

Name:

Period:

## Conceptual and Honors Lab: Build a Roller Coaster

### **Pre-Lab**

1. A marble of mass  $m = 0.010$  kg is released from rest at the top of a roller coaster that is 1.2 meters high.
  - a. Find the potential energy of the marble at the top.
  - b. Find the kinetic energy at the top.
  - c. Find the total energy at the top.
2. The marble rolls down the roller coaster so that it is now 0.2 meters high.
  - a. Find the potential energy of the marble.
  - b. Find the kinetic energy of the marble. Assume energy was conserved.
  - c. Find the speed of the marble.
  - d. The marble is travelling through a loop of radius  $r = 0.12$  meters. What centripetal force acts on the marble?

### **Building the Roller Coaster**

**Materials:** The teacher will provide 3 sections of pipe insulation, duct tape, string, and a limited amount of cardboard. You will also be allowed to use the teacher's scissors and rulers/meter sticks, but those cannot be

part of the roller coaster. Any other legal and non-dangerous materials you want to use are fine, but the teacher will not provide them.

**Requirements:** Your roller coaster must be less than 2 meters high at its highest point and include at least one loop.

**Competition:** We will time your marble from when it is released to when it stops or reaches the end of your roller coaster. The group with a time closest to, but not over, 15 seconds wins a prize (probably food).

**Sketch:** Please sketch your roller coaster in the space below. Include the height at which the marble is released and the radius and height of any loops you have built.

### **Questions**

1. What is the potential energy of your marble when it is released?
  
  
  
  
  
  
  
  
  
  
2. Choose one of your loops.
  - a. What is the marble's potential energy at the top of that loop?
  
  
  
  
  
  
  
  - b. What is the marble's kinetic energy at the top of that loop? Assume energy was conserved.
  
  
  
  
  
  
  
  - c. What is the speed of the marble at the top of that loop?
  
  
  
  
  
  
  
  - d. What is the centripetal force acting on the marble at the top of that loop?