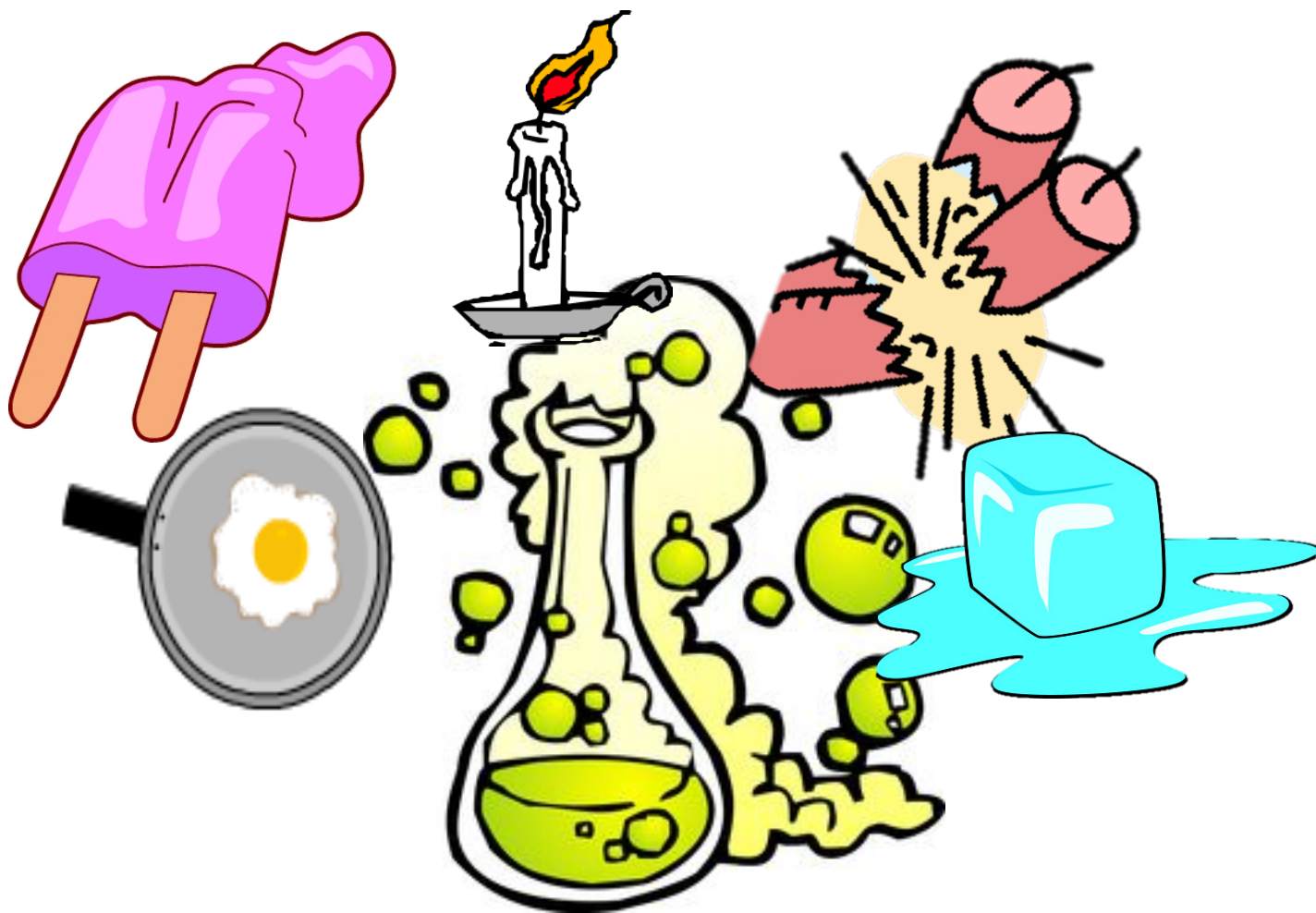


PHYSICAL AND CHEMICAL CHANGES



GRADE LEVEL AND CONTENT: 5TH Grade Science

OVERVIEW

Through the use of several activities, students explore physical and chemical changes in this one-week unit. In addition, students will explore the physical changes of water.

STANDARDS ADDRESSED

S5P2. Students will explain the difference between a physical change and a chemical change.

- Investigate physical changes by separating mixtures and manipulating (cutting, tearing, folding) paper to demonstrate examples of physical change.
- Recognize that the changes in state of water (water vapor/steam, liquid, ice) are due to temperature differences and are examples of physical change.
- Investigate the properties of a substance before, during, and after a chemical reaction to find evidence of change.

AVAILABLE MATERIALS

Physical and Chemical Properties Worksheet
Physical and Chemical Changes Card Activity
Physical and Chemical Changes Lab
Physical and Chemical Changes Review

Day 1-Physical and Chemical Properties

1. Display a picture of a colorful object such as a duck, chicken, etc.
2. Ask students to look at the image. How would you describe this object to a person that is blindfolded? List responses on the board.
3. Explain that all substance have properties that we can use to identify them. You described the object by the color, size, shape and other easy references. There are two basic types of properties that we can associate with matter. These properties are called **Physical** properties and **Chemical** properties. Physical properties do not change the nature of matter, are easily observed with senses, are easily measured and are determined without destroying matter. Measuring will not alter the basic nature of the substance. Chemical properties indicate how a substance reacts with something else changing the chemical nature of matter producing a new substance after the reaction.
4. Examples of physical properties are: color, smell, phase change (melting, freezing, boiling), attraction or repulsion to magnets, shape, texture, luster and density.
5. Examples of chemical properties are combustibility, reactivity, and flammability. Chemical properties cannot be determined by viewing or touching the substance, the substance's internal structure must be affected for its chemical properties to be investigated.
6. Ask students to take out a sheet of paper and list the physical and chemical properties of the sheet of paper. Answers will vary, but should include its color, size, shape, and flexibility for physical properties and it can burn or is flammable for chemical.
7. Pass out the Physical and Chemical Properties Worksheet. Allow students to complete.
8. After enough time for students to complete the worksheet, divide class into groups. Have them discuss their answers to the Physical Properties and Chemical Properties worksheet. Give each group another copy of the worksheet. Tell each group to come up with one set of answers per group and place them on the blank sheet. Be sure all group members have their name on the sheet from the group.
9. Take up the group worksheet to be graded later. Discuss the answers with the entire class.

Day 2-Physical and Chemical Changes

1. Ask students to give you a definition of change. Write responses on the board.
2. Review the Law of Conservation of Matter: Matter is neither created nor destroyed. It merely changes.
3. Take a balloon and hold it up. Ask a student to blow up the balloon and tie it.
4. Ask students to describe what changes occurred to the balloon. Looking for it changed shaped. Ask students if a new substance was formed. Set the balloon aside.
5. Define physical change. **Physical change** is a change in which the substance changes form but keeps its same chemical composition (reversible).
6. Take an ice cube and place it in a beaker. Ask students to describe what they see in the beaker.
7. Place the beaker on a heat source until the ice cube melts. Ask students to describe what they see in the beaker.
8. Continue to heat the beaker of water until it starts to boil. Ask students to describe what they see in the beaker.
9. Ask students if a new substance was formed. Explain that the change of state: solid to liquid to gas, of water is a physical change. No new substance was produced.

10. Now take a match and show it to the class. Ask them to describe what they see. Then strike the match to light it. Ask class to quickly describe what they see. Make sure students see the new substance formed from the match.
11. Define chemical change: **Chemical change** takes place when one or more substances react to form a new substance, or a substance breaks down to form one or more substances. A chemical change is also called a chemical reaction.
12. Discuss with students the main difference in a physical change and a chemical change. Ask students to give examples.
13. Now take a candle and show it to the class. Ask them to list the physical properties of the candle. Make sure they list properties from their observation such as color, size, and shape. Unless you let them feel the candle, do not accept it is wax. Ask them what is a chemical property of the candle. The correct response should be the wick will burn when a heat source is applied. Light the candle and ask them what type change is occurring. Answers will vary. Correct response is both changes are occurring. The wax is changing phase or melting and this is physical. The wick is burning and this is chemical.
14. You will have to make the card activity before doing this activity.
15. Divide class into groups and complete the Physical and Chemical Change Card Activity.
16. After each group has completed the activity, discuss the correct answers.
17. Ticket Out The Door: List two examples of a physical change and a chemical change that were not discussed today. Label each example.
18. Homework: List several examples of physical and chemical changes at home or on the way home.

DAY 3 & 4: Physical and Chemical Change Experiments

Objective: Students will conduct a series of experiments to learn the difference between physical and chemical changes.

Time Allotment: 80-90 minutes

Materials:

Safety goggles	Play-doh
Graduated cylinders	Baking soda
Small plastic cups	Lemon juice
Small plastic jars	Vinegar
Ice	Milk
Antacid tablets	Kool-Aid powder
Squirt bottle of water	Plastic shoebox

1. This lab may take two days. Make sure all students stop at the same point on Day 1 and complete the lab on Day 2.
2. Begin by holding up a beaker of starch solution.
3. Ask students what they think will happen if iodine is added to the starch solution. List responses.
4. Perform the demonstration by adding iodine to the starch solution (the solution will quickly become bluish-black).
5. Ask students if a new substance was created when you added the iodine and what clues did they use to determine this.

6. Draw a helix (spiral) on the board and tell the students that starch takes this form when it is dissolved in water. When iodine is added, the iodine molecule inserts itself into the center of the helix and makes the helix rigid. This creates a new substance and causes the solution to turn blue.
7. Explain that substances react in different ways when they are combined. Sometimes these combinations create new substances (chemical change), but sometimes the reactants merely change physical form or state (physical change). Physical changes are reversible, while most chemical changes are not.
8. Divide students into small groups (3-4 students).
9. Inform students that they will be conducting an experiment on physical and chemical changes.
10. Ask students to review the difference between chemical and physical properties (physical properties are traits that can be observed and chemical properties are only observable during a chemical reaction).
11. Ask students to review physical and chemical changes (chemical changes (reactions) result in the formation of a new substance while physical changes do not).
12. Ask students to identify some clues that could suggest that a chemical reaction has occurred (generation of heat, precipitate formation, gas production, a new odor, etc.).
13. Remind students to look for these clues during their investigation, but there may be some exceptions.
14. Review Safety Regulations.
 - a. Goggles must be worn at all times.
 - b. Although some food items will be used, do not eat, drink or taste anything.
15. Have all students stop at a specific point.
16. Complete the lab on the second day. Allow students time to complete the analysis.

DAY 5

1. Collect all lab reports.
2. Have students complete the Physical and Chemical Changes Review.
3. Divide the class into pairs.
4. Have students compare their answers to the Review.
5. Pass out another blank sheet of the review to each group. Have them record their agreed on responses on this sheet. Make sure both student names are on the sheet. Take the group sheet up for grading late.
6. Go over the correct answers to the review.

Physical and Chemical Properties Worksheet Name_____

Identify if the following are chemical or physical properties by writing chemical or physical below each:

1. Oxygen is odorless and colorless _____
2. Copper turns green when exposed to the environment _____
3. The piece of metal is magnetic _____
4. The density of water is 1.0 gram per cubic centimeter _____
5. Diamonds are a very hard substance _____
6. The tree is 8 meters high _____
7. Sodium reacts very easily with other elements. _____
8. Copper conducts electricity _____
9. The mass of the table salt sample is 30 grams _____
10. Gold is nonflammable _____
11. Alka-Seltzer tablets react with water to produce gas _____
12. The color of the ball is red _____
13. Iron reacts with oxygen and forms rust _____
14. The boiling point of water is 100 degrees C _____
15. Baking soda reacts with vinegar _____
16. The gas is flammable _____
17. Argon is not very reactive _____
18. The perfume smells like peppermint _____
19. Silver necklaces tarnish and turn green. _____
20. A student's shirt suddenly bursts into flames. _____

Answers

1. Physical
2. Chemical
3. Physical
4. Physical
5. Physical
6. Physical
7. Chemical
8. Physical
9. Physical
10. Chemical
11. Chemical
12. Physical
13. Chemical
14. Physical
15. Chemical
16. Chemical
17. Chemical
18. Physical
19. Chemical
20. Chemical

Name_____Date_____

PHYSICAL AND CHEMICAL CHANGES

1. On your desk, place the "Physical Change" card to your left and the "Chemical Change" card to your right.
2. Using what you know about physical and chemical changes, place each card into the correct category.
3. Record your data in the chart below.

Data Table: Physical vs. Chemical Changes

Physical Change	Chemical Change

Analysis:

1. Were there any cards you had trouble classifying? Why/Why not?
2. Give an example of a physical change that was not listed above.
3. Give an example of a chemical change that was not listed above.

Conclusion:

Write 2-3 complete sentences on what you learned.



Frying eggs



Toast



Cracking eggs



Slicing Bread



Lighting a Match



Roasting Marshmallows



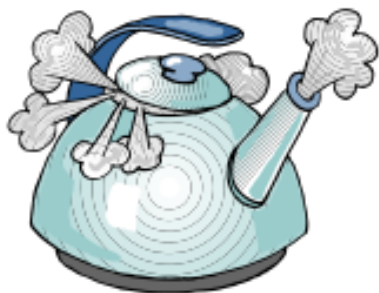
Rusty Nails



Ice Melting



Glass Breaking



Boiling Water



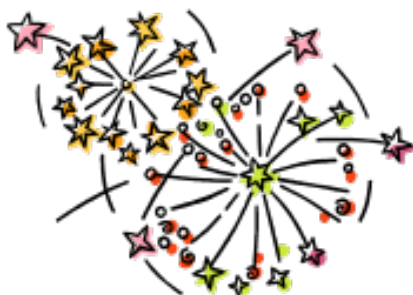
Fresh Lemonade



Baking a Cake



Mowing the Lawn



Fireworks



Digesting Food

Physical Change

Chemical Change

Chemical and Physical Changes: Student Worksheet

You will do several experiments today. To prevent spills, keep the jars and cups inside of a plastic shoebox and only pour ingredients over the box. Keep your goggles on at all times. As you observe the changes that occur during the experiments, your goal is to decide which changes are chemical and which changes are physical. Be sure to fill out the group datasheet with observations of the ingredients before, during, and after they undergo physical or chemical change. When you are done with all of the experiments, work as a group to answer the questions on the datasheet.

Experiment A: Antacid tablet

1. Observe and describe the **antacid tablet** at your table.
2. Break the tablet into small pieces. Is this a physical or chemical change?
3. Using a graduated cylinder, measure 50 ml of **water** and add it to a cup. Drop the tablet pieces into the cup.
4. Observe what happens and write whether it is a physical or chemical change.
5. When you are finished, empty the cup into the waste bucket at the front of the room. Rinse the cup with water from a squirt bottle and save the cup for experiment B.
6. A doctor might tell someone to use an antacid if his or her stomach produces too much acid. Based on what you observed, how do you think antacids work? Write your response in the Analysis part of this activity.

Experiment B: Ice

1. In the empty cleaned cup from experiment A, place 1 **ice cube**. Observe and record how the ice looks and feels.
2. Set the cup and ice cube aside until you are finished with the other experiments.

Experiment C: Baking soda and lemon juice

1. With a graduated cylinder, measure 40 ml of **lemon juice** and add it to a small jar.
2. Add 1 teaspoon of **baking soda** to the jar.
3. Observe and record the changes.
4. On the datasheet, write whether this is a physical or chemical change.
5. Empty the jar into the waste bucket and rinse it with a squirt bottle. Save the jar for experiment G.

Experiment D: Play-Doh

1. Remove the **Play-doh** from its container and describe how it looks, feels, and smells.
2. Break the Play-doh up into many small pieces.
3. Observe and record the change.
4. On the datasheet, write whether this is a physical or chemical change.

Experiment E: Baking soda and vinegar

1. Start with a new cup (NOT the one the ice cube was in) and add 1 teaspoon of **baking soda** to it.

2. Using the graduated cylinder, measure 10 ml of **vinegar** and add it to the same cup.
3. Observe and record the change.
4. On the datasheet, write whether this is a physical or chemical change.
5. Empty the cup into the waste bucket and rinse the cup with a squirt bottle. Save the cup for experiment F.

Experiment F: Milk and vinegar

1. Using the graduated cylinder, measure 25 ml of **milk** and add it to the cup saved from experiment F.
2. Using the graduated cylinder, measure 30 ml of **vinegar** and add it to the same cup.
3. Observe and record the change.
4. On the datasheet, write whether this is a physical or chemical change.

Experiment G: Kool-Aid and water

1. Add 1 teaspoon of **Kool-Aid powder** to the cleaned small jar from Experiment C.
2. Using the graduated cylinder, add 60 ml of **water** to the same jar.
3. Close the lid of the jar and gently mix by swirling it.
4. Observe and record the change.
5. On the datasheet, write whether this is a physical or chemical change.

Back to Experiment B: Ice

1. Look at the cup that held the ice cube from experiment B.
2. Observe and record the change.
3. On the datasheet, write whether this is a physical or chemical change.

Group Members_____

Physical and Chemical Change Experiment

DATA TABLE

Experiment	Original Substance(s)	Describe substance before change	What happened during change?	Describe substance after change	Physical or Chemical Change
A	Antacid Crushed				
A	Antacid in water				
B	Ice				
C	Baking soda & lemon juice				
D	Play-doh broken into bits				
E	Baking soda & Vinegar				
F	Milk & vinegar				
G	Kool-Aid & water				

Analysis: Answer the following six questions as a group.

1. Answer the question from Experiment A here.
2. How were you able to tell the difference between physical and chemical changes?
3. Can it ever be confusing to tell the difference between physical and chemical changes?
Give 2 examples.
4. Does the mass of the ingredients change during physical changes? What about during chemical changes?

5. In one of today's experiments, you made a mixture where the ingredients kept their physical properties. Which experiment was it?
6. If you wanted to learn more about all the physical changes possible for water, what 3 states of matter would you study?

Physical and Chemical Changes Review Name_____

Part A

Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a **physical change** has occurred. If the substance has been changed into another substance, a **chemical change** has occurred.

Physical or Chemical	Changes that happen around us
1.	1. An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2.	2. Two chemicals are mixed together and a gas is produced.
3.	3. A bicycle changes color as it rusts.
4.	4. A solid is crushed to a powder.
5.	5. Two substances are mixed and light is produced.
6.	6. A piece of ice melts and reacts with sodium.
7.	7. Mixing salt and pepper.
8.	8. Chocolate syrup is dissolved in milk.
9.	9. A marshmallow is toasted over a campfire.
10.	10. A watermelon is cut in half.

Part B: Write the word **True** or **False** after each statement.

1. Changing the size and shapes of pieces of wood would be a chemical change. _____
2. In a physical change, the makeup of matter is changed. _____
3. Evaporation occurs when liquid water changes into a gas. _____
4. Evaporation is a physical change. _____
5. Burning wood is a physical change. _____
6. Combining hydrogen and oxygen to make water is a physical change. _____
7. Breaking up concrete is a physical change. _____
8. Sand being washed out to sea from the beach is a chemical change. _____
9. When ice cream melts, a chemical change occurs. _____
10. Acid rain damaging a marble statue is a physical change. _____

Part C

Read each scenario. Decide whether a physical or chemical change has occurred and give evidence for your decision.

Scenario	Physical or Chemical Change	Evidence
1. Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it.		
2. Your friend decides to toast a piece of bread, but leaves it in the toaster too long. The bread is black and the kitchen is full of smoke.		
3. You forgot to dry the bread knife when you washed it and reddish brown spots appeared on it.		
4. You blow-dry your wet hair.		
5. In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise.		
6. You take out your best silver spoons and notice that they are very dull and have some black spots.		
7. A straight piece of wire is coiled to form a spring.		
8. Food color is dropped into water to give it color.		
9. In a fireworks show, the fireworks explode giving off heat and light.		
10. Chewing food to break it down into smaller particles represents a ____A____ change, but the changing of starch into sugars by enzymes in the digestive system represents a ____B____ change.	A, _____ B. _____	

Physical and Chemical Changes Review **Answer Key**

Part A

Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a **physical change** has occurred. If the substance has been changed into another substance, a **chemical change** has occurred.

Physical or Chemical	Changes that happen around us
1. Physical	1. An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2. Chemical	2. Two chemicals are mixed together and a gas is produced.
3. Chemical	3. A bicycle changes color as it rusts.
4. Physical	4. A solid is crushed to a powder.
5. Chemical	5. Two substances are mixed and light is produced.
6. Physical/Chemical	6. A piece of ice melts and reacts with sodium.
7. Physical	7. Mixing salt and pepper.
8. Physical	8. Chocolate syrup is dissolved in milk.
9. Chemical	9. A marshmallow is toasted over a campfire.
10. Physical	10. A watermelon is cut in half.

Part B: Write the word **True** or **False** after each statement.

11. Changing the size and shapes of pieces of wood would be a chemical change. False

12. In a physical change, the makeup of matter is changed. False

13. Evaporation occurs when liquid water changes into a gas. True

14. Evaporation is a physical change. True

15. Burning wood is a physical change. False

16. Combining hydrogen and oxygen to make water is a physical change. False

17. Breaking up concrete is a physical change. True

18. Sand being washed out to sea from the beach is a chemical change. False

19. When ice cream melts, a chemical change occurs. False

20. Acid rain damaging a marble statue is a physical change. False

Part C

Read each scenario. Decide whether a physical or chemical change has occurred and give evidence for your decision.

Scenario	Physical or Chemical Change	Evidence
1. Umm! A student removes a loaf of bread hot from the oven. The student cuts a slice off the loaf and spreads butter on it.	Physical	No change in substances. No unexpected color change, temperature change or gas given off.
2. Your friend decides to toast a piece of bread, but leaves it in the toaster too long. The bread is black and the kitchen is full of smoke.	Chemical	Identity of substances change. Blackening of bread and smoke is the new substance
3. You forgot to dry the bread knife when you washed it and reddish brown spots appeared on it.	Chemical	Identity of substances change. Iron of knife forms rust
4. You blow-dry your wet hair.	Physical	No change in substances. No unexpected color change, temperature change or gas given off.
5. In baking biscuits and other quick breads, the baking powder reacts to release carbon dioxide bubbles. The carbon dioxide bubbles cause the dough to rise.	Chemical	Identity of substances change. Gas is produced
6. You take out your best silver spoons and notice that they are very dull and have some black spots.	Chemical	Identity of substances change. Silver oxide produced
7. A straight piece of wire is coiled to form a spring.	Physical	No change in substances. No unexpected color change, temperature change or gas given off
8. Food color is dropped into water to give it color.	Physical	No change in substances. No unexpected color change, temperature change or gas given off.
9. In a fireworks show, the fireworks explode giving off heat and light.	Chemical	Identity of substances change. Fireworks combust making new products and energy.
10. Chewing food to break it down into smaller particles represents a <u> A </u> change, but the changing of starch into sugars by enzymes in the digestive system represents a <u> B </u> change.	A, <u>Physical</u> B, <u>Chemical</u>	Chewing breaks down matter into smaller particles of the same substance. Enzymes change starch into sugar which is a new substance.

Sources:

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Physical & Chemical Changes Activity Cards:

<http://middleschoolscience.com/>

Physical & Chemical Changes Review:

<http://www.mayfieldschools.org/Downloads/Phys%20and%20Chem%20Properties%20and%20Changes%20and%20KEY.pdf>