



### Part 1 - Investigate

**Materials:** Marble, 6 Pipe insulators cut in half, Ring stand and ring, Ruler, stopwatch

**Directions:** Set the clamp on the ring stand at 5 cm above the base. Create a ramp with ONE pipe insulator.

1. Place a marble at the end of the pipe insulator that is raised to 5 cm and time how long it takes the marble to travel to the end of the pipe insulator Or stop rolling in the pipe insulator. Record the data in the table below.

a. Did the marble travel to the end of the pipe insulator? Explain why.

b. How long did it take for the marble to reach the end of the pipe insulator or stop moving?

2. Repeat the first step 4 more times at 10, 15, 20 and 25 cm. Record the data in the table below.

Height of Ring Stand	5 cm	10 cm	15 cm	20 cm	25 cm
Time to get to end of ramp or stop moving (seconds)					

1. What pattern do you observe as the height of the ramp increased?
2. What do you think would happen if the height of the ramp increased to 50 cm?
3. What do you think would happen if the height of the ramp was 0 cm?

### Part 2 - Build a Roller Coaster

Create and build a rollercoaster out of 6 pieces of pipe insulators and masking tape .

Rollercoaster needs to include: 1 Drop, 2 hills, 1 twisting turn and 1 loop (Challenge: Try to add a jump!)

AND when a marble is placed on the roller coaster, it must be able to travel from the beginning to the end by being pushed ONLY ONE time at the beginning. \*\*\* NO cutting or tearing the pipe insulators and NO tunnels.

Draw a diagram of your roller coaster in the space above. Label the HIGHEST POTENTIAL energy and the HIGHEST KINETIC energy.



### **Part 3- Changes in Roller Coaster**

1. Take the initial drop of your roller coaster (the beginning) and lower it 15cm. Drop the marble down the roller coaster.

**Does the marble still make it all the way to the end?**

**Why/why not?**

2. Take the initial drop of your roller coaster (the beginning) and lower it 15cm **MORE** for a total of 30 cm from the initial drop. Drop the marble down the roller coaster.

**Does the marble still make it all the way to the end?**

**Why/why not?**

### **Evaluation Questions:**

1. What was the biggest challenge in building your roller coaster?

2. What "extras" did you add to your roller coaster?

3. What changes did you observe after lowering the roller coaster?

4. How would you have to adjust your roller coaster if there were 2 loops or turns instead of 1?

5. What are some important things engineers need to consider when building a roller coaster for a theme park to keep people safe?