

### Lesson Plan Format

Author: Louise Liable-Sands,  
Andi Martin

Topic or Unit of Study: Chemical Changes - Volcano Reaction

Grade/Level: 4<sup>th</sup> – 6<sup>th</sup>

Lesson Start and End Time: 40 min

### Outcomes

#### Academic Standards:

PDE Standards:

3.2.4.A4

- Combining two or more substances may make new materials with different properties.

3.2.6.A4

- Differentiate between physical and chemical changes.

Next Generation Science Standards:

5-PS1-3. Make observations and measurements to identify materials based on their properties.

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances

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.

Objectives: SWBAT understand chemical reactions by providing evidence to support the claim of either a physical or chemical change in each of the four activities.

Instructional Materials: Be sure to name materials and resources so that they match your descriptions in the procedure of the Lesson Plan. List all websites or texts according to APA reference procedures.

#### Pre-Trip Information

Teachers review physical properties with students -

- Three states of matter
- Physical properties: Color, odor, can you see light through it, etc.
- Definitions of chemical change, physical change
- Chemical change – changes chemical composition (chemical formula changes)
- Physical change – most common type is physical change of state (s, l, g; water is a good example)

#### Helpful Websites

Chemical Changes: Crash Course Kids [https://www.youtube.com/watch?v=37pir0ej\\_SE](https://www.youtube.com/watch?v=37pir0ej_SE) (3:50 min)

- This would be a good video to do pre-lesson.

Teacher - What will the teacher need?

Below is a list of materials needed for each experiment:

- Introduction/Closure: ice cubes and beaker
- Teacher demo: 1 mL Iron (II) Nitrate solution and 1 mL Potassium Thiocyanate solution, beaker, pipets
- Calcium Chloride: Container of calcium chloride, 25 mL water, beakers, thermometers, tablespoons
- Phenolphthalein: phenolphthalein solution in a dropping bottle, sodium hydroxide solution, vinegar,

beakers

- Calcium Chloride + Sodium Hydroxide: calcium chloride solution, sodium hydroxide solution, test tubes, pipets/droppers
- Volcano materials: Baking soda, 16 oz. water bottles, 50 mL vinegar
- General materials: tablespoons, beakers, test tubes, pipets, temperature probes, safety glasses, waste disposal

Student – What will each student or group of students need?

- Pen/Pencil
- Lab notebooks
- Observation form

### Procedures with Time Span

Introduction (time span - 5 minutes): Informing Students of objectives and rationale for the lesson, Gaining Attention, Activating Background Knowledge, Inquiry into the topic/concept.

Safety

- **Safety glasses at all times**
- Do not pour anything down the drain – waste disposal
- If there is a spill – let an adult know (you're not in trouble)

Share Objectives

ASK: When we mix two things together, how do we know a chemical or physical change occurs? What would you expect to observe? What might change?

Answer: If you can observe the below changes, a chemical change may have occurred.

- Solid forms
- Gas forms
- Temperature changes
- Odor changes
- Color changes

Developmental Activities (time span – 45 minutes): Guided Practice, Checkpoints for Understanding, Independent Practice.

Teacher demo – 5 minutes

Student demos (10 min each – activity + observations/discussion)

3 parts to every observation

1. What are your observations before mixing?
2. What are your observations after mixing?
3. Conclusions: Physical or Chemical change? Support with your observations
  - a. This is P/C because....

Go through one teacher demo and four student activities. After each demo, pause for a discussion of

observations.

- Go through three steps of observations.
- Is it a physical or chemical change? Tell me why.

### Teacher Demo – Iron (II) Nitrate solution and Potassium Thiocyanate solution

#### 1. **Mixing two Liquid Solutions** – Mixing 0.1 M iron (III) nitrate solution and 0.1 M potassium thiocyanate solution

*Purpose: Students to observe color change.*

- i. Materials: Iron (II) Nitrate solution and Potassium Thiocyanate solution, beaker, disposable pipets
- ii. Instructions:
  1. Obtain a container of 0.1 M iron (III) nitrate solution and 0.1M potassium thiocyanate solution, one small test tube, a test tube rack, and two disposable pipets.
  2. **Record at least three (3) physical properties** that describe each material below.
  3. Using a disposable pipet, add 20 drops (~1 mL) of 0.1 M iron (III) nitrate solution to a small test tube.
  4. To the same test tube, add 20 drops (~1 mL) of 0.1M potassium thiocyanate solution.
  5. While holding the test tube, flick the bottom of it to mix the two liquids.
  6. Record observations **in your lab notebook first** and then **transfer the information neatly** onto the observation form.
  7. When finished, give the test tube to your instructor for disposal.

#### Observations for mixing iron (III) nitrate solution and potassium thiocyanate solution

**Determine whether a physical or chemical change occurred when mixing iron (III) nitrate solution and potassium thiocyanate solution and document on the observation form. Be sure to support your claim with your observations!!!**

### Student Activities

Break students into pairs to complete each student demo.

Have one student grab a tray of materials (trays are set up on the side beforehand).

#### 1. **Mixing a Solid with Water**

##### A. **Mixing sugar and water**

*Purpose: Students to observe the physical change of dissolution.*

- i. Materials: sugar, 25 mL deionized water, and 50 mL beaker
- ii. Instructions:
  1. Obtain a container of sugar and a wash bottle of deionized (DI) water.

2. Record **at least three (3) physical properties** that describe each material below.
3. Add approximately 25 mL of DI water to a 50 mL beaker.
4. Add 1 – 2 scoops of sugar to beaker and **stir**.
5. Record observations.

#### **B. Mixing calcium chloride and water**

*Purpose: Students to observe temperature change.*

- i. Materials: calcium chloride, 25 mL deionized water, and 50 mL beaker, thermometer
- ii. Instructions:
  1. Obtain a container of calcium chloride and a wash bottle of deionized (DI) water.
  2. Record **at least three (3) physical properties** that describe each material below.
  3. Add approximately 25 mL of DI water to a 50 mL beaker.
  4. Add 3 – 4 scoops of calcium chloride to beaker and **stir**.
  5. Insert a thermometer into the solution and record initial and final temperatures.
  6. If no temperature change is observed within one minute, add another 2 – 3 scoops of calcium chloride to beaker and stir.
  7. Record observations.

### **2. Phenolphthalein**

*Purpose: Students to observe color change.*

#### **A. Mixing phenolphthalein and vinegar**

- i. Materials: phenolphthalein solution in a dropping bottle, vinegar, beaker
- ii. Instructions:
  1. Add phenolphthalein to vinegar in a beaker.
  2. Observe what happens in each mixture (*mixture in vinegar stays colorless*).
  3. Record observations.

#### **B. Mixing phenolphthalein and sodium hydroxide**

- i. Materials: phenolphthalein solution in a dropping bottle, sodium hydroxide solution, beaker
- ii. Instructions:
  1. Add phenolphthalein solution to sodium hydroxide solution in a beaker.
  2. Observe what happens in each mixture (*mixture in sodium hydroxide will turn pink*).
  3. Record observations.

### **3. Mixing two Liquid Solutions – Calcium chloride and Sodium hydroxide Solutions**

*Purpose: Students to observe formation of a solid.*

- i. Materials: 0.1 M calcium chloride solution and 10% sodium hydroxide solution, test tube, and disposable pipets
- ii. Instructions: Mixing 0.1 M calcium chloride solution and 10% sodium hydroxide solution
  1. Obtain a container of 0.1 M calcium chloride solution and 10% sodium hydroxide

solution and one small test tube.

2. Record **at least three (3) physical properties** that describe each material below.
3. Using a disposable pipet, add 20 drops (~1 mL) of 0.1 M calcium chloride solution to a small test tube.
4. To the same test tube, add 20 drops (~1 mL) of 10% sodium hydroxide solution.
5. While holding the test tube, flick the bottom of it to mix the two liquids.
6. Record observations.

#### 4. Volcano reaction

*Purpose: Students to observe formation of a gas and the solid disappears.*

- i. Materials: baking soda, 50 mL vinegar, beaker, and teaspoon
- ii. Instructions: Mixing baking soda and vinegar
  1. Get a container of baking soda and vinegar.
  2. Record **at least three (3) physical properties** that describe each material on the observation form.
  3. Place approximately 50 mL of vinegar in a dry 150 mL beaker.
  4. Add one scoop of baking soda to the vinegar in the beaker.
  5. Record observations.

#### Make observations and claims after each activity -

- What do you see?
- What are your observations? Students need to name three observations.
- Is it physical or chemical? Tell me why.
  - o You have to make a choice and support it with evidence. *Students should be able to distinguish between P/C.*

Closure/Summary (time span – 5 minutes): Making connections, Summarizing/Generalizing learning

Talk about claiming physical or chemical change that must be supported by observations (evidence).

- What are some of the observations you used to support physical change?
- What are some of the observations you used to support chemical change?

Assessment: Name the task used in your introduction, development or closure that documents student achievement of the LO.

- Observation form for the teacher demonstration and four student activities

Rating Scale: Rubric or other measure of student achievement of LO:

**3 – Exemplary:** The observations and claims are accurate for all four student activities.

**2 – Proficient:** The observations and claims are accurate for most of the activities, but more detail could enhance the students' explanations.

**0-1 – Unacceptable:** The observations and claims are inaccurate for most of the activities; or the task was not submitted.

## Observation Form

Student Name:

<b>Teacher Demonstration Solution A + Solution B (Iron (II) Nitrate + Potassium Thiocyanate)</b>	
Observations BEFORE mixing:	
Solution A	Solution B
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
Observations AFTER mixing:	
_____	
_____	
_____	
Circle one: Physical or Chemical Change	
Evidence from observations to support your choice.	
_____	
_____	
_____	



<p align="center"><b>Student Activity #2 A</b>  <b>Solution A + Solution B (Phenolphthalein + Vinegar)</b></p>	<p align="center"><b>Student Activity #2 B</b>  <b>Solution A + Solution C (Phenolphthalein + Sodium Hydroxide)</b></p>																
<p>Observations BEFORE mixing:</p> <table border="0"> <tr> <td data-bbox="235 321 619 358">Solution A</td> <td data-bbox="621 321 1047 358">Solution B</td> </tr> <tr> <td data-bbox="235 402 619 440">1. _____</td> <td data-bbox="621 402 1047 440">1. _____</td> </tr> <tr> <td data-bbox="235 483 619 521">2. _____</td> <td data-bbox="621 483 1047 521">2. _____</td> </tr> <tr> <td data-bbox="235 565 619 602">3. _____</td> <td data-bbox="621 565 1047 602">3. _____</td> </tr> </table> <p>Observations AFTER mixing:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Circle one: Physical or Chemical Change  Evidence from observations to support your choice.</p> <p>_____</p> <p>_____</p> <p>_____</p>	Solution A	Solution B	1. _____	1. _____	2. _____	2. _____	3. _____	3. _____	<p>Observations BEFORE mixing:</p> <table border="0"> <tr> <td data-bbox="1050 321 1434 358">Solution A</td> <td data-bbox="1436 321 1860 358">Solution C</td> </tr> <tr> <td data-bbox="1050 402 1434 440">1. _____</td> <td data-bbox="1436 402 1860 440">1. _____</td> </tr> <tr> <td data-bbox="1050 483 1434 521">2. _____</td> <td data-bbox="1436 483 1860 521">2. _____</td> </tr> <tr> <td data-bbox="1050 565 1434 602">3. _____</td> <td data-bbox="1436 565 1860 602">3. _____</td> </tr> </table> <p>Observations AFTER mixing:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>Circle one: Physical or Chemical Change  Evidence from observations to support your choice.</p> <p>_____</p> <p>_____</p> <p>_____</p>	Solution A	Solution C	1. _____	1. _____	2. _____	2. _____	3. _____	3. _____
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<p align="center"><b>Student Activity #3</b></p> <p align="center"><b>Solution A + Solution B (Calcium Chloride + Sodium Hydroxide)</b></p>	<p align="center"><b>Student Activity #4</b></p> <p align="center"><b>Solution A + Substance B (Vinegar + Baking Soda)</b></p>																
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