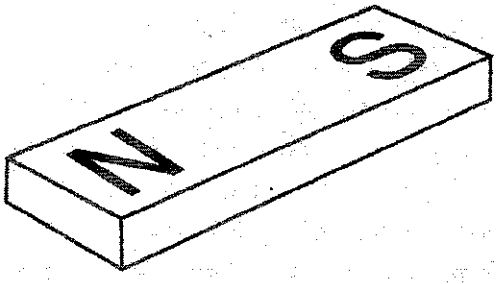
Gravity is an important force of attraction between objects in the universe. Earth's gravity pulls on the moon, keeping the moon in orbit. The moon pulls on Earth, causing the tides. The sun pulls on Earth and the other planets, keeping them in its orbit. These objects in space do not touch, but the force of gravity affects them.

As important as gravity is, it is still simply a force that can be balanced and overcome by other forces. If you set a book on a table, gravity pulls down on the book. But the book does not fall to the ground, because the force of the table pushing up on the book is equal to the force of gravity. Remember that when forces are balanced, objects do not change their motion. When you throw a ball up into the air, the force of your throw is greater than the force of gravity, and so the ball goes upwards.

Magnets

Magnetism is another force that can act across a distance, without objects touching. When you hold a magnet near an object that contains iron, for example, the iron will be pulled toward the magnet. Only some materials are attracted to magnets.

Magnetic force also acts between magnets. Each magnet has a north and a south pole. The opposite poles of two magnets will be attracted, or pulled, toward one another. The north end of one magnet will be attracted to the south pole of another magnet. But two like poles—two north poles or two south poles—will push away from, or repel, each other.



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Student-Response Activity

1. Which forces act on a tennis ball as it travels from one side of a tennis court to the other during a tennis match?

2. A bowling ball is rolled down a bowling lane and knocks over several pins. Describe how the forces acting on the bowling ball and the pins affect their motion.

3. Matt lined up the north pole of a magnet with the south pole of another magnet. Did the magnets attract or repel each other? Explain your answer.

4. Kiki and Jake both push on a box from opposite directions. At first, Kiki and Jake push the box with the same amount of force. Then Kiki pushes with 3 N of force and Jake pushes with 2 N. Describe what happens to the box.

Benchmark Assessment SC.5.P.13.1

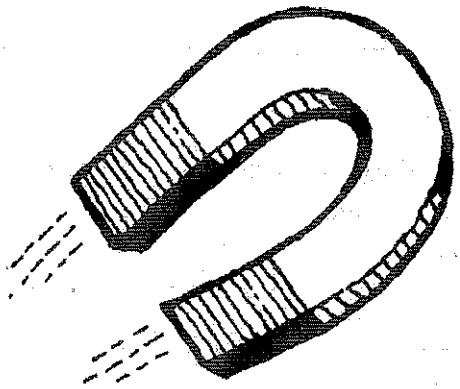
Fill in the letter of the best choice.

1. Which is **true** of gravity?
   - Ⓐ Gravity acts only through air, not through water or land.
   - Ⓑ Gravity does not act on airplanes flying in the sky.
   - Ⓒ Gravity always acts toward the center of Earth.
   - Ⓓ Gravity does not act on objects falling through space.

2. Which forces can affect an object's motion without touching the object?
   - Ⓕ friction and gravity
   - Ⓖ gravity and magnetic force
   - Ⓗ friction and magnetic force
   - Ⓘ gravity, friction, and magnetic force

3. Which describes how forces affect a soccer ball?
   - Ⓐ Forces cause it to change color and size.
   - Ⓑ Forces cause it to change speed and direction.
   - Ⓒ Forces cause it to change mass and position.
   - Ⓓ Forces cause it to change location and weight.

4. If you held the object in the picture near paperclips containing iron, what would be the result?



   - Ⓕ The paper clips would be repelled.
   - Ⓖ The paper clips would be attracted.
   - Ⓗ The paper clips would not be affected.
   - Ⓘ The paper clips would be repelled by one pole and attracted to the other.

5. Eli pushes a box with 1 N of force, and Judy pushes with 2 N in the opposite direction. Which describes what happens to the box?
   - Ⓐ It does not move.
   - Ⓑ It moves toward Eli.
   - Ⓒ It moves toward Judy.
   - Ⓓ It moves toward Eli and then toward Judy.

Name _____ Date _____ Benchmark Review SC.5.P.13.2

SC.5.P.13.2 Investigate and describe that the greater the force applied to it, the greater the change in motion of a given object.

Force, Mass, and Motion

Describing Motion

Motion is any change in the position of an object. An object's motion can be described by the distance the object traveled, by the direction it moved, and by how fast it traveled.

Speed is a measure of the distance an object moves over a certain amount of time. You can calculate speed by dividing the distance traveled by the time it took the object to travel that distance. If you apply a force in the same direction as the object is already moving, you will increase the speed of the object because the object will move the distance in a shorter time. If you apply a force in a different direction from the one in which the object is traveling, the force will cause the object the slow down, stop, or turn.

You can also describe the direction an object moves by using compass directions or words such as *up, down, left,* and *right* to indicate direction. When you tell both the speed and the direction of an object, you give its velocity. Two objects with the same speed have different velocities if they are moving in different directions.

Forces

A force is a push or pull. Forces can cause an object at rest to begin moving, or to change position. A force can cause an object in motion to change the way it is moving—stop, start, speed up, slow down, or turn. Any change in an object's velocity—its speed or direction—is called **acceleration**. So, forces cause acceleration.

Not all forces result in motion or acceleration. If equal forces act on an object in opposite directions, the forces are balanced. **Balanced forces** do not cause a change in motion. Only **unbalanced forces** affect an object's motion.

Force and Motion

Both the amount of force applied to an object and the direction of the force determine how the force will affect the motion of an object. If first a large force and then a small force act on the same object, the larger force will cause the object to move a greater distance and at a faster speed. If two forces act on an object from opposite directions, the object will move in the direction of the greater force.

Mass and Motion

The motion of an object is related to its mass. **Mass** is the amount of matter in an object. Consider pushing two objects of different masses with the same amount of force. The object with less mass will move a greater distance and at a higher speed. For example, if you push two toy cars with the same amount of force, the one with less mass will go faster and farther. If you push an empty shopping cart but keep adding groceries, you will have to push with greater and greater force to move at the same speed.

Name _____ Date _____

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SC.5.P.13.2

Student-Response Activity

1. Explain how the amount of force and an object's mass affect motion.

2. Explain how balanced forces affect the motion of an object.

3. Explain how unbalanced forces affect the motion of an object.

4. Two runners run the same distance, but one runs in the morning and one runs in the evening. How could you determine which of the two runners ran the distance faster?

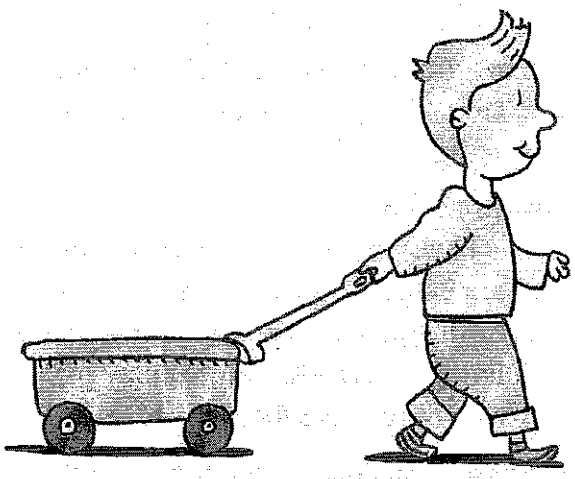
Name _____ Date _____

Benchmark Assessment SC.5.P.13.2

Fill in the letter of the best choice.

1. Which can **not** be changed by applying a force to an object?
   - Ⓐ mass
   - Ⓑ direction
   - Ⓒ speed
   - Ⓓ velocity

2. The boy pulls a wagon.



What is likely to happen if the boy adds objects to the wagon?

- Ⓕ He will find that it is easier to pull the wagon.
- Ⓖ He will find that it is harder to pull the wagon.
- Ⓗ He will find that he needs less force to pull the wagon.
- Ⓘ He will find that he needs the same amount of force to pull the wagon.

3. What do you need to know to find the speed of an object?
   - Ⓐ mass and position
   - Ⓑ distance and time
   - Ⓒ velocity and energy
   - Ⓓ force and mass

4. What always changes when an object is in motion?
   - Ⓕ position
   - Ⓖ speed
   - Ⓗ direction
   - Ⓘ mass

5. Dan plans to push several balls across a floor with the same amount of force. He will record data about distance each one traveled.

Ball	Mass	Distance
A	50 grams	
B	500 grams	
C	1 kilogram	
D	4 kilograms	

Which object do you predict will move the farthest?

- Ⓐ A
- Ⓑ B
- Ⓒ C
- Ⓓ D