

LESSON TITLE: Lesson 2: Science Matter Energy and Systems GRADE: 9-12

Amount of Preparation Needed Prior to Class: 10 minutes

Learning/Lesson Plan

Environmental Concepts

NGSS Standards: For more details on the standards and clarification statements click here: [NGSS](#)

In this unit we are still building the foundations that will help students address the following standards as we progress throughout this curriculum. The standards may not be directly addressed in this unit but will provide the necessary foundation as we move forward.

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

Objective(s) and Essential Questions

(What will a student know [content] and be able to do [skills/process]?)

Overview: The purpose of this lesson is to give students an overview of the major causes of environmental issues. The themes discussed in the first lesson will be revisited on several occasions throughout the course.

Objectives

- Describe the scientific method and the importance of observations, models, and proper experimentation.
- Recognize the importance and differences of evidence, hypothesis, theories, and scientific laws.
- Understand the limitations of science.
- Define matter and describe the Law of Conservation of Matter.
- Identify the pH of various items and how pH impacts living things.
- Distinguish between chemical and physical changes.
- Recognize the difference forms of energy.
- Understand the First and Second Law of the Thermodynamics.
- Identify the key components of a system.
- Describe ways a system can respond to feedback.

Essential Questions:

- What do scientists do?
- What is matter?
- What is energy?
- What are systems?

Assessments Summative and Formative

(What strategies will be employed? How will we know instruction has been successful?)

- Bell Ringers
- Exit Activities
- Mini Quizzes
- Discussions
- Lesson 2 Assessment (Summative)

Materials Needed

- Multiple types of paper towel.
- Beach Ball
- Basketball
- Tennis Ball
- Bromothymol Blue
- Pipettes
- pH Test Strips
- Computer
- Projector or a way to share a presentation
- Access to a computer lab or iPad cart or some other mean to do research
- Optional (elephant toothpaste demo)-3% hydrogen peroxide (hair developer), yeast, soda bottle)

Setting the Stage/Beginning the Lesson/Engagement* (How will new learning be introduced? How will students get motivated/excited regarding new learning? How will prior knowledge be tapped and assessed?)

Day 1 [Engagement]– Pre -Assessment (Assessing Prior Knowledge and Misconceptions of the Nature of Science)- Pre-Assessment Bell Ringer 2.1

Day 2 – Display a few different paper towels type or brands. Ask students to develop a way to rank the paper towel from best to worse. Students will complete Activity 2.2 questions one and two as part of this Bell Ringer.

Day 3 – Students will complete slide #13. “Bell Ringer: Where does a tree get its mass?” Many students fail to recognize how trees get their mass (from the CO₂/ Carbon Fixation). This is a great lead in question for the Law of Conservation of Matter.

Day 4 – Students will complete Bell Ringer 2.2. **Optional Extra Activity.** Since students discuss the Law of Conservation of Matter a fun demo you could do is the Elephant Toothpaste Demo. Here are some instructions on how to do this demo. This demo catalyzes hydrogen peroxide into oxygen and water. You could write the formula on the board and use it to discuss the Law of Conservation of Matter. **Resource:** [Elephant Toothpaste](#)

Day 5 – Energy Transfer Ball Demo: For this demo have a student help you. Drop a basketball while students observe and record how high it bounced. It may be helpful to set up several meter sticks to help with this demo. Students should record the heights on slide 23 in their notes. Next, drop a tennis ball and record how high the tennis ball bounced. Have the students predict what will happen when the tennis ball is dropped while balancing on top of the basketball. Next, drop a tennis ball and basketball together and record the how high each one bounce. The tennis ball will probably be outside of the range of your measurement, but students will clearly see the difference. What should happen? The basketball should not bounce as high and the tennis ball will bounce much higher. This occurs because the kinetic energy from the basketball is transferred to the tennis ball. Here is a video you could show and pause if you do not have the materials: https://www.youtube.com/watch?v=yhTz_6NFmV0 I could also be helpful to watch so you know what to expect and how it should look.

Day 6 Students will complete the **Lesson 2 Vocabulary Quiz**. You may choose to review prior to the quiz depend on the level of your course. When students are done with the Quiz on a piece of paper have them complete the Activity 2.3 Types of Energy Worksheet. (While students are working try to get their quizzes graded so students have some feedback prior to the assessment tomorrow.)

Acquisition of Skills/Developing the Lesson/Exploration*/Explanation*/ Elaboration* (What will Modeling, Guided Practice, Independent Practice, and Checking for Understanding look like?)

Day 1: The teacher will present slides 1-12. Students will complete the guided student notes. After completing the notes, students will work on the **Worksheet “Law vs Theory Vs Hypothesis”**

Day 2: Students will detail what the criterion they would use to determine which is best or worse (absorbance, softness, strength, etc.) using the Activity 2.2 Which Paper Towel is Best?

Day 3: The teacher will present slides 13-22. Students will complete their Guided Student Notes.

Day 4: Students will complete the pH Exploration Lab. See lab notes on the lab page of the activity.

Day 5- The teacher will present slide 23-End of the presentation. Students will complete their Guided Student Notes.

Day 6- Students will complete the Lesson 2 Test Review using their notes.

Day 7 - Assessment

Closing the Lesson/Summary of Learning/Evaluation*

(How will learning be explained, summarized, applied to assure student understanding?)

Day 1 – Go over the worksheet “**Law vs Theory Vs Hypothesis**” and discuss each question and clarify student misconceptions.

Day 2 – Have a discussion with students about their conclusions and caution students about drawing conclusions on limited data. Have students compare their data and discuss any discrepancy. Mention that this process is like the peer review process.

Day 3 – Use the [beach ball activity](#) to review the following terms: **atom, element, compound, ion, molecule.**

Day 4 – Bromothymol blue demo and discussion: Place a few drops of bromothymol blue into a beaker of about 100ml until you have a blue/light blue solution. The number of drops will vary depending on the concentration of BTB. Put on goggles. Using a straw, blow into the solution continuously until the color changes from blue to yellow. Test the solution to determine if it is concentrated enough to get a strong enough color change. It should turn from blue to green to yellow after blowing bubbles into the solution for about thirty second to a minute. What is happening? The Carbon dioxide is mixing with the water to create carbonic acid causing the BTB acid indicator to change colors. If you let it sit for a while the

CO₂ will diffuse back into the atmosphere and the color will return to blue. This is a great opportunity to discuss how increasing carbon dioxide into the atmosphere could lead to ocean acidification. You could follow it up with placing a seashell into vinegar overnight. The shell will completely dissolve. It should be noted that acetic acid (vinegar pH 2.5) is a much stronger than the carbonic acid (pH 4.18).

Day 5 – Students should play Quizlet Live or Review the Key Vocabulary Terms. Student will take a vocabulary Quiz tomorrow.

Day 6- Go over the Lesson 2 Quiz Review. Students should ask questions about anything they do not understand. The teacher should address misconceptions that surfaced during the review.

Differentiating the Lesson Differentiations will be based on students' needs

Higher Differentiation – For the quizzes and test remove the word banks. Students can design and carry out their own experiment. See Unit 1 and 2 in our Biology Curriculum.

Lower Differentiation- Use the modified versions of the quiz. Strategically group students and possibly have them submit a group packet for the pH exploration activity. Strategically partner the students.

Learning/Lesson Reflection

(What went well? What may need revision the next time I use this lesson? How did students react? etc.)

Learning/Lesson Extension

(What web sites, references, field experiences, related topics, or activities might offer enriched or enhanced learning opportunities?)

- Additional lessons to review experimental design are available in Unit 1 and 2 in Biology.
- Students can build a model to show a feedback loop.

