Name: _____ #: _____

Matter Changing States

STEMscopes: Matter can change from one state or phase to another. The amount of matter, called its mass, is conserved when it changes from one state or phase to another, even when it appears to have been reduced or have disappeared. When two or more substances are mixed together, a new substance with different properties may be formed. Regardless of the change in form, the total mass of the original substances will be unchanged. In everyday events, mass is neither created nor destroyed.

Standards that will be addressed:

- **5-PS1.A.2**: The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
- **5-PS1.B.2**: No matter what reactions or change in properties occurs, the total weight of the substance does not change.
- **5-PS2**: Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

Remember to look at the Science tab on our class website for additional resources, information, and updates.

Pages included in the packet:

1. Hook: Changing States
2. STEMscopedia
3. Linking Literacy: Main Ideas and Details
4. Linking Literacy: Anchor Chart
5. Content Connections Video: Changing States of Matter
6. Science Today: Shade for a Pond
7. Independent Practice
8. Concept Attainment Quiz

Optional Extension Activities:

- At Home Connection Piece (see class website)
- Web Surfing Science (see STEMscopes account)

Quiz date: ***tentatively December 8th***

- The quiz will be 5 Multiple Choice Questions

Name: _____ Date: _____ Group: _____

Changing States

Student Journal

Material	Mass
Pie pan	
Pie pan + ice cube	
Ice cube only	
Pie pan + melted ice cube	
Melted ice cube only	

Describe which physical properties of the ice cube changed and which stayed the same when it melted. Use data from the table to support your answer.

What properties of the ice cube changed when it melted?

It changed states; it changed from a solid to liquid. It changed its shape. It must have had a change in temperature because it melted.

What properties of the ice cube remained the same when it melted? Why?

The mass stayed the same. I think the mass stayed the same because we did not add anything or take anything away from the pie pan.

Explain how this was only a physical change.

The substance is still water even though the state of matter changed from a solid to a liquid.

Reflect

Heating and cooling change matter.
Water, for example, is one of the most important parts of our planet. All living things need water to survive. You use many forms of water every day. You may use ice (solid water) to keep your iced tea cold. You drink liquid water and use it to take baths and showers. But did you know that there is also water in the air that you cannot see? How does water get into the air? How does water in the air get back to the ground?

What happens to the outside of a glass when you pour ice water into it? When you put ice in a glass of water, the ice cools the water and the glass, but the ice also cools the air around the glass. Cooling the air causes something surprising to happen. Do you know what happens?

The air around us contains water in the form of a gas called *water vapor*. When the ice cools the air next to the glass, the water in the air changes from a gas into liquid water. Water vapor forms drops of water on the outside of the glass. This process is called **condensation.**

condensation: when a gas changes to a liquid

Look Out!

Cooling causes condensation on surfaces like mirrors and drinking glasses, so cooling can cause water to change its physical state from a gas to a liquid. Think about when you've seen it happen. What do those drops on the glass look like? What are some other examples of condensation? Have you ever seen drops of water on the grass on a cool morning? That is one example. Droplets on the windshield of a car in the morning are another example.

Everyday Life: Water on My Tea!
Have you ever made a glass of iced tea? Maybe you started with warm tea. You added some ice to cool it off. After a few minutes, you noticed drops of water on the side of the glass. Water in a puddle also formed around the bottom of the glass. This is an example of condensation. Where did this water come from? The water on the side of the glass came from water that we cannot see in the air!

It is important to remember that the drops of water on the outside of the glass come from water vapor in the air around the glass. The water vapor in the air cools and forms drops of water on the glass. Some people think that the water drops come from the water inside the glass. This is not correct.

What Do You Think?

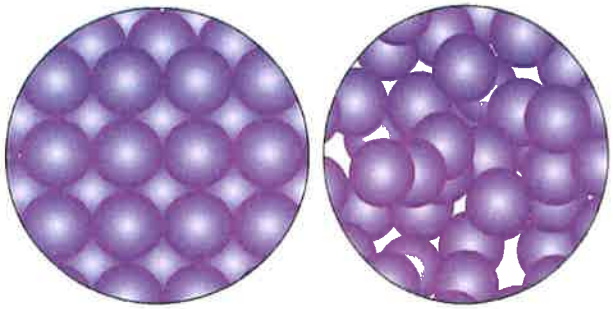
Ask your friends and family members where they think the water on the side of a cold glass comes from. Do they think it comes from the air or from the water in the glass? You may be surprised by their answers. Pass along your new knowledge! Let them know that the water drops come from the air around the glass.

Take a look at these pictures. The picture on the left shows ice cubes sitting in a puddle of water. The picture on the right shows a glass of iced tea with drops of water on the side.

Where did the puddle of water under the ice cubes come from? Where did the drops of water on the glass come from? Support your answers with evidence: how do you know?

What happens to ice when it is heated?

Imagine that you place five ice cubes on the road on a warm summer day. You let them sit for a few minutes, and then you come back. What do you think you will see? You will probably see a puddle of liquid water! But where did the ice go?



The particles in a solid (left) are packed tightly together. The particles in a liquid (right) move easily around each other, which is why we can pour liquids.

Solids, liquids, and gases are different states of matter.

Ice is solid water. Ice has the same particles as liquid water, but they are packed together and do not move around each other the same as they do in liquid water. A solid has a definite shape and definite volume. The particles of liquid water can flow and slide around each other. Although liquid water has a definite volume, it does not have a definite shape. That is why it is hard to hold liquid water in your hand. A liquid will take the shape of the container it is in.

Ice is easier to hold in your hand because the particles do not move around in the same way. Water vapor, the gas form of water, has neither a definite volume nor a definite shape. Water vapor keeps expanding to fill its container.

Heating or cooling can change the state of matter. When ice is heated, the particles in the ice start to move more quickly. The water changes from a solid state (ice) to a liquid state (water). Note: when matter changes state, the amount (weight) of it is conserved.

Reflect

How can we stop water from changing state? Sometimes, we do not want ice to melt quickly. We may want to use the ice to keep food or drinks cold, so we use insulating materials. *Insulating materials* help to maintain an object's temperature, either keeping it cool or warm. These materials make it more difficult for heat to melt the ice.

Can you think of some examples of things that we use to keep ice from melting? You may have a lunch box that keeps your sandwich cold or an insulated cup that keeps your drink cold. These materials slow heat from melting the ice. The ice in an insulated cup lasts longer and keeps food and drinks cold.

Scientists in the Spotlight: Adrienne Block

You know that ice is cold. Imagine being surrounded by ice and snow all day long. Polar scientist Adrienne Block doesn't work in a lab. She works in one of the coldest places on the planet: Antarctica. Block lives and works in the cold so that she can learn about mountains that are buried deep beneath thick ice sheets. Did the mountains form beneath water that later froze? Did the ice sheets slide over mountains that had already formed? Block and her team are working hard to answer these questions. How would insulating material be useful to these scientists?

The mountains that Block is exploring are located in the center of Antarctica, up to 3 km beneath the ice.

Try Now

Let's take a closer look at melting ice.

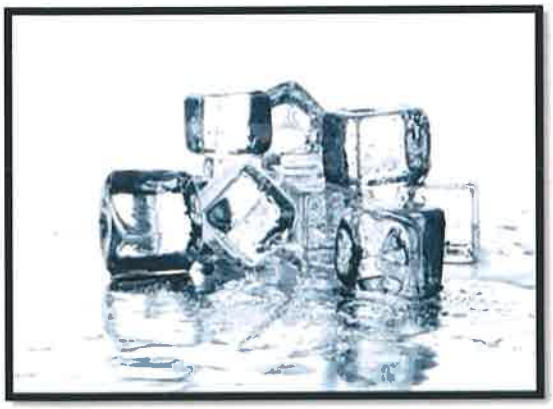
1. Get two ice cubes and two plastic bags.
2. Seal one ice cube in each bag.
3. Put one bag on a table. Put the other bag in a cooler, lunch bag, or insulated cup.
4. Make a prediction about which ice cube will last longer.
5. Check each bag after 10 minutes, and record what you see.
6. After another 10 minutes, check each bag again. Record what you see. Keep watching the ice in the bags until both cubes have melted.
7. Which ice cube melted first, the one on the table or the one in the insulated bag?
8. Why didn't the ice cubes melt at the same rate?

You have seen how heating and cooling can cause an object to change state. Heating and cooling can cause other changes as well. For example, cooking cake batter in an oven causes its texture to change. The heat changes gooey, sticky batter into a moist but firm cake. Heat can also cause changes in color. Cooking a roast changes the meat from pink to reddish-brown. Can you think of other changes that result from heating or cooling?

What Do You Think?

What do you know?

We see many forms of water every day. The table below shows two examples. Describe the water in each picture. Explain how heating or cooling caused the changes in state.

Melting Ice Cubes		Ice Forming on a Spider Web	
			
How is the water changing?	*What causes this change?*	*How is the water changing?*	*What causes this change?*
The water is changing from a solid to a liquid.	Heating is causing this change.	The water is changing from a liquid to a solid.	Cooling (or removal of heat) causes this change.

Name: _____ Date: _____ Group: _____

Main Ideas and Details

While you read: Look for details in the text that give more information about the three main ideas listed below. Write four details for every main idea.

Text Topic: **Matter can change states.**			
Page 1	Main Idea: **Cooling air can cause condensation.**	Detail 1: Ice in a glass of water can cause the air around the glass to cool off.	Detail 2: The air contains water vapor, or water in a gas state.
		Detail 3: When the air cools off, the water vapor turns into liquid water.	Detail 4: The liquid water appears on the outer surface of the glass and is known as condensation.

Linking Literacy

Page	Main Idea:	Detail 1:	Detail 2:
1, 2	**Solids, liquids, and gases are all states of matter and can be used for different purposes.**	You can hold a solid like ice in your hand because its particles do not move around much.	Liquids like water are not easy to hold in your hand because the particles move around more.
		Detail 3: A gas like water vapor just keeps expanding to fill its container.	Detail 4: Some people may use ice to keep their drink cold or liquid water to take a shower.
Page	Main Idea:	Detail 1:	Detail 2:
2, 3	**A change in temperature can cause a change in state and some materials can help prevent these changes from happening.**	Heating something, like ice, causes the particles to move more quickly and causes the solid to turn to a liquid (water).	Insulating materials make it more difficult for heat to melt ice.
		Detail 3: Cooling the air can turn water vapor (a gas) into water (a liquid).	Detail 4: Ice in an insulated cup lasts longer and keeps drinks cold.

Content Connections Video

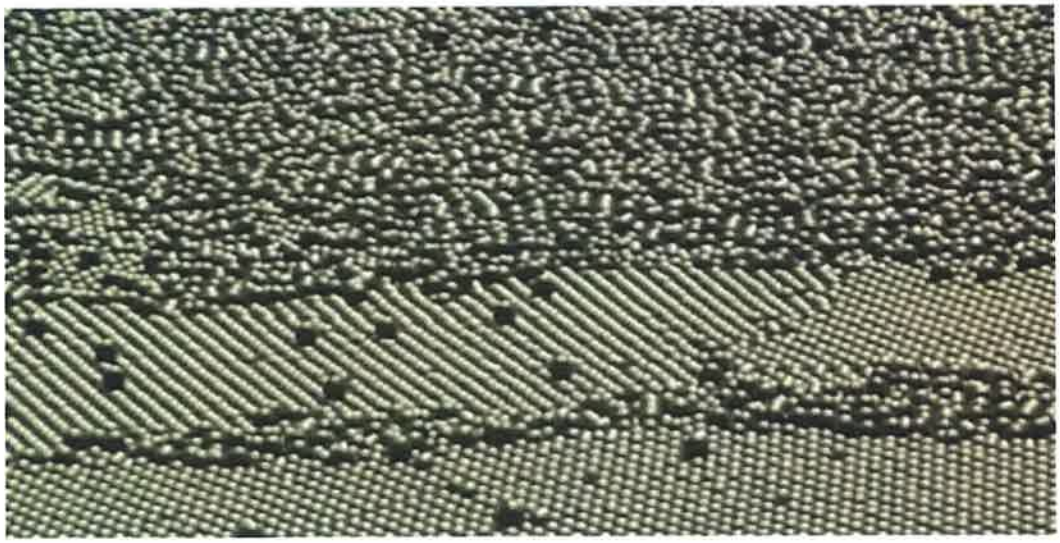
Name: _____ Date: _____ Group: _____

Changing States of Matter

1. What makes different states of matter of the same substance different? Explain. (Pause 0:29)
   The physical arrangement of their molecules makes them different.
2. How do solid molecules become a liquid on the particle level? (Pause 1:00)
   When enough energy is added to the particles, they break and move freely, the change is called melting.
3. What is happening to the temperature when a substance is melting? (Pause 1:36)
   A substance remains at its melting point temperature while the substance is melting (the temperature does not change).
4. How do liquid molecules become a gas on the particle level? (Pause 1:55)
   Heating a liquid makes its particles move more quickly. Some particles near the surface gain enough energy to break free and become a gas. This is called evaporation.
5. How does a gas turn back into a liquid? Give an example. (Pause 2:33)
   A substance cools the particles loose energy and change back to a liquid. An example of this would be condensation.
6. What are the two important temperatures for each individual substance? (Pause 3:02)
   Melting point and boiling point.

Name: _____ Date: _____ Group: _____

Shade for a Pond



1. Before using the shade balls, was the water just disappearing? Explain.
The water was not disappearing, it was evaporating. The heat from the sun was causing the water to turn from a liquid to a gas.

2. How are the shade balls helpful?
They float on top of the water and block the sunlight from hitting the water.

3. Design another solution to the problem. Draw and label your solution below.

Answers will vary

Independent Practice

Name: Answer Key Date: _____ Group: _____

Part I: Riddle

1. QUANTITY
2. WEIGHT
3. CONSERVED
4. PROPERTY
5. STATES OF MATTER
6. REACTION
7. MATTER
8. DISSOLVE

Riddle answer: Hot, because you can catch a cold!

Independent Practice

Name: Answer Key Date: _____ Group: _____

Part II: Word Search

E	M	P	D	R	T	I	Q	L	E	P	O	R	P
V	O	W	I	D	T	I	U	A	T	S	A	O	R
N	D	A	S	I	J	C	A	P	E	O	T	R	O
O	R	T	S	S	S	B	N	E	L	V	H	T	P
I	S	O	O	S	R	A	T	M	A	L	G	I	E
T	V	A	L	O	E	A	I	U	N	R	I	N	R
C	R	O	V	E	T	T	T	E	S	G	E	S	T
A	R	F	E	V	T	E	Y	E	K	Y	W	O	I
E	A	G	N	E	A	R	Y	L	T	C	O	L	E
R	E	T	T	A	M	F	O	S	E	T	A	T	S

1. When you look at an object, you can see many of its PROPERTIES.
2. Result of a chemical change. REACTION
3. One of the distinct forms that matter takes on. STATES OF MATTER
4. Solids, liquids, and gasses, are all forms of this. MATTER
5. An exact or specified amount or measure. QUANTITY
6. To be incorporated into a liquid. DISSOLVE
7. An amount an object weighs. WEIGHT

Concept Attainment Quiz

Name: ANSWER KEY Date: _____ Group: _____

I. Vocabulary Matching

C When matter changes from one state to another	A. Conserved
B The amount of material	B. Quantity
D The attributes of a substance, including physical characteristics such as mass, magnetism, and state	C. Phase changes
A To maintain the amount started with; not changed	D. Properties

II. Identification

Use the clues provided to fill in the blanks.

parts	conserved	object	temperature	mass

1. Even when matter appears to have been reduced or disappeared, the amount of matter is conserved when it changes from one state to another.
2. A change in temperature can cause a substance to change from a gas state to a liquid, or from a liquid state to a solid state.
3. When changing states, the overall mass does not change.
4. The sum of the weights of the parts equals the total weight of the object.