

## Physics Resource Package

### STEM Activity Ideas and Lesson Plans

#### Area 1: Activity Ideas

This is a sampling of activity ideas. You can also check out activity ideas available with the teacher tools included with individual videos in this resource package.

- ❖ Using a Hot Wheel car and track, test different heights of drops and observe if there is enough energy to get the car up over the next hill designed.
- ❖ Explore the impact of friction on the movement of an object, trying different objects that increase or decrease friction.
- ❖ Explore the 3<sup>rd</sup> Law of Motion: choose 2 marbles, set one marble at the end of a flat surface, then push the 2<sup>nd</sup> marble into the first marble. What happens when the two marbles run into each other?
- ❖ Explore the transfer of kinetic energy: get a heavy ball and a smaller, lighter ball. Hold the large ball in one hand. Place the smaller ball on top and hold it still. Take your hands off of both balls at the same time. Observe what happens and explain why this is important to engineers.
- ❖ Explore Newton's 2<sup>nd</sup> Law of motion by putting different weights in a small car. Use a spring scale to measure the amount of force needed when pulling the different weights.
- ❖ Take a bowling trip to a bowling ally that records the speed of the ball. Each student should record speed for each ball bowled for 10 frames, and find the mean, median, and mode of the rolls.
- ❖ Conduct a “drop the egg” experiment. Students will build a cage with cushion for the egg and drop it down a flight of stairs.
- ❖ Build a miniature roller coaster.
- ❖ Build a PVC rocket launcher.

#### Area 2: Lesson Plans

This is a sampling of lesson plans. Additional activity lesson plans are available with the teacher tools included with individual videos in this resource package.

©2019 Educate.Today

## Sample Lesson 1: Energy Racer

**Type of Teacher Tool:** Small Group

**Targeted Grade Level(s):** 5-8

**Targeted Curriculum Areas:** Physics

### Learning Objectives:

The learner will:

1. Create a structure (Energy Racer) demonstrating potential energy to kinetic energy
2. Test the racer, modify and redesign to go the farthest distance.

### Featured National Standards:

1. CCSS.ELA-LITERACY.RST.6-8.3  
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
2. ISTE National Technology Standards 3d—Students build knowledge by actively exploring real world issues and problems, developing ideas and theories and pursuing answers and solutions
3. ISTE 4a—Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems
4. ETS1-2 Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

**Additional State and National Standards related to the content of our videos listed below for this lesson are also provided on the Educate.Today page where you find the video.**

### Resources/Materials Needed:

1. Physics 9: The Science Behind Roller Coasters
2. Building Materials: different sizes of rubber bands, different washers, wooden or plastic spools, toothpicks, tape, and pencils

### Teacher Instructions:

1. Watch the video and discuss potential and kinetic energy.
2. Give each group a spool, toothpick, pencil, rubber band and washer.
3. Give directions for creating the Energy Racer: push the rubber band through the hole in the spool; secure the rubber band at one end by pushing a toothpick into the rubber band loop that sticks out of the hole and taping the toothpick and rubber band loop to the spool; break off any extra toothpick, on the other side of the spool, push the other end of the rubber band through a washer and slide a pencil through the rubber band loop that sticks out from the washer; holding the spool in one hand use the other hand to wind the pencil around two times; put the spool and pencil on the floor and let it go.
4. Give the students the design challenge: make the Energy Racer run as fast as possible or make the Energy Racer run as far as possible.

©2019 Educate.Today

5. Have the students choose one challenge and work to redesign their racer using different rubber bands and washers to best meet the challenge.

**Extension Activity Options:**

1. Try different materials for the racer such as Styrofoam cups, paper cups, paper plates, bamboo skewers, beads, and rubber bands.
2. Try to build an Energy Racer with both challenges met.

**Assessment/Evaluation Options:**

1. Check that the students have built the Energy Racer using the materials and directions given.
2. Check that students did redesign to improve their Energy Racer to make their racer go as fast or as far as possible.

## Sample Lesson 2: The Data of Bowling

**Type of Teacher Tool:** Whole Class

**Targeted Grade Level(s):** 9-12

**Targeted Curriculum Areas:** Physics and Mathematics

### Learning Objectives:

The learner will:

3. Students will practice finding the mean, median, standard deviation and calculate the force
4. Students will increase their understanding of data sets and use standard deviation to evaluate the variation between bowls
5. Students will use data to calculate momentum

### Featured National Standards

1. CCSS.ELA-LITERACY.RST.9-10.3  
Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
2. CCSS.ELA-LITERACY.RST.9-10.7  
Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
3. CCSS.ELA-LITERACY.RST.11-12.9  
Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
4. Interpreting Categorical and Quantitative Data  
Summarize, represent, and interpret data on a single count or measurement variable  
Summarize, represent, and interpret data on two categorical and quantitative variables  
Interpret linear models

### Resources/Materials Needed:

3. Physics 8: The Science behind Bowling
4. Physics 11: Newton's First Law of Motion
5. Physics 13: Velocity and Acceleration
6. Physics 15: Finding the Average Velocity
7. Chart provided
8. Bowling Alley

### Teacher Instructions:

1. Plan a trip to a local bowling alley where the speed of the ball is shown on the score monitor.

2. For use prior to the trip to the alley, have students watch any combination of the Educate.Today videos listed above that you think would be most helpful in providing background information for them prior to their data experiment.
2. Have students record their speed for each bowl to use as their data set.
3. In class have students calculate the mean, median and mode of their data set
4. Students should use the formula  $\text{Momentum} = \text{Mass} \times \text{Acceleration}$  to calculate and record the momentum of each bowl, using the recorded speed and the weight of the bowling ball they used.
5. Calculate the mean, median and mode from the data set from step 4
6. Have students compare results with other students and speculate as to what changes they might make to improve their game

**Assessment/Evaluation Option:**

1. Use the chart provided on the next page for students to record their results and turn in to be graded on accuracy.

Name \_\_\_\_\_

<b>Bowl</b>	<b>Speed</b>	<b>Momentum</b>
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

	<b>Mean</b>	<b>Median</b>	<b>Mode</b>	<b>Standard Deviation</b>
<b>Velocity</b>				
<b>Momentum</b>				