

TLPL 688 Fall 2019, Spring 2019, Summer 2019

Designing High-Quality Learning Experiences: Transdisciplinary STEM Lesson

Name: _____

School: _____

Grade Level/Subject: 5th Grade _____

Phenomenon/Topic: Inflating a ball _____

Lesson Snapshot

Title	Air - is it really there?
NGSS Performance Expectation	<ul style="list-style-type: none"> ● 5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.
Disciplinary Core Ideas	<p>PS1.A: Structure and Properties of Matter</p> <ul style="list-style-type: none"> ● Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means.
Disciplinary Practices	<p>Disciplinary Practices (science and engineering)</p> <ul style="list-style-type: none"> ● Use models to describe phenomena.
Crosscutting Concepts	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> ● Natural objects exist from the very small to the immensely large.
Maryland College and Career Ready Standards. Mathematics	<p>CCSS.MATH.CONTENT.5.MD.B.2</p> <p>Make a line plot to display a data set of measurements in fractions of a unit ($1/2$, $1/4$, $1/8$). Use operations on fractions for this grade to solve problems involving information presented in line plots. <i>For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.</i></p> <p>CCSS.MATH.CONTENT.5.NBT.A.3</p> <p>Read, write, and compare decimals to thousandths.</p>

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Maryland College and Career Ready Standards. ELA/Literacy	CCSS.ELA-LITERACY.W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. CCSS.ELA-LITERACY.W.5.2.D Use precise language and domain-specific vocabulary to inform about or explain the topic.
Maryland STEM Standards of Practice	<ol style="list-style-type: none">1. Learn and Apply Rigorous Science, Technology, Engineering, and Mathematics Content2. Integrate Science, Technology, Engineering, and Mathematics Content3. Interpret and Communicate Information from Science, Technology, Engineering, and Mathematics4. Engage in Inquiry5. Engage in Logical Reasoning6. Collaborate as a STEM Team7. Apply Technology Strategically

Overview

This is a summary of what students will learn in the lesson and/or unit. It explains the academic focus and real-world connection (phenomena under study).

Air is an essential part of our everyday lives and we depend on it to live. Students will investigate how something that we cannot see, feel, or necessarily manipulate, be matter. Students will use their understanding and their definition of matter to prove that just because you can't see or feel air, that it is matter. Students will use a variety of everyday objects to show that air takes up space and has weight. These experiments will lead students to understand the changes that occur in a recess ball when it is inflated.

Driving Question:

A broad, open-ended, life-relevant question that ties the identified performance expectations to the phenomena under study. It helps to initiate and focus inquiry.

How does a recess ball change when it is inflated?

Why does a recess ball change when it is inflated?

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Suggested Student Outcomes

The specific student outcomes for the lesson and/or unit. They describe the transferable knowledge and skills that students should understand and be able to do when the unit is completed. What will the students understand better as a result of this lesson?

Students will develop a model to show that air is matter.

Students will also have to prove that air takes up space and has weight.

Students will explain an increase in weight is due to the fact that air is matter.

Students will be able to explain that a soccer ball changes its shape and weight due to air particles that are too small to be seen.

Interdisciplinary Connections

How do the core ideas, concepts, and practices of multiple disciplines come together to support student understanding?

Students will use science, technology, engineering, and mathematics to develop a model to observe and measure the properties of matter.

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Enduring Understandings/ Key Ideas:

Students will develop an understanding that air is made up of particles that are too small to be seen and that air is matter.

5 E Components	General Description	MSDE STEM S.O.P (check all that apply)
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<p align="center">Engage</p> <p>Did you design an activity that allows students to:</p> <p><input type="checkbox"/> Activate and apply prior knowledge and understandings?</p> <p><input type="checkbox"/> Ask questions?</p> <p><input type="checkbox"/> Identify problems to be solved, conflicts to be resolved, decisions to be made?</p>	<p>1. Starting questions/Discussion: What is matter? What are the properties of matter?</p> <p>2. Students will be given materials to begin investigating that air is matter.</p> <p>Problem: How can you use a bag to lift a textbook off a table?</p> <ul style="list-style-type: none"> - Task: <ul style="list-style-type: none"> - Students will lift a book off the desk using only a bag to prove that air is matter. - They will be given a ziplock bag and a book. - Students will use the given materials to lift the textbook off the table. - Questions to ask after the experiment: <ul style="list-style-type: none"> - How can something we can not see be made of matter? - How does our model show that air is matter? <p>3. Air Video: Crash Course Kids!</p> <ul style="list-style-type: none"> - Questions to ask after watching this video: <ul style="list-style-type: none"> - How did the balloon demonstrations in the video, further explain your model? 	<p><input type="checkbox"/> Learn and Apply STEM Content</p> <p><input type="checkbox"/> Integrate STEM Content</p> <p><input type="checkbox"/> Interpret and Communicate Information from STEM disciplines</p> <p><input type="checkbox"/> Engage in Inquiry</p> <p><input type="checkbox"/> Engage in Logical Reasoning</p> <p><input type="checkbox"/> Collaborate as a STEM Team</p> <p><input type="checkbox"/> Apply Technology Strategically</p>
<p align="center">5 E Components</p>	<p align="center">General Description</p>	<p align="center">MSDE STEM S.O.P (check all that apply)</p>

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<p align="center">Explore</p> <p>Did you design an activity that allows students to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Actively explore new concepts through hands-on learning experiences? <input type="checkbox"/> Ask questions and define issues or problems related to the phenomena under study? <input type="checkbox"/> Engage in disciplinary practices to learn, and apply disciplinary core ideas and crosscutting concepts when exploring the phenomena? <input type="checkbox"/> Demonstrate refinement of everyday thinking around core ideas and concepts? <input type="checkbox"/> Select and employ tools (including technology) that are relevant to answering the driving question? 	<p>Driving Question:</p> <ul style="list-style-type: none"> - How does a recess ball change when it is inflated? <p>Students will be able to use different materials to inflate their recess ball and measure the changes in the shape, size, and weight of the ball.</p> <p>Materials:</p> <ul style="list-style-type: none"> - deflated recess ball - hand pump - scale - ruler - measuring tape - string <ul style="list-style-type: none"> - Students will collaborate as a STEM team to try and inflate their ball and note the changes in the shape, size, and weight of the ball using materials of their choice. 	<ul style="list-style-type: none"> <input type="checkbox"/> Learn and Apply STEM Content <input type="checkbox"/> Integrate STEM Content <input type="checkbox"/> Interpret and Communicate Information from STEM disciplines <input type="checkbox"/> Engage in Inquiry <input type="checkbox"/> Engage in Logical Reasoning <input type="checkbox"/> Collaborate as a STEM Team <input type="checkbox"/> Apply Technology Strategically
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<p align="center">Explain</p> <p>Did you design an activity that allows students to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Analyze data/information and draw conclusions? <input type="checkbox"/> Communicate understandings and possible solutions? <input type="checkbox"/> Construct explanations and design solutions? <input type="checkbox"/> Demonstrate critical thinking and reasoning? <input type="checkbox"/> use technology appropriately for analysis and communication? 	<p>Driving Question:</p> <ul style="list-style-type: none"> - Why does a recess ball change when it is inflated? <p>Students will analyze their data on the different changes in shape, size, and weight to explain what is the cause of the changes.</p> <p>- Questions:</p> <ul style="list-style-type: none"> - What made the ball change shape? - Why did the weight change? - What was inflating the ball? - What properties of matter were demonstrated in this experiment? - How did your experiment prove that air is matter? 	<ul style="list-style-type: none"> <input type="checkbox"/> Learn and Apply STEM Content <input type="checkbox"/> Integrate STEM Content <input type="checkbox"/> Interpret and Communicate Information from STEM disciplines <input type="checkbox"/> Engage in Inquiry <input type="checkbox"/> Engage in Logical Reasoning <input type="checkbox"/> Collaborate as a STEM Team <input type="checkbox"/> Apply Technology Strategically
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<p>Extension / Elaboration</p> <p>Did you design an activity that allows students to:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Modify/refine procedures, prototypes, models, solutions, arguments, essays, etc.? <input type="checkbox"/> Challenge and/or deepen their understandings of the core ideas and concepts related to the phenomena under study? <input type="checkbox"/> Demonstrate critical thinking and reasoning? <input type="checkbox"/> Make connections to other real-world applications of the knowledge constructed in the activity? 	<p>Using their model, does the amount of air affect the bounciness of the ball?</p> <ul style="list-style-type: none"> - students will modify the amount of air in their ball to test if the amount of air affects the bounce of their ball. - students will measure the different heights of their ball's bounce to determine if air affects their bounciness. - Students can create a graph to show the effect air has on the ball. - Students will develop an understanding of how the particles of air affect the function of the ball. 	<ul style="list-style-type: none"> <input type="checkbox"/> Learn and Apply STEM Content <input type="checkbox"/> Integrate STEM Content <input type="checkbox"/> Interpret and Communicate Information from STEM disciplines <input type="checkbox"/> Engage in Inquiry <input type="checkbox"/> Engage in Logical Reasoning <input type="checkbox"/> Collaborate as a STEM Team <input type="checkbox"/> Apply Technology Strategically
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<p align="center">Evaluation</p> <p>Did you design an activity that allows students to:</p> <p><input type="checkbox"/> Assess and/or justify their own understandings?</p> <p><input type="checkbox"/> Demonstrate an understanding of concepts through performance-based tasks?</p> <p><input type="checkbox"/> Participate in peer reviews and/or offer feedback to each other?</p> <p><input type="checkbox"/> Demonstrate critical thinking and reasoning?</p> <p><input type="checkbox"/> Reflect on answers or solutions to the complex question, global issue, challenge or real-world problem?</p>	<p>Students will complete the exit card to explain how and why air is matter.</p> <p>-The exit card will assess students' understanding that air is made up of particles so small to be seen. These particles take up the space inside the shell of the ball causing it to change shape, size, and weight.</p>	<p><input type="checkbox"/> Learn and Apply STEM Content</p> <p><input type="checkbox"/> Integrate STEM Content</p> <p><input type="checkbox"/> Interpret and Communicate Information from STEM disciplines</p> <p><input type="checkbox"/> Engage in Inquiry</p> <p><input type="checkbox"/> Engage in Logical Reasoning</p> <p><input type="checkbox"/> Collaborate as a STEM Team</p> <p><input type="checkbox"/> Apply Technology Strategically</p>