

## P A P E R R O L L E R C O A S T E R L A B

# Calculating Average Speed of a Rolling Marble

### INTRODUCTION AND OBJECTIVES

In a typical paper roller coaster, the speed of a marble will increase and decrease many times. In this activity, you will find the speed of the marble in different portions of a paper roller coaster. You will also find the average speed of the marble during the entire trip down the paper roller coaster.

### EQUIPMENT NEEDED

- completed Paper Roller Coaster
- meter stick
- pencil
- calculator
- string

### PROCEDURE

#### I. Selecting starting and ending points.

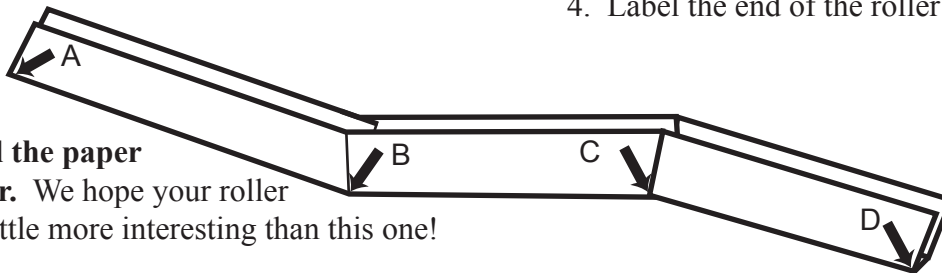
Divide your paper roller coaster into three different sections by placing marks on the tracks.

1. Label the beginning of the roller coaster with an "A." See the drawing below.

2. About 1/3 of the way down the roller coaster, label the track with a "B."

3. About 2/3 of the way down the roller coaster, label the track with a "C."

4. Label the end of the roller coaster with a "D."



**How to label the paper roller coaster.** We hope your roller coaster is a little more interesting than this one!

#### II. Measuring Distances between points

1. Measure the distance that the marble must travel to get from Point A to Point B. To do this, lay one end of a string on the track at Point A. Stretch the string along the path that the marble will travel. Mark the string where it meets Point B on the track. Remove the string from the track and measure the length of the string that reached from Point A to Point B when it was lying on the track. Record the distance in meters in the data table.

2. Use the same procedure to measure the distance from Point B to Point C and the distance from Point C to Point D. Record these distances in the data table.

3. Measure the amount of time it takes for the marble to roll from Point A to Point B. To do this, release the marble at Point A and use a stopwatch to find how long it takes for the marble to reach Point B. Record this time in the data table. Repeat this procedure three times and record your results in the data table. Find the average for the three trials and enter that time in the data table.

4. Measure the amount of time it takes for the marble to roll from Point B to Point C. Do not release the marble at Point B. Instead, release the marble at Point A again and start the stopwatch when it passes Point B. Stop the timer when the marble passes Point C. Repeat for three trials and calculate the average.

# PAPER ROLLER COASTER LAB

5. Measure the amount of time it takes for the marble to roll from Point C to Point D. Do not release the marble at Point C. Instead, release the marble at Point A again and start the stopwatch when it passes Point C. Stop the timer when the marble reaches Point D. Repeat for three trials and calculate the average.

6. Calculate the average speed of the marble between Point A and Point B. Divide the distance between Point A and Point B by the average amount of time that it took to get from Point A to Point B. Enter the speed of the marble in the data table. Use the correct units in the table.

7. Calculate the average speed of the marble between Point B and Point C. Record your result in the table. Repeat the same steps to calculate the average speed of the marble between Point C and Point D.

	TRIALS			AVERAGE
	1	2	3	
Distance A to B				
Time from A to B				
Speed between A and B				
Distance B to C				
Time from B to C				
Speed between B and C				
Distance C to D				
Time from C to D				
Speed between C and D				

### III. Questions

1. Between which two points did the marble have the highest average speed? \_\_\_\_\_

2. Why do you think that the marble was moving the fastest on this part of your roller coaster? \_\_\_\_\_

3. Between which two points did the marble have the lowest average speed? \_\_\_\_\_

4. Why do you think that the marble was moving the slowest on this part of your roller coaster? \_\_\_\_\_

5. If you wanted to make a roller coaster on which the marble would have the slowest average speed from the top to the bottom, how would you design it? \_\_\_\_\_

6. Calculate the average speed of the marble during the entire trip down the paper roller coaster.

	TRIALS			AVERAGE
	1	2	3	
Distance from A to D				
Time from A to D				
Speed from A to D				