**Solid, Liquid, & Gas: Phase Changes, Temperature, and Physical Properties**

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**Overarching Question:** What observations and measurements of physical properties of matter explain phase changes between solid, liquid, and gas?



How do I identify the differences between solid, liquid, and gas?

What is a phase change?

How does temperature play a part in a phase change?

How do I identify the differences between solid, liquid, and gas?

What is a phase change?

How does temperature play a part in a phase change?

Are interactive notebooks effective?

How are interactive notebooks organized?

How are interactive notebooks assessed?

**Overarching Question:** What observations and measurements of physical properties of matter explain phase changes between solid, liquid, and gas?

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| **Line of Evidence – Paper Changes** |
| *In this activity, the teacher introduces a phase change to the students. The teacher starts out with a sheet of paper and tries different ways to change it. They still only have paper until it is combined with fire which causes a phase change and change in physical properties.* |

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| **Line of Evidence – Preparing to Investigate** |
| *During this activity, the students visit different stations that have different types of solids, liquids, and gases. They will have to determine and record what each item is at the station, and explain whether it is a solid, liquid, or gas.* |

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| **Line of Evidence – Let’s Make Butter** |
| *The heavy cream particles in the jar heat up when the jar is shaken vigorously. Therefore, the temperature in the jar causes the phase change creating butter.* |

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| **Big Aha Thesis Statement** |
| *All matter goes through different phase changes of solid, liquid, and gas. Matter also consists of physical properties that can be changed; the changes can be observed and measured by the amount of time that passes during the change or by the amount of something being added to cause the phase change.* |

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**Engage – Paper Changes**

During these questions you can have the students write down their observations of what happens each time the teacher changes the paper. This engagement activity is also going to introduce not only physical properties, but also chemical properties. Questions: “Do we still have paper, though shape or size has changed?” “What is different about the paper now?”

|  |  |  |
| --- | --- | --- |
| **Change** | **Observations/Result** | **Drawing of Result** |
| Crumbling the paper | Wrinkled, still paper |  |
| Fold the paper | Still paper |  |
| Tearing the paper | Two pieces of paper, still paper |  |
| Burning the paper | Color changed, texture changed |  |

Boyden, C. (2016, July). BetterLesson: Empowering Teachers' 'Professional Learning'. *Lesson Day 1 Physical Vs Chemical Changes | BetterLesson.* Retrieved March 21, 2017, from <http://betterlesson.com/lesson/638994/day-1-physical-vs-chemical-changes>

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**Explore – Preparing to Investigate**

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**Preparing to Investigate CER & Answers**

**Claim** (Write a sentence stating the reasoning for making a predication before an investigation.)

Because the whole point of an investigation or experiment is to test the prediction or hypothesis, to see if you were correct.

**Evidence** (Provide one of your predictions that you made before the investigation. Explain whether or not your prediction was correct.)

Prediction: The milk and vinegar will mix, bubble, and have a foul smell.

My prediction was somewhat correct. The milk and vinegar did mix and smell; however, when the two items were mixed they formed lumps or curds.

**Reasoning** (Explain how your evidence supports your claim. Describe how predictions are not always correct.)

We made our predictions before starting the investigation, so that we could test them to see if we were correct. However, not all of our predictions were correct. Predictions are just guesses of what will happen or what the cause is.

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**Explain – What’s the Matter? Flip Chart**

King, H. (2013,). Elementary Shenanigans. *Elementary Shenanigans: Chicks, Eggs, Matter...& MORE!* Retrieved March 2, 2017, from http://www.elementaryshenanigans.com/2013/03/chicks-eggs-matter-more.html

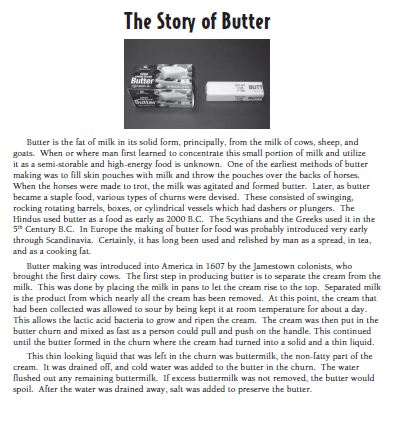
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| (Terms)  Solid, Liquid, Gas | (Definition)  Solid- fixed shape, fixed volume, atoms are tightly touching.  Liquid- no fixed shape, fixed volume, atoms have breathing room and can move around somewhat.  Gas- no fixed shape or volume, atoms are free to move about as they wish. |  |
| Physical Properties | Properties of matter that can be observed or measured without changing the identity of the matter.  Examples: color, shape, taste, density, smell, size, hard, soft, |
| Phase Changes | Phase change- change from one state (solid or liquid or gas) to another without a change in chemical composition. |
| Temperature | When a temperature increases, the particles of matter speed up and move more freely. (liquid to gas; boiling water)  When the temperature decreases, the particles of matter slow down. (liquid to solid; water to ice) |
|  |  |

**Elaborate – Let’s Make Butter!**

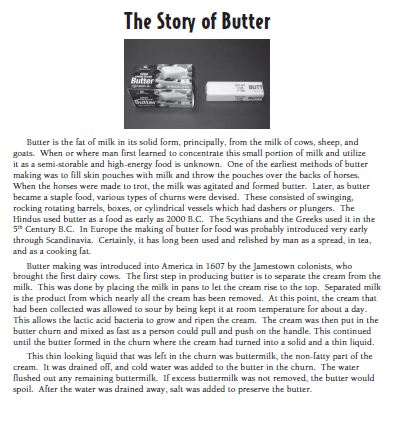
Room 6, T.I. (2015, April 10). Bloglovin'. *Colonial Science and Making Butter | Teaching in Room 6 | Bloglovin’.* Retrieved March 21, 2017, from http://www.bloglovin.com/blogs/teaching-in-room-6-3939351/colonial-science-making-butter-4279747321



LessonPlans, U. (2008, June 14). Utah Education Network. *Hidden Science in Colonial Living.* Retrieved March 21, 2017, from http://www.uen.org/Lessonplan/preview.cgi?LPid=21547

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**\*Students will have a chart/table like this that they will fill out before, during, and after the activity. They will fill in the boxes under each subheading with their observations. This is an example of what would be wrote in the table. (This table will work as the observations and final results)**

**BUTTER IN A JAR OBSERVATIONS**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Before:** | **During:** | **After:** |
| **State of matter** | liquid | Partly liquid, partly solid (transforming) | solid |
| **Is there a phase change occurring? If yes, what is it?** | No | Yes, the heavy whipping cream is changing from the liquid state to a solid. | The liquid is now a solid. |
| **What happens inside the jar?** | Nothing | The cream is changing to a solid due to the shaking motion, which causes the temperature to rise in the jar. | We now have butter in a jar. |

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**Let’s Make Butter! CER & Answers**

**Claim** (Write a sentence stating what phase change will occur to the whipping cream when the temperature changes.)

The whipping cream will change from liquid to solid as the temperature rises while shaking.

**Evidence** (Provide evidence from the activity to support your claim. Describe how you knew or could tell a phase change was occurring.)

As we shook the jar we could fill and hear the change in the state from solid to liquid. We opened the lid after 3 minutes, 5 minutes, and 7 minutes which is when we were able to see the phase changes.

**Reasoning** (Explain how your evidence supports your claim. Describe how making the butter in a jar was possible.)

Making butter in a jar out of whipping cream is possible when you only fill the jar half way, so there is room for it to change. Also, by shaking the jar the liquid changes to a solid as the particles speed up and heat up.

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**Evaluate- Assessment Questions & ANSWERS**

1. Short answer. What is matter?

Matter is anything that takes up space.

1. Has fixed volume, and fixed shape?

A. liquid

B. solid

C. gas

1. Which has the ability to let the atoms move freely without touching?

A. gas

B. liquid

C. solid

1. Something that takes shape of its container and can be poured, flow, and spill is a \_\_\_\_\_\_\_\_\_.

Liquid

1. Draw a picture for each state of matter. Think back to the butter in a jar activity we did.



Gas Liquid Solid

1. Short answer. How does a phase change happen? Explain with each state of matter.

A phase change can occur when heat is added to a solid or liquid such as water which then turns it to a gas. A phase change can also occur when you cool a substance of matter which then turns it to a solid.

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**Big Ah-Ha Thesis**

The purpose of this unit was to understand the differences between solid, liquid, and gas. As well as, understanding phase changes and the role of temperature in a phase change. We also went over the physical properties of matter. We completed an observation chart of paper changes, Preparing to Investigate lab, and the Let’s Make Butter activity to gather lines of evidence.

The first activity we did as a group was the Paper Changes. It gave us the opportunity to observe and discuss physical changes vs. chemical changes. It was very insightful for the students in beginning this unit. They were able to provide ideas on how we could make changes to the paper and then wrote down their observations of each idea we tried.

In Preparing to Investigate, the students got into groups and went around to the six stations in the classroom. At each station there was a different type of change taking place among different items. Each student is given a packet to fill out for every station. They are asked to predict what they think is going to happen at each station before conducting the experiment/investigation. These types of experiments/investigations really get the students to think about the type of change that is taking place.

Let’s Make Butter seemed to be really enjoyed by all the students. Before, actually doing the activity the students’ partner up to read and find evidence in “The Story of Butter”, and tell if it was a physical or chemical change. It was a hands-on activity that allowed them to be able to experience a phase change due to temperature change. This is the type of learning experience that will stick with the students and be easy to remember with physical and phase change.

Each of our learning activities was a line of evidence. They helped us explain the difference in solid, liquid, and gas; as well as, how a phase change occurs.

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