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Physical and Chemical Changes

Focus on Inquiry

The students will:

- Investigate and differentiate between physical changes and chemical changes.
- Investigate and describe how temperature influences physical and chemical changes

Lesson Content Overview

Students will

- Understand that chemical changes occur when different substances combine to form new substances.
- Understand that physical changes occur when substances change form but not their chemical composition.
- Identify evidence that a physical or a chemical change has occurred.

Duration	Setting	Grouping	PTI Inquiry Subskills
4 days @ 50 min	Classroom	2- 4 students	1.1, 4.1, 5.1, 2.5, 3.1, 3.2, 3.3, 3.7, 5.2, 5.3, 5.4, 5.7, 6.2, 7.2, 7.3

Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
Engage	20 min	1.1, 4.1, 5.1, 5.2	Lab equipment	2	Elephant's toothpaste demonstration. Making elephant toothpaste is an easy and fun science experiment. It is the result of a chemical reaction that creates a large amount of oozing foam. The movement of the foam looks like toothpaste squirting out of a tube while the amount of foam usually is enough for an elephant to brush its teeth.
Explore	90	1.1, 2.5, 3.1, 3.2, 3.3, 3.6, 3.7, 4.1, 5.1, 5.2,5.7,7.2	Timer and lab equipment	3	Students will work in groups of 2 to 4 to explore how substances may react with other substances to produce chemical changes, and how others do not react but their physical properties may change.
Explain	45		None	2	The students will share answers on the previous activities. They will discuss how physical and chemical changes took place. Using the chart with the changes and write questions using rally robin, rally coach, all record round robin, or 4 corners. Teacher explains based on previous activity, introduction of vocabulary.
Expand	50		None	3	Students will work in teams of 3 or 4 to identify unknown substances based on their reactivity.
Evaluate	45		None	2	Inside-outside circle Teacher will evaluate the outcome of the students expand activity as a form of formative assessment. The teacher will also use 5 questions as a summative assessment.

Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

Next Generation Science Standards – Inquiry NGSS Practice 3: Planning and Carrying Out Investigations NGSS Practice 4: Analyzing and Interpreting Data NGSS Practice 6: Constructing explanations NGSS Practice 7: Engaging in arguments from evidence NGSS Practice 8: Obtaining, Evaluating and Communicating Information
Next Generation Science Standards – Earth Science MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
Florida Science Standards - Nature of Science **SC.8.N.2.2** Discuss what characterizes science and its methods. **SC.8.N.1.6** Understand that scientific investigations involve the collection of relevant empirical evidence, the use of logical reasoning, and the application of imagination in devising hypotheses, predictions, explanations and models to make sense of the collected evidence. **SC.8.N.1.1** Define a problem from the eighth grade curriculum using appropriate reference materials to support scientific understanding; plan and carry out scientific investigations of various types, such as systematic observations or experiments; identify variables; collect and organize data; interpret data in charts, tables, and graphics; analyze information; make predictions; and defend conclusions.
Florida Science Standards – Matter and its Properties **SC.8.P.8.4** Classify and compare substances on the basis of characteristic physical properties that can be demonstrated or measured; for example, density, thermal or electrical conductivity, solubility, magnetic properties, melting and boiling points, and know that these properties are independent of the amount of the sample. **SC.8.P.9.2** Differentiate between physical changes and chemical changes. **SC.912.P.8.2**: Differentiate between physical and chemical properties of matter

Materials and Advance Preparation

Engage Activity – Demonstration – The Elephant Toothpaste

Materials

- Hydrogen peroxide (30%)
- Sodium iodide crystals (This is a dry chemical that looks like salt.)
- 250-milliliter beaker
- Liquid dish soap
- Food coloring (optional)
- 1,000-milliliter graduated cylinder
- Measuring spoons
- Goggles
- Apron
- Plastic tarp to cover the demonstration table
- Rubber gloves

Advanced preparation

- **Preparation of Sodium Iodine catalyst**
  - In a beaker, measure 120 mL of room temperature water.
  - Add 15g of sodium iodide crystals to the water and stir with a stirrer until all of the crystals have dissolved. Label the beaker “Sodium Iodide Catalyst” and set it aside to use later.

- **Set up Area**
  - Cover the experimentations table with a plastic tarp to collect the foam at the end of the demonstration and throw the foam in the garbage can. This will make clean up easier.
  - This demonstration can be done outside since the foam is safe enough to be washed away.

Explore Activity: Physical and Chemical Changes – small group set:

Materials per group

- Vinegar
- Water
- Baking soda
- Baking powder
- 4 Balloons
- 4 Test tube
- Test tube holder
- Triple beam balance
- 10 mL of milk
- 3 mL of vinegar
- Beaker
- Calibrated cylinder
- Sandwich Ziploc bag
- Sugar
- Food coloring
- Alcohol
- Water
- Vegetable oil
- Popsicle sticks

Advanced preparation

To save time identify the materials per station.

Expand Activity: Identify the Unknown Powder – small group set:

Materials per group

- Baking soda in a small cup
- Cornstarch in a small cup
- Cream of tartar in a small cup
- Baking powder in a small cup
- Thermometer
- 4 beakers
- Water
- Measuring spoons or scales

Advanced preparation

To save time prepare small cups with each one the four powders for the groups.

Blackline Masters:

Blackline Master #1: Explore - Physical and Chemical Changes Lab
Blackline Master #2: Explain – Physical and Chemical Changes Checklist
Blackline Master #3: Evaluate – Quiz Physical And Chemical Changes
Blackline Master #4: Expand – Identify the unknown powder

Lesson Information

Learning Objectives

1. The student will be able to observe and record different changes that happen when chemical reactions occur to correctly differentiate between chemical and physical changes.
2. The student will be able to correctly differentiate between chemical and physical changes based on their observations, and understand that several tests may be performed before a change can be classified as physical or chemical.

Prior Knowledge Needed by the Students

Elementary

- SC.4.P.8.1 Measure and compare objects and materials based on their physical properties including: mass, shape, volume, color, hardness, texture, odor, taste, attraction to magnets.

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

Background Information

The different types of matter can be distinguished through two components: composition and properties. The composition of matter refers to the different components of matter along with their relative proportions. The properties of matter refer to the qualities/attributes that distinguish one sample of matter from another. These properties are generally grouped into two categories: physical or chemical.

1. **Chemical Properties and Changes**
   Chemical change results in one or more substances of entirely different composition from the original substances. The elements and/or compounds at the start of the reaction are rearranged into new product compounds or elements. A **CHEMICAL CHANGE** alters the composition of the original matter. Different elements or compounds are present at the end of the chemical change. The atoms in compounds are rearranged to make new and different compounds.x.
   Chemical properties of matter describes its "potential" to undergo some chemical change or reaction by virtue of its composition. What elements, electrons, and bonding are present to give the potential for chemical change. It is quite difficult to define a chemical property without using the word *"change".* .
2. **Physical Properties and Changes**
   Physical properties can be observed or measured without changing the composition of matter. Physical properties are used to observe and describe matter. Physical properties of materials and systems are often described as intensive and extensive properties. This classification relates to the dependency of the properties upon the size or extent of the system or object in question.
   A **physical change** takes place without any changes in molecular composition. The same element or compound is present before and after the change. The same molecule is present through out the changes. Physical changes are related to physical properties since some measurements require that changes be made. Matter can be classified in four states are: Solid, Liquid, Gas, and plasma.
   (http://chemwiki.ucdavis.edu/Core/Physical_Chemistry/Physical_Properties_of_Matter/States_of_Matter)

1. Solid is distinguished by a fixed structure. Its shape and volume do not change. In a solid, atoms are tightly packed together in a fixed arrangement.
2. Liquid is distinguished by its malleable shape (is able to form into the shape of its container), but constant volume. In a liquid, atoms are close together but not in a fixed arrangement.
3. Gas is made up of atoms that are separate. However, unlike solid & liquid, a gas has no fixed shape and volume.
4. Plasma is very hot ionized gas that consists of nearly the same amount of positively charged ions and negatively charged electrons.

Lesson Procedure

Engage

A. **Demonstration -** Elephant's toothpaste demonstration. Making elephant toothpaste is an easy and fun science experiment. It is the result of a chemical reaction that creates a large amount of oozing foam. The movement of the foam looks like toothpaste squirting out of a tube while the amount of foam usually is enough for an elephant to brush its teeth.
   Taken from: Steve Spangler Science http://www.stevespanglerscience.com/lab/experiments/exploding-toothpaste-elephants-toothpaste/

NOTE: This demonstration should be conducted by the teacher due to the concentration of the hydrogen peroxide. Wear rubber gloves to protect against burns caused by concentrated hydrogen peroxide. The handler must be properly trained to store and handle any chemical.
This demonstration can be performed in the classroom or outside. Don't allow the observers to touch the foam in case some of the hydrogen peroxide didn't react. However, the product is safe enough to be thrown away in the trash can or wash down the drain.

Procedure

1. Wear goggles, apron, and gloves
2. Pour 60 mL of the 30% hydrogen peroxide into a graduated cylinder. Place the graduated cylinder in the middle of the plastic tarp.
3. Add about 5 milliliters of dish soap to the graduated cylinder containing the 60 mL 30% hydrogen peroxide.
4. Add a few of drops of food coloring to the cylinder mixture and swirl to make the mixture more homogeneous.
5. Pour 5 milliliters of the sodium iodide catalyst into the graduated cylinder and quickly stand back. The reaction will occur very quickly and a foam will cover the table. Note: For a more dramatic reaction, use a large Florence or Erlenmeyer flask instead of a graduated cylinder.

B. Ask the following question to promote discussion using Rally Robin (Kagan strategy)

Question: How would you classify this demonstration, as a chemical change or physical change? Justify your answer.

Possible answer: Chemical change, because when the substances came in contact with each other a new substance (foam) formed.

Explore – Physical and Chemical Changes

Teacher notes: This is an inquiry activity, in which the students have the opportunity to work with their teammates to explore and find possible explanations with little teacher intervention. The teacher should not provide students with background information.
In this activity the students will experiment when a chemical reaction occurs, new substances are formed. They will also experiment that in a physical change substances keep their chemical properties, but their physical properties change.
Note: This activity will probably take more than one day. This can be done in rotating stations.

1. Students will work in groups of 3 to 4. Each group will assign a role to each of the members: Senior Investigator who directs others to follow procedures; Materials Manager who collects and cleans up materials; Reporter who records data and talks to the teacher; Timekeeper / Clean-Up Captain who keeps time and helps clean up.
2. Remind students of safety procedures
3. Distribute Blackline master #1 – **Physical and Chemical Changes**
4. Ask Materials Manager to collect materials
5. Students start investigations using Blackline master #1 – **Physical and Chemical changes**

Explain

1. Questions are included in Blackline Master #1
2. Possible answers are included in the teacher copy of the same Blackline Master.

Expand: Identify the Unknown Powders

(Adapted from: http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson6)

1. Distribute Blackline Master #4 – Expand activity: Identify the unknown powder

2. Students will work in teams of 3 or 4 to identify unknown substances based on their reactivity.
3. Possible answers are included in the Blackline Master #4

Evaluate

WRAP UP.

Bring the lesson to a conclusion by having the students doing inside-outside circle and answer the following questions:

1. What is a physical changes? In physical changes the chemical makeup of the substance(s) doesn't change.
2. What is a chemical change? In chemical changes the chemical makeup of the substance(s) changes.
3. What is the relationship between evaporation and temperature change? If the temperature of the liquid increases, the molecules will move faster and the liquid turns into gas.
4. What is the relationship between temperature change and freezing? If the temperature decreases, the molecules will start to move slower compacting, turning the liquid into a solid.

Blackline Master # 4: Quiz

1. After reviewing with the wrap up activity, distribute Blackline Master #4 and allow the students to complete this assessment individually.

Supplementary Resources

Teachers

1. Comparing Chemical and Physical Changes
   Studios, Andrew Rader. "Chemical Changes Versus Physical Changes." *Chem4Kids.com: Matter: Chemical vs. Physical Changes*. Andrew Rader Studios, Retrieved from http://www.chem4kids.com/files/matter_chemphys.html .
2. Phase changes
   Phase. (2016). In *Encyclopædia Britannica*. Retrieved from https://www.britannica.com/science/phase-state-of-matter

Students:

1. Comparing Chemical and Physical Changes Interactive Activity
   "Comparing Chemical and Physical Changes - Activity." *Comparing Chemical and Physical Changes - Activity*. University of Utah, Retrieved from http://home.utah.edu/~u0577548/Comparing%20Chemical%20and%20Physical%20Changes/comparing_activity.htm .
2. Test your knowledge Interactive Quiz
   "Comparing Chemical and Physical Changes - Quiz." *Comparing Chemical and Physical Changes - Quiz*. University of Utah, Retrieved from http://home.utah.edu/~u0577548/Comparing%20Chemical%20and%20Physical%20Changes/comparing_quiz.htm
3. Interactive lab
   Physical and Chemical Changes Lab. Taken from http://vital.cs.ohiou.edu/steamwebsite/downloads/ChangeLab.swf

CITATION OF SOURCES.

I/We used the following resources to build our lesson:

1. Spangler, Steve. "Exploding Toothpaste - The Lab." *The Lab*. N.p., n.d. Web. 5 Feb. 2016. http://www.stevespanglerscience.com/lab/experiments/exploding-toothpaste-elephants-toothpaste/ .
2. "Discovery Education." Discovery Education. N.p., n.d. Web. 11 Sept. 2016. https://tools.discoveryeducation.com/assessment/viewAssessment.cfm?guidAssetID=93DD8CAE-53C0-4EE0-89EF-B3F67365CD07&student=0&hidesiteformating=true&assetGuid=93DD8CAE-53C0-4EE0-89EF-B3F67365CD07&blnPopup=1 .
3. Patti, Galvan, and Kessler Jim. "Using Chemical Change to Identify an Unknown." Middle School Chemistry. American Chemical Society, n.d. Web. 11 Sept. 2016. http://www.middleschoolchemistry.com/lessonplans/chapter6/lesson6 .

__✓__ Yes, I cited all materials and resources used in this lesson.

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Lesson author signature

Blackline Master #1

Name _____ Date _____

Chemical & Physical Changes

Objective: In this activity the students will experiment when a chemical reaction occurs, new substances are formed. They will also experiment that in a physical change substances keep their chemical properties, but their physical properties change.

Note: This activity will probably take more than one day. This can be done in rotating stations.

Station 1 - What would happen if...

Inquiry Question: What do you think will happen when vinegar combines with baking soda or baking powder?

Prediction:

Baking soda: _____

_____

Baking powder: _____

_____

Safety: Wear goggles and apron; don't smell, drink, or eat anything during this lab. Clean your area and your instruments after the lab and wash your hands.

Materials

- Vinegar
- Water
- Baking soda
- Baking powder
- 4 Balloons
- 4 Test tube
- Test tube holder
- Triple beam balance

Initial observations:

Physical properties:

a. Vinegar: _____

b. Baking soda: _____

c. Water _____

d. Baking powder _____

Procedure

1. Place 4 test tubes in the test tube holder and label each one as follows: 1a, 1b, 2a, 2b
2. Pour 10 mL of vinegar into test tubes 1a and 2a.
3. Pour 10 mL of water into test tubes 1b and 2b.
4. Measure 1 tsp (5 grams) of baking soda and pour it inside 2 of the 4 balloons.
5. Measure 5 grams (1 tsp) of baking powder and pour it inside the other 2 balloons.
6. Put each balloon in the mouth of the test tubes (making sure that you do not drop the baking soda or the baking powder inside) covering the entire mouth of the test tube.
7. Lift each one of the balloons (one at a time) just enough to release the baking soda or baking powder inside the test tube: 1a, 1b, 2a, 2b.
8. Observe and record observations for each one of the test tubes.

Observations:

1a	*1b*	*2a*	*2b*

Using the check list, answer the following questions

Analyze:

1. What type of change (physical or chemical) did you see in this experiment? What evidence supports your answer?

_____

_____

_____

_____

2. Did the experiment support your prediction? What evidence supports your answer?

_____

_____

_____

Station 2: Dissolving a substance (Adopted from ACS Chemistry for Life: Inquiry in Action http://www.inquiryinaction.org/classroomactivities/activity.php?id=16)

Inquiry Question: Does colored sugar dissolve equally well in water, vegetable oil, and alcohol? Prediction

_____

Make colored sugar

Materials

- Sandwich Ziploc bag
- Sugar
- Food coloring
- Alcohol
- Water
- Vegetable oil
- 3 popsicle sticks

Procedure

1. Put 1 tablespoon of sugar in the plastic bag. Add 1 drop of food coloring to the sugar.
2. Leaving air in the bag, seal the bag securely.
3. Shake the bag vigorously until the sugar is thoroughly colored.
4. Add 1 teaspoon of colored sugar to 1 tablespoon of water; add 1 teaspoon of colored sugar to 1 tablespoon of alcohol, and add 1 teaspoon of colored sugar to 1 tablespoon of vegetable oil.
5. Stir each with a clean Popsicle stick.
6. Record your observations below.

Observations

Water	Alcohol	Oil

Analyze:

1. Describe what happens to both the color and the sugar when you stir colored sugar in each liquid. What did you do to make sure it was a fair comparison?

_____

_____

_____

_____

_____

_____

2. If a substance dissolves in one liquid, will it necessarily dissolve equally well in another?

_____

_____

_____

_____

3. Explain your answer using evidence from your experiment.

_____

_____

_____

_____

4. Let's say your teacher gave you a sample of water and a sample of isopropyl rubbing alcohol but did not tell you which one was which. Assuming you had no colored sugar; do you think dissolving salt or some other solute might help you identify the liquids? Why or why not?

_____

_____

_____

_____

_____

Answers

Chemical & Physical Changes Lab

Station 1 - What would happen if...

Inquiry Question: What do you think will happen when vinegar combines with baking soda or baking powder?

Prediction:

Baking soda: Predictions will vary

Baking powder: Predictions will vary

Safety: Wear goggles and apron; don't smell, drink, or eat anything during this lab. Clean your area and your instruments after the lab and wash your hands.

Materials

- Vinegar
- Water
- Baking soda
- Baking powder
- 4 Balloons
- 4 Test tube
- Test tube holder
- Triple beam balance

Initial observations:

Physical properties:

a. Vinegar: liquid, clear, strong odor Water: liquid, clear, odorless

b. Baking soda: solid, white, odorless, powder Baking powder: solid, white, odorless, powder

Procedure

1. Place 4 test tubes in the test tube holder and label each one as follows: 1a, 1b, 2a, 2b
2. Pour 10 mL of vinegar into test tubes 1a and 2a.
3. Pour 10 mL of water into test tubes 1b and 2b.
4. Measure 1 tsp (5 grams) of baking soda and pour it inside 2 of the 4 balloons.
5. Measure 5 grams (1 tsp) of baking powder and pour it inside the other 2 balloons.
6. Put each balloon in the mouth of the test tubes (making sure that you do not drop the baking soda or the baking powder inside) covering the entire mouth of the test tube.
7. Lift each one of the balloons (one at a time) just enough to release the baking soda or baking powder inside the test tube: 1a, 1b, 2a, 2b.
8. Observe and record observations in the table below for each one of the test tubes.

Observations:

1a (vinegar+ baking soda)	*1b (water+ baking soda)*	*2a (vinegar + baking powder)*	*2b (water + baking powder)*
Possible answers may include formation of bubbles, balloon inflates rapidly	Possible answers may include that there is no reaction, balloon doesn't inflate	Possible answers may include formation of bubbles, balloon inflates very slowly	Possible answers may include formation of small bubbles, balloon inflates very slowly

Using the check list, answer the following questions

Analyze:

- What type of change (physical or chemical) did you see in this experiment? What evidence supports your answer?
- Vinegar and Baking soda- Chemical (Considerable formation of gas, bubbling, drop of temperature)
- Water and Baking soda- Physical (No reaction, the baking soda will dissolve in the water)
- Vinegar and Baking powder-Chemical (Medium formation of Gas, very little drop of temperature, little bubbles)
- Water and Baking soda- Chemical (Small formation of gas, very little drop of temperature, little bubbles)
- Did the experiment support your prediction? What evidence supports your answer? Answers will change depending on the students' predictions

Station 2: Dissolving a substance (Adopted from ACS Chemistry for Life: Inquiry in Action http://www.inquiryinaction.org/classroomactivities/activity.php?id=16)

Inquiry Question: Does colored sugar dissolve equally well in water, vegetable oil, and alcohol? Prediction Answers will vary

Make colored sugar

Materials

- Sandwich Ziploc bag
- Sugar
- Food coloring
- Alcohol
- Water
- Vegetable oil

Procedure

1. Your teacher will give you a plastic bag with 1 tablespoon of sugar in it. Add 1 drop of food coloring to the sugar.
2. Leaving air in the bag, seal the bag securely.
3. Shake the bag vigorously until the sugar is thoroughly colored.

Conduct the experiment

Procedure

1. Add 1 teaspoon of colored sugar to 1 tablespoon of water; add 1 teaspoon of colored sugar to 1 tablespoon of alcohol, and add 1 teaspoon of colored sugar to 1 tablespoon of vegetable oil.
2. Stir each with a clean Popsicle stick.
3. Record your observations below in the table below.

Observations

Water	Alcohol	Oil
Water – the color and the sugar dissolved completely	Alcohol – the color dissolves, but the sugar does not dissolves	Oil – the color does not dissolves neither does the sugar

Analyze:

1. Describe what happens to both the color and the sugar when you stir colored sugar in each liquid. What did you do to make sure it was a fair comparison? The sugar dissolved in the water and the color blended in with the water. (Answers may vary).
2. If a substance dissolves in one liquid, will it necessarily dissolve equally well in another? No
3. Explain your answer using evidence from your experiment. Although sugar dissolved in water, it did not dissolve in the alcohol or the oil. (Answers may vary)
4. Let's say your teacher gave you a sample of water and a sample of isopropyl rubbing alcohol but did not tell you which one was which. Assuming you had no colored sugar; do you think dissolving salt or some other solute might help you identify the liquids? Why or why not? Yes because salt will dissolve in water but it will not dissolve in alcohol.

Blackline Master #2

Physical and Chemical Changes Checklist

Physical Change

_____ Change in state of matter

_____ Change in color

_____ Change in density

_____ The identity of the substances didn't change

Chemical Change

_____ Formation of gas or bubbles

_____ Change in temperature happened when the substances were added together.

_____ Formation of a precipitate (solid)

_____ Change in color

Physical and Chemical Changes Checklist

Physical Change

_____ Change in state of matter

_____ Change in color

_____ Change in density

_____ The identity of the substances didn't change

Chemical Change

_____ Formation of gas or bubbles

_____ Change in temperature happened when the substances were added together.

_____ Formation of a precipitate (solid)

_____ Change in color

Blackline Master # 3

Identify the Unknown Substance

Background: Baking powder is a combination of different powders—baking soda, cream of tartar, and cornstarch. There are two of these ingredients that react when water is added to the mixture to release a gas, CO_2.

Objective: identify the unknown substance in baking powder that reacts with water.

Inquiry question: Which two substances in baking powder react with water to release CO_2 (gas)?

Prediction: _____

Identify:

A. Independent variable: _____

B. Dependent variable:_____

C. Control group:_____

Materials for each group

- Baking soda
- Baking Powder
- Cornstarch
- Cream of tartar
- Water
- 4 beakers

Procedure

1. Label 4 beakers: 1, 2, 3, 4
2. In beaker 1 mix 5 grams (1 tsp) of cream of tartar with 5 grams (1 tsp) of corn starch.
3. In beaker 2 mix 5 grams (1 tsp) of cream of tartar with 5 grams (1 tsp) of baking soda.
4. In beaker 3 mix 5 grams (1 tsp) of baking soda with 5 grams (1 tsp) of corn starch.
5. In beaker 4 add 10 grams (2 tsp) of baking powder.
6. Place a thermometer in each one of the beakers and record the initial temperature.
7. Add 10 mL of water to beaker 1, observe and record observations.
8. Repeat step 7 with beaker 2, beaker 3, and beaker 4.

Table Selection	Cream of Tartar + Baking Soda	Baking Soda + Corn Starch	Corn Starch + Cream of Tartar	Control group
Water				

1. What two substances react with water to produce gas?

_____

_____

2. Was this a chemical or a physical change? Explain your answer

_____

_____

_____

3. What two substances underwent physical changes when water was added? Explain your answer.

_____

_____

_____

Answers

Identify the Unknown Substance

Background: Baking powder is a combination of different powders—baking soda, cream of tartar, and cornstarch. There are two of these ingredients that react when water is added to the mixture to release a gas, CO_2.

Objective: identify the unknown two substances in baking powder that reacts with water.

Inquiry question: Which two substances in baking powder react with water to release CO_2 (gas)?

Prediction: _Answers will vary _____

Identify:

A. Independent variable: _The combination of powders: cream of tartar and baking soda, cream of tartar and cornstarch, and cornstarch and baking soda_____

B. Dependent variable:_The formation of bubbles _____

D. Control group:_The sample with baking powder only _____

Materials for each group

- Baking soda
- Baking Powder
- Cornstarch
- Cream of tartar
- Water
- 4 beakers
- Thermometer

Procedure

1. Label 4 beakers: 1, 2, 3, 4
2. In beaker 1 mix 5 grams (1 tsp) of cream of tartar with 5 grams (1 tsp) of corn starch.
3. In beaker 2 mix 5 grams (1 tsp) of cream of tartar with 5 grams (1 tsp) of baking soda.
4. In beaker 3 mix 5 grams (1 tsp) of baking soda with 5 grams (1 tsp) of corn starch.
5. In beaker 4 add 10 grams (2 tsp) of baking powder.
6. Place a thermometer in each one of the beakers and record the initial temperature.
7. Add 10 mL of water to beaker 1, observe and record observations.
8. Repeat step 7 with beaker 2, beaker 3, and beaker 4.

Test Solution	Baking Soda + Cream of Tartar	Baking Soda + Corn Starch	Corn Starch + Cream of Tartar	Baking Powder Control group
Water	Bubbling	No change	No change	Bubbling

4. What two substances react with water to produce gas? When water was added, the mixture of baking soda and cream of tartar produced bubbles

5. Was this a chemical or a physical change? Explain your answer This was a chemical change because when water was added to the mixture of cream of tartar and baking soda the production of gas was observed.

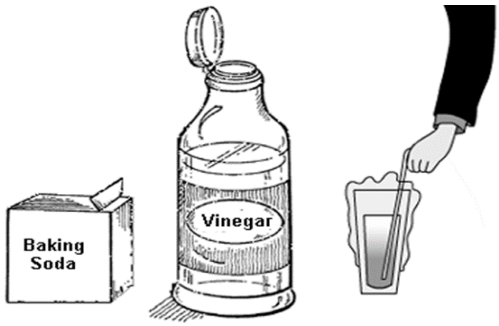
6. What two combinations underwent physical changes when water was added? Explain your answer. When water was added to the mixture of either cream of tartar and cornstarch, or corn starch and baking powder no new substances were formed, and no significant temperature changed was noticed.

Blackline Master # 4

Name:_____ Period:_____ Date:_____

Physical and Chemical Changes

1. Identify what the reactants are in a chemical reaction.



A) the substances that result from the reaction
B) the substances that change as a result of the reaction
C) the substances that change as a result of and from the reaction
D) neither the changing nor resulting substances

2) Which of the following is not evidence of a chemical change?

A) change in state of matter
B) change in temperature
C) change in color
D) change in odor

3. Identify what the products are in a chemical reaction.

A) the substances that result from the reaction
B) the substances that change as the result of the reaction
C) the substances that change as a result of and from the reaction
D) neither the changing nor resulting substances

4. David's mother made a concentrated sugar syrup by dissolving sugar in hot water. On cooling, crystal of sugar got separated. This indicates a:

A) Physical changes can be reversed
B) Chemical changes can be reversed
C) Physical changes can not be reversed
D) Chemical changes can not be reversed

5. Which is of the following statement is **incorrect** for a **chemical change**?

A) Heat may be given out but, never absorbed
B) Sound may be produced
C) A color change may take place
D) A gas may be evolved

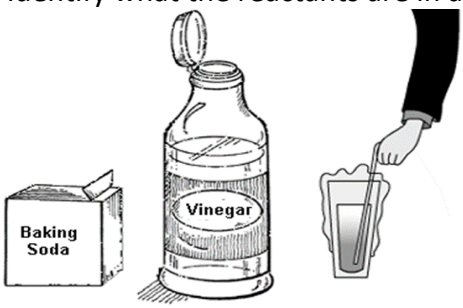
6. Two drops of sulfuric acid were added to 1g of copper sulfate powder and then a small amount of hot water was added to dissolve it (step 1). On cooling, beautiful blue colored blue crystal, got separated, (step 2). Step 1 and 2 are:

A) chemical and physical changes respectively
B) physical and chemical changes respectively
C) both physical changes
D) both chemical changes

Name:_____ Period:_____ Date:_____

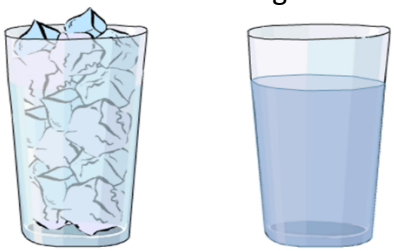
Physical and Chemical Changes

1. Identify what the reactants are in a chemical reaction.



A) the substances that result from the reaction
B) the substances that change as a result of the reaction (Correct)
C) the substances that change as a result of and from the reaction
D) neither the changing nor resulting substances

2) Which of the following is not evidence of a chemical change?



A) change in state of matter (Correct)
B) change in temperature
C) change in color
D) change in odor

3. Identify what the products are in a chemical reaction.

A) the substances that result from the reaction (Correct)
B) the substances that change as the result of the reaction
C) the substances that change as a result of and from the reaction
D) neither the changing nor resulting substances

4. David's mother made a concentrated sugar syrup by dissolving sugar in hot water. On cooling, crystal of sugar got separated. This indicates a:

A) Physical changes can be reversed (Correct)
B) Chemical changes can be reversed
C) Physical changes can not be reversed
D) Chemical changes can not be reversed

5. Which of the following statement is **incorrect** for a **chemical change**?

A) Heat may be given out but, never absorbed (Correct)
B) Sound may be produced
C) A color change may take place
D) A gas may be evolved

6. Two drops of sulfuric acid were added to 1g of copper sulphate powder and then a small amount of hot water was added to dissolve it, (step 1). On cooling, beautiful blue colored crystals were formed. (step 2). Step 1 and Step 2 are : (Identify the changes in each step in order).

A) chemical and physical changes respectively
B) physical and chemical changes respectively (Correct)
C) both physical changes
D) both chemical changes