



INCLINE LAB

EXPERIMENTAL SKILLS

MONROE

Time Frame:	Standards:
45 minutes	Idaho Standards 2.1, 2.2, 2.3
Objectives:	
<p>Students will be able to see the relationship between Gravitational Potential Energy and Kinetic Energy, and make a graphical representation of the relationship between the two. Students will be able to make predictions based on experimental data.</p> <p>Students will use previously learned skills involving graphing and variable manipulation in this experiment.</p>	
Background Information:	
<p>Gravitational Potential Energy is the potential energy of an object that is reliant upon its location above the surface of the Earth. Three things are needed. One must know how massive something is, how high it is, and how much gravity there is. The formula for Gravitational Potential Energy is</p> $\text{GPE} = \text{gravity (meters per second per second)} \times \text{height above surface (meters)} \times \text{mass (kilograms)}.$ <p>Kinetic Energy is the energy of an object, which is reliant upon the mass and velocity of an object. Velocity and speed can usually be considered the same, because direction will generally not be changing. Velocity is actually speed with a directional component. The formula for Kinetic Energy is $\text{K.E.} = \frac{1}{2} \text{mass} \times \text{velocity}^2$.</p> <p>The GPE will be converted to KE as it rolls down the incline, and the KE will be converted to thermal energy because of the friction with the carpet.</p>	
Materials Needed:	
<p><u>Balls of various sizes.</u> The maximum size should be about five centimeters (2 inches) in diameter. You will need at least one ball per group of two, but it is best to have extra so that students can have a choice of balls to roll.</p> <p><u>Meter Sticks.</u> Yard sticks would work, but science works with the metric system, so centimeters and meters should probably be the units of use. One meter stick per group works best.</p> <p><u>Tape.</u> You will need a roll of cheap, cheap masking tape, and the thinner the better.</p> <p><u>Inclines.</u> The inclines should be rounded and about 75 to 100 centimeters long. Thin gauge PVC pipe can usually be found at a local home improvement center, and the staff will often cut it into one meter lengths for you.</p> <p><u>Books.</u> Usually students will have these in their backpacks.</p> <p><u>Graph Paper.</u> The students will make their own graphs, but I will suggest that the “x” axis be the ramp “rise”, and the “y” axis be how far the ball rolled.</p>	

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Procedure:

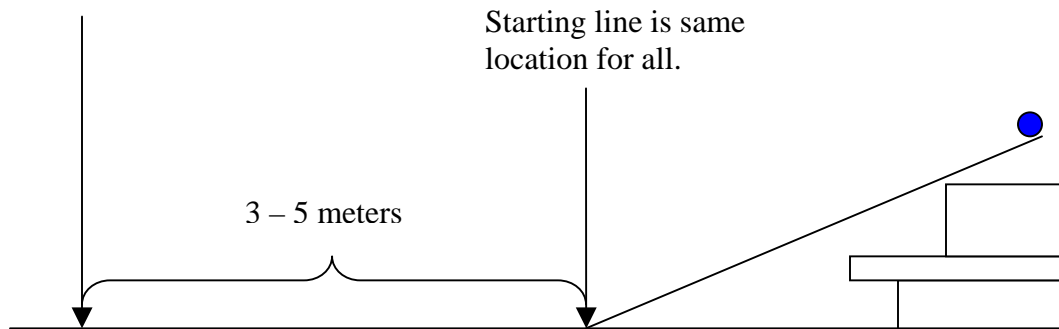
1. Find an area that is large enough for your class to spread out. If it is carpeted, that is even better.
2. Place a “starting line” on the floor that is made of masking tape.
3. Have students place the “end” of their ramp on the starting line, and raise the “start” of the ramp with a certain number of books.
4. Students should measure the “rise” of the ramp with the meter stick, and release the ball.
 - a. Students measure how far the ball rolled and mark that point on their graphs.
 - b. Students change the slope of the incline four more times to complete their graphs.
 - c. The graphs can be used as an assessment, but its main use is to predict how high the ramp will have to be raised to make the ball go a certain distance.
5. Place a “target tape” three or four meters away from the “starting line” and challenge the students to be able to roll the ball down the ramp having it end up on the “target tape”.
 - a. By using the graph as a reference, students should be able to predict how high they will have to raise the ramp to make the ball roll a specific distance.
 - b. Do not be surprised when a team has a ball land on a 2 cm piece of tape from three meters away.
 - c. Do not be surprised when some students laugh, scream and dance with their success.
 - d. Do try to give away a token of success.

Other:

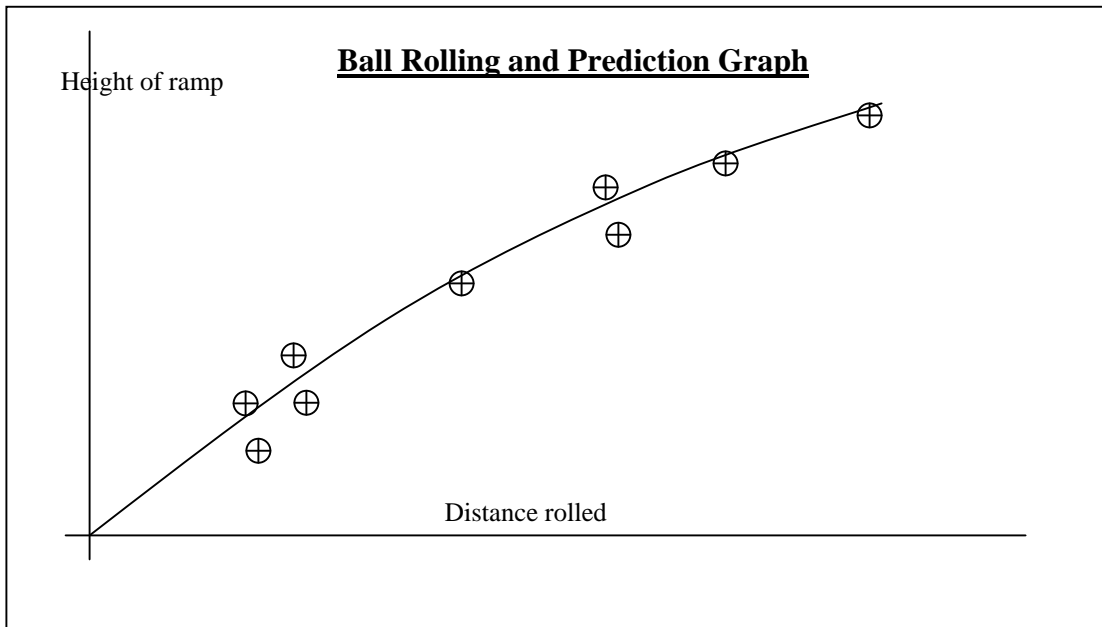
Description of Course:

Finish line. This is an arbitrary placement. Whichever team gets closest without any practice trials will win.

Students determine slope of ramp by using the data on their graphs.



Example of Student Graph:



This is an example of a graph of what a student might make. It is often rough, but the level of sophistication will be similar to the level of precision that the students seek.

Assessment:

An assessment is only needed if the instructor feels that is so. This is often times used only as an application of previously learned graphing and experimental skills.



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Additional Content:

References:

Energy for Educators

Bringing Energy into the Classroom