

Marble Roller Coaster



QUESTION: What forces are at work on a moving roller coaster?

MATERIALS:

- | | |
|--------------|--------------|
| cup | marble |
| masking tape | marble track |

This lab is about the thrill of velocity, acceleration, and unbalanced forces ... We're talking about roller coasters! In this lab we are going to create a roller coaster that is the fastest and most exciting to build!

PROCEDURE:

1. Design a ramp (one 6-foot length) for a marble to travel on that will allow the marble to jump the greatest distance possible and land in a cup. There are constraints:
 - Your marble must complete the ramp before “jumping off.”
 - You may not use human force to get your marble started on the ramp.
 - The distance of the jump is measured from where the marble leaves the ramp to the cup.
2. In the Data table record the greatest distance your marble “jumped” successfully.
3. Determine the velocity of your marble and record it in the Data table. Determine velocity by using this formula

$$V = d \div t$$

$$V = \text{velocity (m/s)} \quad d = \text{distance (m)} \quad t = \text{time (s)}$$

4. Great America has enlisted your help to create an old-fashioned roller coaster that relies solely on the force of gravity to move the cars. Design a rollercoaster for a marble to travel on (without falling off) which has at least one complete vertical loop. There are constraints:
 - Your marble must complete the course while staying on the track.
 - You may not use human force to get your marble started on the track.
 - You need to have one complete vertical loop.
5. Determine the velocity of your marble and record this in the Data Table.
6. Because of your previous successes in roller coaster design, Great America has asked to you to continue your work with your roller coaster by adding yet another loop to your design (a total of two vertical loops). The previously stated constraints still apply (see step #4 above).
7. Determine the velocity of your marble and record this in the Data table.
8. Now you really have the interest of Great America. They want you to build onto your existing coaster or build a completely new one ... BUT, they want at least 4 vertical loops. See what you can do!! Good Luck!!

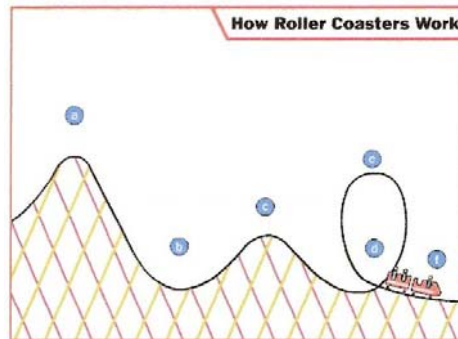
PS – Activity #21

DATA:

Greatest distance your marble jumped			
	DISTANCE	TIME	VELOCITY
Velocity 1			
Velocity 2			
Velocity 3			
Velocity 4			

QUESTIONS:

1. What makes the marble move on your ramp?
2. What did you do to make the marble jump farther?
3. When the marble is at the top of the ramp, what kind of energy does it have?
4. As the marble rolls down the ramp its speed increases. What kind of energy does it have now?
5. Why do roller coasters begin with a really high hill and then continue with smaller hills and loops and turns?
6. Look at the diagram below and answer the questions that follow:



- At which point would the roller coaster have about an equal amount of potential and kinetic energy?
- At which point would the roller coaster have the maximum amount of potential energy?
- At which point would the roller coaster have the maximum amount of kinetic energy?
- At which point would the roller coaster have the least amount of potential energy?
- At which point would the roller coaster have the least amount of kinetic energy?