

# Energy and Motion Activity Bag

## Potential & Kinetic Energy: Student Activity Guide

To lift a marble above the floor, you have to do work on the marble against the force of gravity. The work done on the marble is stored as a form of energy called “potential energy.” This is a form of energy associated with the position. As long as the marble remains at a certain height above the floor (above the Earth) the stored potential energy is constant. When we drop the marble, the potential energy transforms into the energy of motion, which we call “kinetic energy.” The amount of potential energy stored and the amount of kinetic energy released is directly related. In this activity, you will explore potential and kinetic energy.

These directions will get you started. Your teacher will be in contact to guide you and provide information.

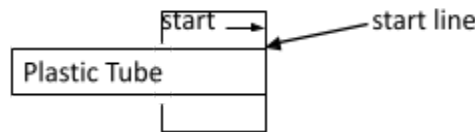
### Materials From The Bag

- Plastic Tube
- Marble
- Steel Ball
- Wooden Ball
- 2 Tape Measures
- 4 x 6 Index Card
- Post-It Notes

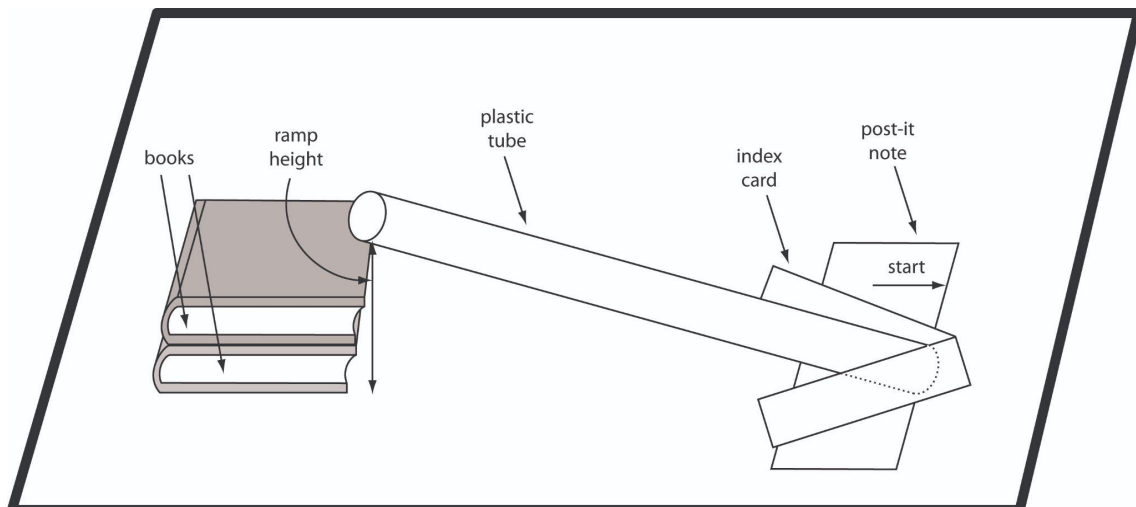
### Preparation: Ramp Set-Up

The ramp set-up will be used in all three parts of this lesson.

1. Find a smooth, flat place a little longer than a meter. Use one tape measure to be sure it’s long enough. A countertop, floor, or table will work.
2. We need to create a starting line for our ramp. Stick a post-it note to the surface of the table. Get the clear tube from the bag and place one end on the edge of the post-it. This edge is the start and line. It looks like this:



3. Get some books and lift the end of the tube not on the start line and slide the books under it so the ramp slopes down, touching the start line. Fold an index card in half, lengthwise, then once again in the middle to make a “V.” Place it at the bottom of the tube. See the diagram below.



4. To change the height of the ramp you will need to move the books closer or further away from the start line. Use a tape measure to measure the height of your ramp. Measure from the surface of the table to the **bottom** of the tube.

### **Part 1: How Does Height Affect Kinetic Energy?**

In this part of the lesson, we will explore how height affects kinetic energy.

1. Choose 3 heights from which to roll the **marble**. You will roll 3 times from each height and record how far the index card travels as the results. Test heights may range from **30-150 mm**.
2. Test, collect, and record data. Choose the median distance for each height.

*How did the height of the marble affect the distance the card traveled? Review the definitions from the introduction and give examples of potential and kinetic energy from this activity.*

#### *What's happening...*

You may have noticed when the tube was higher the marble was able to push the card further than when the tube was lower. The height of the tube affects the marble's ability to push the card because the higher the ramp the more potential energy the marble has. When you release the marble, the force of gravity pulled it down the tube and released a higher amount of kinetic energy. When the marble hit the card that energy was transferred to the card and the card traveled.

### **Part 2: How Does Mass Affect Kinetic Energy?**

In this part of the lesson, we will explore how mass affects kinetic energy. You will be working with 3 different balls: wood, glass, & steel. The wood ball weighs 1.5g. The glass ball weighs 4.8g. The steel ball weighs 16.3g.

1. Make a prediction:
  - a. Which ball will push the card farthest? How far do you expect it to go?
  - b. Which ball will push the card the shortest distance? How far do you expect it to go?
2. Set the ramp to 100mm. Release the glass marble and record how far the index card travels. Do this three times, record your data and choose the median distance for each ball.
3. Repeat step 2 with the steel ball and the wooden ball.

*How did the mass of the ball affect the distance the card traveled? What other factors may have affected the results?*

#### *What's happening...*

Everything has mass. Mass is the amount of matter that makes up an object. The steel ball has more mass than the marble and wooden ball. Moving objects that have a greater mass will have more kinetic energy than those with less mass.

### **Part 3: Hit Your Mark**

In this part of the lesson, we will solve a challenge in as few trials as possible. Use all the data you have collected in Part 1 and Part 2. Using the steel ball, what ramp height will cause the folded index card to travel 58cm? (Allow a range of 570-590 mm). Once your steel ball has traveled between 570-590mm you have completed the challenge!