Name: ANSWER KEY #: _____

Mixtures

STEMscopes: When two or more substances are mixed together, a new substance is formed.If the substances interact chemically, the result is called a compound. If the substances do not interact chemically, the resulting substance is called a mixture.

Standards that will be addressed:

- **5-PS1.B.1: Ch**emical Reactions: When two or more different substances are mixed, a new substance with different properties may be formed
- **5-PS1-4:** Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

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

Pages included in the packet:

1. Hook: Chemical Changes
2. STEMscopedia
3. Linking Literature:
    a. 3-2-1 Notes
    b. Find Changing Matter
    c. Chemical or Physical Change?
4. Content Connection Videos
    a. Chemical Reactions - Can you spot…?
    b. Mixtures
5. Science Today: Fertilizer Plant Explosion
6. Independent Practice
7. Concept Attainment Quiz

Optional Extension Activities:

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

Test Date & Journal Collection: _____

Name: _____ Date: _____ Group: _____

Chemical Changes

Student Journal

Draw and describe the hair clips before and after you have tried to clean them.

Hair Clip	Before	After
New	Description_____	Description_____
Rusted	Description_____	Description_____

answers will vary

1. What did you do to clean your hair clip? Was it successful?

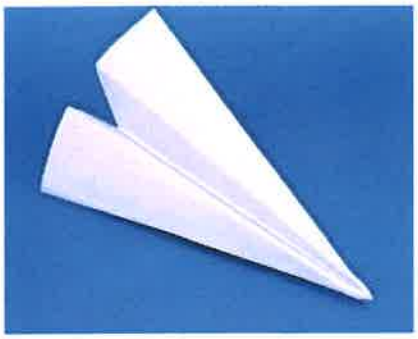
answers will vary

2. Did you notice anything on the paper towel, tooth brush, or in the water cup after trying to clean your hair clip? Where did it come from?

answers will vary

Reflect

Imagine that you took a full sheet of notebook paper and made a paper airplane. What would happen if you cut the notebook paper in half before making the airplane? You would have a smaller piece of paper, but you would still have paper.

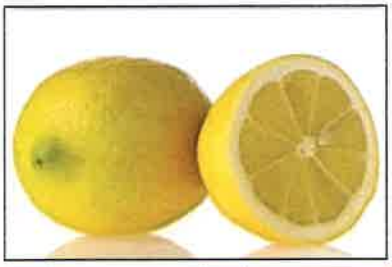


Now, suppose you threw the paper airplane into a fire. What would happen to the paper? How would it change? How are changes caused by burning different from changes caused by cutting or folding?

Physical and chemical properties can identify a substance. Different types of matter, including elements and compounds, have different properties. We can use these properties to identify specific types of matter. For example, when you hear the word *lemon*, what thoughts come to mind? You might think of the color yellow or a sour taste. These are all properties that describe lemons.

element: matter made of a single type of atom

compound: matter made of two or more types of atoms



A substance can be identified from both its physical and chemical properties. What properties help you identify a lemon?

Properties of matter are either physical or chemical. A *physical property* is one that you can observe without changing the matter itself. Some examples of physical properties of matter include color, density, and melting and boiling points. Other physical properties include whether a substance is magnetic and whether a substance conducts electricity.

A *chemical property* is one that you can observe only when the matter changes as a result of a chemical reaction. An example of a chemical property is *flammability*, or how easily a substance catches fire. Another chemical property is how a substance reacts when exposed to different chemicals. For example, if you add lemon juice to a glass of milk, the milk *curdles*, or forms large chunks. Curdling results from a chemical reaction between lemon juice and milk that changes each substance.

Combining substances can produce a mixture or a compound. When no new substance is formed, a mixture results. For example, when you combine raisins, nuts, and chocolate candies, you produce a mixture. No chemical reaction takes place and no new substance is formed. However, when you combine baking soda and vinegar, a chemical reaction takes place and a new substance is formed that gives off gas bubbles. That new substance is compound, not a mixture.

What Do You Think?

The picture on the left shows flowers. The picture on the right shows a fireworks display. What physical and chemical properties can you observe in each picture?

Matter can change. Matter can undergo two types of changes: physical and chemical changes. Physical changes involve changes to a substance's physical properties only. Some common physical changes are freezing, melting, evaporating, and dissolving. Making a paper airplane by folding the paper is a physical change. The paper does not undergo a chemical reaction—its chemical properties do not change. Like with the paper airplane, you can undo a physical change fairly easily. To turn the paper airplane back into a sheet of paper, simply unfold the paper. To turn an ice cube back into liquid water, simply melt the ice cube.

Liquid water freezing to form ice cubes is a physical change. Ice cubes melting to form liquid water is also a physical change.

Burning wood is a chemical change. Like burned paper, the wood changes to ash.

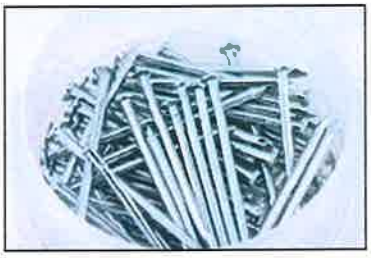
Chemical changes involve changes to the physical and chemical properties of a substance. During a chemical change, a new substance forms. Burning a piece of notebook paper changes the paper's physical and chemical properties. Initially, notebook paper is white; you can crumple and rip it but it maintains its original color and composition. When the paper burns, however, it changes to black, flaky ashes. The ashes are a new type of substance that does not resemble the notebook paper. Unlike physical changes, a chemical change cannot be reversed. You cannot "unburn" the ashes to get back the original paper.

Reflect

Everyday Life: Rust is an example of a chemical change.
When a piece of iron or steel is exposed to water and oxygen over a long period of time, a chemical change occurs. You may be familiar with the product in this chemical change: rust. Objects made of iron—such as chains, automobiles, and bicycles—have certain physical properties in common. For example, iron objects are typically hard with shiny, metallic surfaces. When an iron object rusts, the object's properties change. Rust is a flaky, red substance that crumbles easily. You cannot change rust back into iron.

product: the result of a chemical change

There are ways to prevent rust. In many places when it snows, people put salt on the roads to keep ice from forming. However, salt also speeds up the process of rusting. Cars driving on salt-covered roads are more likely to rust. Washing salt off cars helps to slow this chemical change. In addition, people use special chemicals to coat boats and other metals that are exposed to salt water. These chemicals create a barrier that protects the metal from the salt. Painting an object made of iron or steel can also provide a barrier to water and oxygen in the air. (The most common place for rust to form on an automobile is where the paint has chipped off the surface.)



The nails below have rusted. The nails above have not. How does rusting change the properties of nails?

We can identify evidence of chemical changes. There are several indicators that provide evidence of a chemical change. One chemical change may not show all of these signs; yet, one or more of these is strong evidence that a chemical change has occurred. The only way to know for sure that a chemical change has occurred is to determine if a new substance with new properties has formed.

Let's take a closer look at what you might see when a chemical change happens.

- **Production of a gas:** When a gas is produced in a reaction involving a liquid, bubbles form. If you mix two common household items, baking soda and vinegar, a chemical change occurs. During the process, the bubbles that you see are molecules of carbon dioxide gas being produced. Carbon dioxide is not present initially—it forms due to chemical changes in baking soda and vinegar.

Reflect

- **Change in temperature:** Chemical changes can either give off heat or absorb heat. When a log burns, a large amount of heat is given off. You feel this as warmth if you are near the flames. This temperature change is evidence of a chemical change. Other chemical changes absorb heat. For example, some "ice" packs contain chemicals that become colder when they react. When you bend the pack, you cause the chemicals to contact each other and react. As a result, the pack becomes cold like ice.
- **Formation of a precipitate:** A *precipitate* is a solid substance that forms and separates from a solution. A precipitate often settles to the bottom of a liquid reaction. When milk and lemon juice combine, a chemical change called curdling occurs and a precipitate forms. This is a chunky, solid substance. This precipitate is evidence of a chemical change.
- **Change in color:** A sliced apple that is left out on the table turns brown over time. This is because of a chemical reaction that occurs between the apple and oxygen in the air. The change in color, from white to brown, provides evidence that a chemical reaction has happened. Note: Painting to change color is just a physical change.

Several signs can indicate that a chemical change has occurred. Is there evidence of a chemical change in the flask?

Look Out!

Some physical changes may at first seem like chemical changes. For example, when you boil water, the liquid water turns into the gaseous form of water, water vapor. You may think that a chemical change has happened because a liquid has become a gas. However, a new substance has not formed—water vapor (H_2O) is still water (H_2O).

The change from liquid water to water vapor is an example of a *phase change*. A phase change (also called a change in state) is reversible—you can turn water vapor back into liquid water by cooling it. This process is called *condensation*. Because a phase change is reversible, it is a physical change, not a chemical change.

Try Now

What Do You Know?

Matter can change, and these changes can be physical or chemical. Study the list of changes in the box below. Decide if each change is a physical change or a chemical change. Write your answers in the table below. If the change is chemical, provide possible evidence that you could observe; write this evidence in the column to the right.

Type of Change	
• Boiling water • Exploding fireworks • Dissolving sugar in water • Cutting a circle out of a piece of paper • Baking a cake	• Green leaves turning red and yellow during autumn • Mixing oil and vinegar • Dew forming on grass in the morning • A banana ripening • Mixing lemon juice with milk

Physical Change	Chemical Change	
Type of Change	Type of Change	Evidence of a Chemical Change
• boiling water • dissolving sugar in water • cutting a circle out of a piece of paper	• exploding fireworks	• change in color + temp.
	• baking a cake	• change in color + temp • smell = gas production
	• green leaves turning red/yellow	• change in color
• mixing oil + vinegar • dew forming on grass in the morning	• a banana ripening	• change in color
	• mixing lemon juice with milk	• formation of a precipitate

Linking Literacy

Name: _____ Date: _____ Group: _____

3-2-1 Notes

Complete the table below:

3 facts about changing matter	Student answers will vary, but may include things such as changing states, changing temperature, changing size, or changing substance.
2 examples changing matter	Student answers will vary, but may include things such as water freezing, metal rusting, or items burning.
1 question you still have about changing matter	Student answers will vary, but may include questions about what causes matter to change.

Name: _____ Date: _____ Group: _____

Find Changing Matter

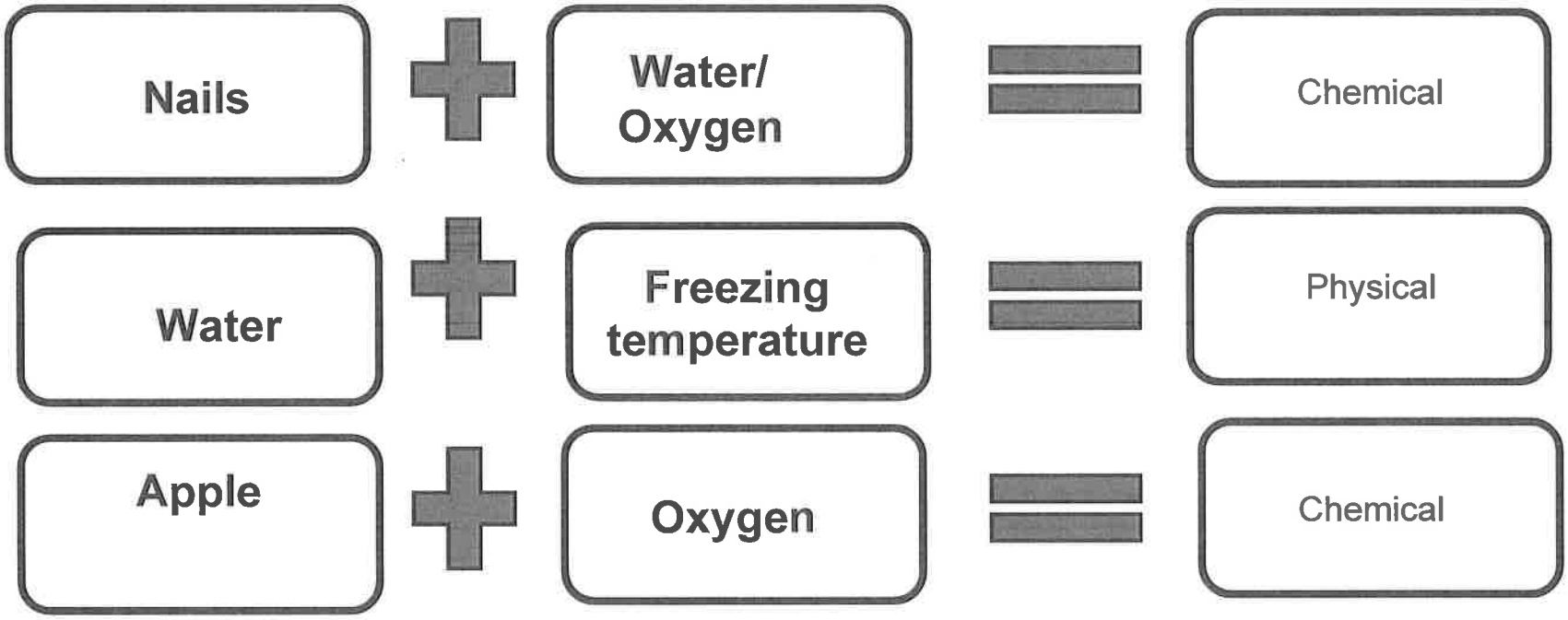
As you read the STEMscopedia, record the different ways matter changes mentioned in the passage. Circle the physical changes in Red and the Chemical Changes in Blue.

Changing Matter	
	Cutting paper
	Freezing
	Melting
	Evaporating
	Burning paper
	Rust
	Mixing baking soda and vinegar
	Ice packs

Name: _____ Date: _____ Group: _____

Chemical or Physical Change?

For each combination of substances, record if it would make a physical or chemical change. Put chemical or physical in the box.



Explain why changes in matter are important to everyday life.

Answers will vary, but may include ideas like creating new substances for use or new uses for the same substance.

Content Connections Video

Name: _____ Date: _____ Group: _____

1. Chemical Reactions-Can You Spot the Chemical Reactions?

1. Is this a chemical reaction? What is the evidence that a chemical reaction occurred or a physical change occurred? (Pause 0:25)
   Yes, the ingredients combine to create something different.

2. Is this a chemical reaction? What is the evidence that a chemical reaction occurred or a physical change occurred? (Pause 0:30)
   Yes, the coals burn and turn into ash.

3. Is this a chemical reaction? What is the evidence that a chemical reaction occurred or a physical change occurred? (Pause 0:35)
   A physical change because you are just mixing the fruits together.

4. Is this a chemical reaction? What is the evidence that a chemical reaction occurred or a physical change occurred? (Pause 0:41)
   Yes, the iron interacts with oxygen to create rust.

5. Is this a chemical reaction? What is the evidence that a chemical reaction occurred or a physical change occurred? (Pause 0:47)
   No, it is merely changing state.

6. Is this a chemical reaction? What is the evidence that a chemical reaction occurred or a physical change occurred? (Pause 0:53)
   No. If you can evaporate the water you would have sugar again.

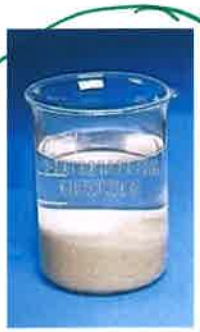
Content Connections Video

Name: _____ Date: _____

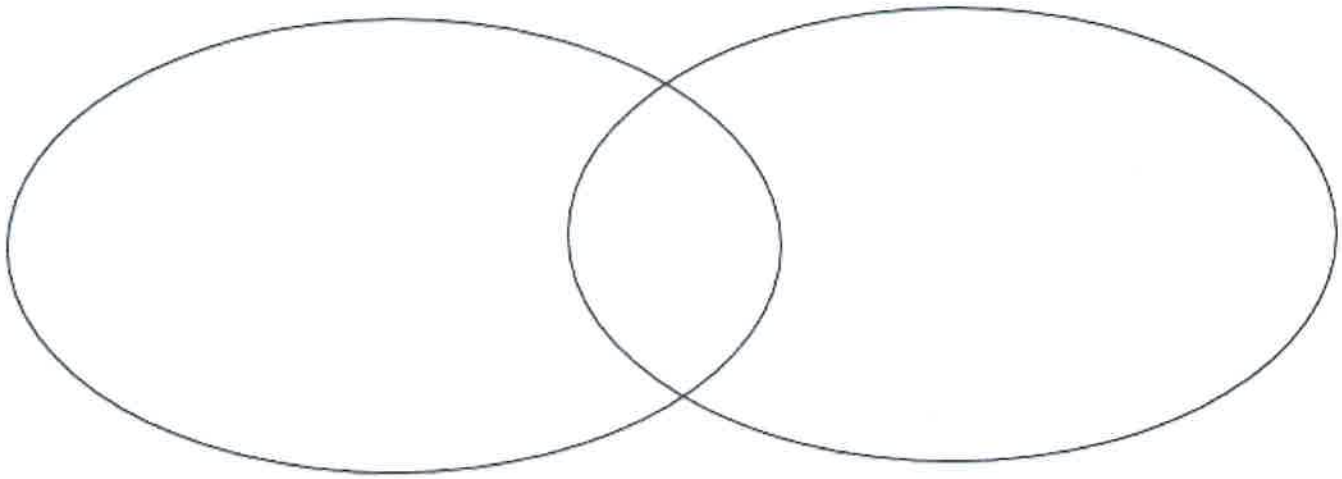
Mixtures

1. **Directions:** Look at the pictures below. Draw circles around the ones that are examples of mixtures, but NOT solutions. (pause 3:10)



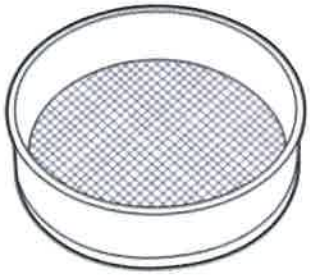
2. **Explain:** Complete the Venn diagram by filling in information to compare and contrast mixtures and solutions. student responses will vary

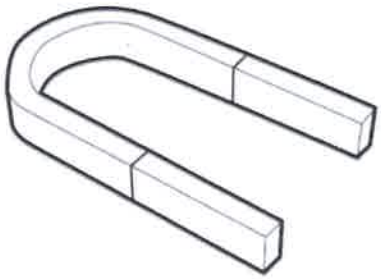


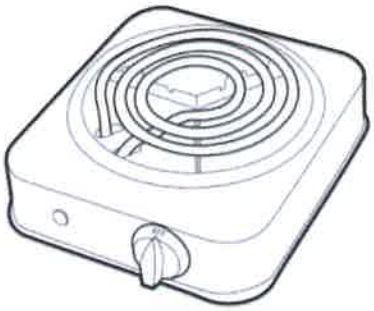
Content Connections Video

3. Circle the tool you think will best separate a solution of dissolved sugar and water. (Pause 3:20)

student responses will vary







4. How can you separate a mixture of 10 grams of salt and 10 grams of sand? (After the video)

You can filter them through a variable sized strainer or by dissolving the salt in water, filtering off the sand, and finally boiling the water away.

Name: _____ Date: _____ Group: _____

Fertilizer Plant Explosion

One cheap and effective fertilizer is a chemical called ammonium nitrate. This chemical was likely responsible for the massive explosion in the town of West, Texas. The chemical is usually a solid. When it comes in contact with fire, it very quickly turns into two gases: nitrous oxide and water vapor. This change happens so fast that it causes an explosion. The conditions have to be just right for this explosion to happen.

Ammonium nitrate is made from a combination of ammonia gas and nitric acid, which is a liquid. When these ingredients are first combined, they get very hot. Eventually, they turn into ammonium nitrate and water. The water can be evaporated, which leaves behind the solid ammonium nitrate.

1. Circle two examples in the text above where new substances were formed.

2. What evidence proves that a new substance is formed when ammonia gas and nitric acid are combined? Underline your evidence in the text above.

3. Draw and describe all the different ways you can know if a new substance is formed when two substances are mixed.

answers will vary

Independent Practice

Name: Answer Key Date: _____ Group: _____

Part I: Word Sort

Evidence of a Mixture	Evidence of a Chemical Reaction
only physical changes physical properties stay the same no new substance can be easily separated	new substance fire heat is released chemical changes

Part II: Analogies

1. chemical reaction
2. properties
3. mixture
4. substance
5. evaporation
6. physical changes

Concept Attainment Quiz

Name: _____ Date: _____ Group: _____

Part I: Vocabulary Matching

C	A combination of two or more substances that do not form a new substance, but maintain their original physical properties	A. Substance
D	Something we use to describe a material	B. Ingredient
A	The material an object is made of	C. Mixture
B	One of the substances that forms a mixture	D. Physical property

Part II: Short Answer Questions

Answer the following questions:

1. How could you separate iron filings and sand?

Use a magnet to remove the iron filings because the filings are magnetic and the sand is not.

2. Is fruit salad a mixture? (circle one) (Yes) No

Why or Why not?

A fruit salad is a combination of different ingredients (the different kinds of fruits), and the fruits keep their physical properties.

3. Is cake a mixture? (circle one) Yes (No)

Why or Why not?

You cannot separate the ingredients of cake once it has been cooked, and the physical properties have changed.