County Implementation Award Program (CIAP) Math and Science Lesson

Unit Title: Transference of Energy

Lesson Title: Energy of Motion

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Grade Level: 4/5

Time Frame: 1-2 days

Targeted Standard(s):
Math: 4.4.NF.3.c Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.
5.5. MD.2 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.

CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others.

Science:
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down

Short Description of Targeted Phenomenon:
The targeted phenomenon is a video showing Newton's Cradle.
https://binged.it/2uEQBEl

Three Dimensions of NGSS

Science & Engineering Practice/s (SEP):
Asking Questions and Defining Problems
Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.

- *Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)*

Engaging in Argument from Evidence
Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s).

- *Support an argument with evidence, data, or a model. (5-PS2-1)*

Students will also engage in:

Analyzing and Interpreting Data
Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

Crosscutting Concept/s (CCC):

Energy and Matter

- Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4)

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change. (5-PS2-1)

Disciplinary Core Idea/s (DCI):

PS3.A: Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2), (4-PS3-3)

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2), (4-PS3-3)

PS3.C: Relationship Between Energy and Forces

- When objects collide, the contact forces transfer energy to change the objects' motions.

PS2.B: Types of Interactions:

- The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (5-PS2-1)

Language Supports: Energy in motion; potential energy

Materials Needed: Materials Needed: Table, several balls that are different sizes and weights, a bucket of water, a ruler, large pieces of paper to tape to the inside of the bucket (make sure the paper is at least 18 in. above the bucket.

Objective(s): Students will be able to:

1. Understand that volume, mass and gravity affect the transfer of energy.

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2. Create a line plot using the data from the experiment.

<table>
<tr><td colspan="2">3. Use the line plot to look at patterns in the data.</td></tr>
<tr><td colspan="2">How Math and Science concepts/skills/practices were integrated in this lesson: Math was used for extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.</td></tr>
<tr><td colspan="2">Possible Challenges /Misconceptions: There may be difficulty in measuring the splash of the water. The water may go above the paper. To help with this, do not put too much water in the bucket.</td></tr>
<tr><td colspan="2">Formative Assessment:
See worksheet below.</td></tr>
<tr><td colspan="2">Lesson Opening</td></tr>
<tr><td>Teacher Actions

Show the video. https://binged.it/2uEQBEl</td><td>Student Actions

Watch the video</td></tr>
<tr><td colspan="2">Lesson Introduction</td></tr>
<tr><td>Teacher Actions
Teacher introduces the task and makes sure students understand what they are trying to accomplish. The teacher will ask questions to help students make the connection between the movement of the balls and the transfer of energy.

Ask questions: What did you notice about the video? What did you notice about the ball movement? Why do you think this happened?</td><td>Student Actions
Quietly answer the questions in a journal or on a piece of paper. Next, have students discuss in small groups. Then, discuss as a class.</td></tr>
<tr><td colspan="2">Body of Lesson</td></tr>
<tr><td>Teacher Actions
Teacher will pass out the worksheet to go along with activity.

Teacher will go over the worksheet and demonstrate how to drop one ball into the container of water and measure the splash. Then the teacher will observe and monitor the students engaging in the activity.</td><td>Student Actions
Students will work in small groups to complete the task. They will choose 3 different balls with different masses. They will make a prediction as to what they will find when they drop each ball into the container of water. Then they will drop each ball in 3 times, measure the splash and record their findings. The students will plot their finding for each ball (using a different color for each ball) on a line plot. Students will then use the line plot to draw conclusions and construct an argument about which object consistently</td></tr>
</table>

	created the largest splashes.
Lesson Closure	
Teacher Actions Teacher facilitates group discussion, helps students share their work/progress, helps students make connections, and ensures that big ideas are brought forward. Teacher will ask students to discuss what they noticed during the experiment with their groups and then write and/or illustrate this in their science journals.	**Student Actions** Students will discuss their findings in small groups. They will then write their findings in their science journals.
Summative Assessment: There is a follow-up lesson coming that will assess the students' knowledge of the transfer of energy.	
Other Teaching Resources: See the worksheet below.	
Lab Safety:	
Extensions (if any):	

Object	Predict height	Height #1	Height #2	Height #3
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Make a line plot of the splashes (Label to the nearest ½ inch.)

|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|_____|

Object 1 - color _____

Object 2 - color _____

Object 3 - color _____

Which object was most consistent? _____

Which object had the highest height? _____

Which object had the lowest height? _____

What was the difference between the highest height and the lowest height?

_____

Which object would you say consistently creates the largest splashes? Explain your reasoning. (Use the back for more space)