NSTA Connection

Solids, Liquids, and Gases Lesson

Unit: Solids, Liquids, Gases
Lesson #6: How Does Matter Change State?
Created by Seth Marie Westfall

Learning Target:

- Students will have a general understanding of matter, that it can change forms, and that something must happen to the matter in order for it to change.

Success Criteria: I can...

- explain what matter is.
- explain how the particles in solids, liquids, and gases are structured differently.
- explain the freezing and boiling points of matter.
- explain and prove that different items have different freezing, melting, and boiling points.
- apply what I have learned about changing states of matter in the creation of a tool to make an ice pop.

Materials:

- science notebook
- ice cubes
- one flask
- one hot plate
- one balloon
- iPads, ChromeBooks, laptops, or other research tools
- oil
- vinegar
- eggs
- Alka-Seltzer
- water
- corn starch

Preassessment:

- In your science notebook create a chart listing examples of solids, liquids, and gases that you encounter daily.
- Under your chart, tell me what you know about solids, liquids, and gases with as much detail as possible.
- What do you know about matter changing from one state to another?

Demonstration:

- Show the ice cubes in the flask. Show the hot plate. Have students share with their shoulder partner what will happen when you put the flask on the hot plate. Then they should write their prediction in their science notebooks.

- Place a balloon around the opening of the flask. Have the students share with their shoulder partner what will happen when you put the flask on the hot plate. Then they should write/draw their prediction in their science notebook.
- Put the ice cubes in the flask and place the flask on the hot plate. Have students watch what happens. The ice should melt and the balloon should slowly start to fill and expand.
- Have students discuss with their table partners why they think the balloon is expanding and what is causing it.
- Ask students to share with their shoulder partners what will happen if you take the flask off of the hot plate and let it cool down.
- Take the flask off of the hot plate. As it is cooling down, have a discussion with the class about what was actually happening during this demonstration. Include the terms melt, evaporate, and freeze into the discussion as the opportunity comes up. Encourage students to use these terms throughout the course of the discussion.
- Have the students draw a picture sequence showing each step in the demonstration. There should be an explanation of each step and what is happening in that step. Provide an opportunity for students to share their sketches and explanations with peers; possibly through a mix-pair-share. (The explanation should have the fact that in order to change states there must be heating up or cooling down. This will be expanded on later in the lesson.)

Student Brainstorm/Research:

- Ask students in either partners or small groups to brainstorm a list of materials that can change states. They should make that list on a piece of chart paper. If they are having a hard time, they can use the iPads or Chromebooks to research matter that changes states.
- Have each group share their lists while you make a master list to display in the classroom.
- Use these examples to begin the discussion about whether or not these examples can change from one state to another and then back to the original state. Underline those that cannot be reversed.
- Some more examples of changes that cannot be reversed are:
    - cooking an egg
    - baking a cake
    - mixing oil, vinegar, and egg yolk to make mayonnaise
    - dropping Alka-Seltzer tablets into water to produce a gas
    - adding corn starch to water to make Oobleck

- Bring in some of these items and have different groups experiment with the mayo, Oobleck, and tablets so they can explain it firsthand.
- Each group can then create a poster explaining how their materials changed from one state of matter to another and how they know it changed. Take a picture of each poster so that it can be printed out and glued into their science notebooks.

Literacy:

- Read the article “Melting and Boiling” or “Changing States of Matter” (*www.ducksters.com/science/melting_and_boiling.php*) or (*www.chem4kids.com/files/matter_changes.html*)

- Have kids highlight the facts about freezing point, melting point, and boiling point.
- In groups or partners kids should share the facts they found and discuss similarities and differences in what they highlighted. What did you learn about these points? How do these facts relate to the demonstrations we have seen so far?
- In their science notebook, they should look back at the pictures and notes taken for the flask demonstration and the changing states (reversible/irreversible). They should write an explanation and draw a picture of how they know these points have been met. Do all substances have the same freezing, melting, and boiling points? What evidence do they have to support that claim?

Lab Activity:

- Have students examine an old-fashioned ice cream maker. In small groups have them discuss the design of that ice cream maker, how it works, and why they think it was designed that way.
- They should draw a picture of the ice cream maker and label the parts to explain the purpose. They will then share that picture with the whole class explaining how the ice cream maker works. Hang those pictures up on the wall.
- Explain to the class that they are going to use this design to help them design and create their own "freezers" in order to make their own ice pops.
- List out the materials they will have available: plastic bucket, ice, salt, newspaper, Ziploc baggies, water, juice mix, spoon, funnel, pitcher.
- Each group will have to design the best "freezer" possible to make and freeze their ice pops. They will then share their designs with the class and explain how they should work. Kids from the class should have an opportunity to ask questions about the design and why the group thinks it will work.
- Each group should have an opportunity to revise their design based on the questions or suggestions from the class.
- Then each group will build their "freezer" and make their ice pops.
- After 2 hours return to their "freezers" and have each group decide if their design was successful. Share these results with the class.
- Have a discussion about each design and decide what made each successful or not successful. Make sure to include the ideas of insulation, freezing point, and energy transfer.
- You may need to explain that the salt put into the ice changes the freezing point from 0˚ to -20˚. This means that when you add the salt to the ice it allows the ice to start melting immediately. In order for this to happen, energy (heat) is drawn away from the juice in the Baggies, which then allows the juice to freeze.

Assessment:

- Students should glue their designs into their science notebooks. On the next page they should draw a picture of the ice cream maker studied at the beginning of the lab, label it, and explain their understanding of how the parts work to make ice cream.
- Did their freezer work? Why or Why not? How would they change it to make it more successful? What materials might they use?

Engineering of Sound

Unit: Engineering of Sound

Lesson #6: What Is Pitch? How Can We Make High- and Low-Pitched Sounds?

Created by Seth Marie Westfall

Learning Target:

- Students will understand that pitch is dependent on the frequency of the sound wave vibrations and that the frequency is dependent on the material being used.

Success Criteria: I can...

- describe high- and low-pitched sounds.
- explain different ways to make high- and low-pitched sounds by using the size of objects.

Materials:

- 3 metal tubes of different lengths
- 1 foam base
- 1 rhythm stick
- 3–4 rubber bands of different widths for each group
- 1 sound box for each group
- science notebooks

Preassessment:

- In their groups or with a partner have students make a list of questions they have regarding the pitch of sound.
- Have students share out when they talked about.
- Encourage students to add to or revise this list as they complete the sections of this lesson.

Demonstration:

- Give each group a wooden box and 3 different sized rubber bands. Ask them to experiment with plucking the rubber bands and making observations among them.

- Share out with the class what they noticed about the size of the rubber band and the sound it made.
- Guide students to the understanding that the larger the rubber band, the slower it vibrates, creating a lower pitch. Guide them also to the understanding that when they stretch the rubber band it increases the frequency, increasing the pitch.

Literacy:

- Read *Higher and Lower* (de Pinna, S. 1998) and *Sound* (Raintree Steck-Vaughn Publishers 1998).
- Find information relating to the pitch of sound and how it relates to size or frequency (how fast) something is vibrating.
- Draw a picture on the board showing what the sound waves look like in a high pitched sound versus a low pitched sound.

Lab Activity:

- Show the students the materials they will be using (metal tubes of different lengths, foam pad, wooden stick). Tell them they will be using these materials to define pitch and decide what characteristics cause difference in pitch.
- Students should discuss their ideas about pitch with their partners. They should then discuss a plan for testing their ideas.
- Students then get their materials and begin their tests. Observations should be documented in a chart describing the differences between the varying tubes.
- They should then make a claim defining pitch and its characteristics. What characteristics affect pitch? How do their observations support their claim?

Assessment:

- Use their chart or table displaying the size of the metal tube and the pitch. Their explanation or conclusion should relate the size of the tube, the frequency (how fast) the rubber band was vibrating, and the pitch of that sound.

Grading Rubric, 2nd Grade Science and Literacy

	4 - Advanced	3 - Proficient	2 - Approaching	1- Limited
Science Content	-Extended understanding of facts/knowledge, vocabulary, content -Describes facts and information accurately, with detail and examples -Analyzes content knowledge to give detailed explanation of concepts -Draws conclusions to make connections between concepts, content, & real world	-Basic understanding of facts/knowledge, vocabulary, content -Knows & describes relevant facts & information -Uses vocabulary correctly when explaining ideas -Explains concepts & content accurately	-Understands some facts/knowledge, vocabulary, content -Knows & describes some relevant facts & information -Attempts to use vocabulary, but may be incorrect/inaccurate -Explains some concepts & content accurately	-Limited understanding of facts/knowledge, vocabulary, content -Unable to describe facts/information, or not relevant -No vocabulary use, or incorrect -Unable to explain concepts/content accurately
Science Application	-Uses data & observations to create & defend conclusions -Designs & conducts controlled experiments/investigations	-Uses data to make valid connections and support concepts -Demonstrates observation skills -Conducts simple experiments	-Uses data to make some connections, may not be valid or support concepts -Demonstrates some observation skills -Conducts simple experiments with guidance	-Unable to make connections using data -Limited observation skills -Unable to conduct simple experiments
Literacy – Reading	-Makes connections between science content (compare/contrast, cause/effect) -Uses relevant details from text to support content	-Identifies main idea/purpose from text -Uses details from text to support ideas/purpose	-Identifies some main ideas/purpose -Supports ideas/purpose with some details, may be irrelevant/inaccurate	-Needs guidance to identify ideas/purpose -Needs guidance to find supporting details from text
Literacy - Writing	-Recall information from text or observations to make a claim, give supporting evidence, and provide relevant reasoning	-Recall information from text or observations to make a claim and give supporting evidence	-Recalls some relevant information from text or observations to make a claim and give supporting evidence, may need some guidance	-Recalls some relevant information from text or observation to answer questions, but needs guidance to make a claim or give evidence