Roller Coaster Lab

Name_____**Date**_____**Group**_____**Period**___

You pedal your bike up a hill and have to work hard to go up. You roll down the other side hardly pedaling at all and it is easy. Use this information as you think of the following problem.

A marble is allowed to roll along a wooden roller coaster track. Its speed is measured at several places along the track, at the tops of the hills, at the bottom of the hills and halfway between the bottom and tops of the hills.

Problem: What effect does an increase in height above the table have on the speed of the marble?

Hypothesis: If_____

_____

Variables: By the time you finish this experiment , you will need to identify the different types of variables present in this investigation. Consult your notes for definitions of the types of variables.

Independent Variables:_____

_____

Dependent Variables:_____

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Controlled Variables:_____

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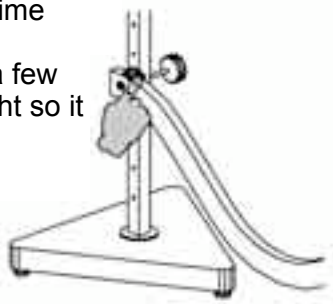
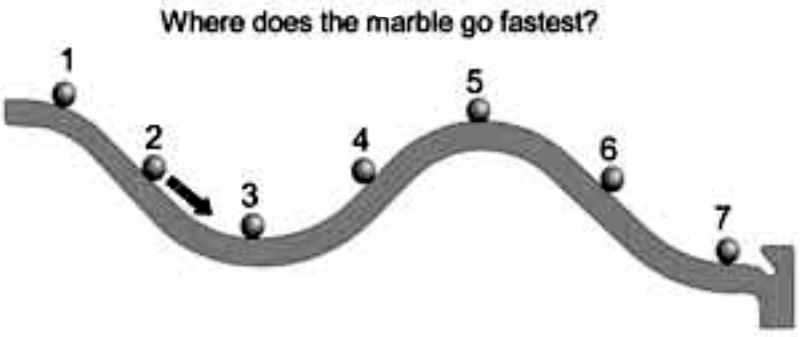
Use the starting peg to start the marble in the same place each time you roll it down. It sometimes takes a few tries to roll it straight so it stays on the track.





1. At which numbered position (or positions) shown in the diagram above, do you think the marble will move the fastest and explain your reasoning?

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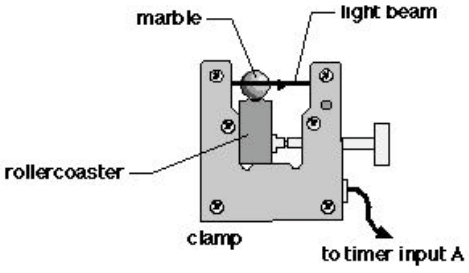
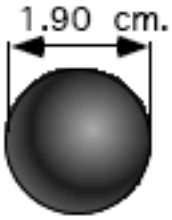
To understand what is happening to the marble you need to measure the speed and the height at different places on the Roller coaster.

To measure the speed of the marble, attach a photogate clamp so that the marble breaks the light beam as it rolls through. Plug the clamp into input A of the Timer and use interval mode. Be sure that the bottom of the Clamp is flat against the bottom of the Roller Coaster. If the clamp is not attached properly, the light beam will not cross the center of the marble and the speed you calculate for the marble will be incorrect.

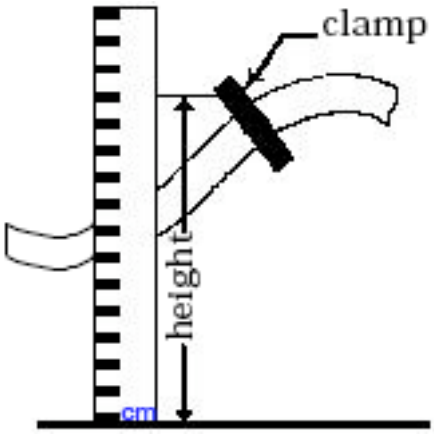




Remember that speed is the distance traveled divided by the time taken to travel that distance. During the time that the Timer is counting, the marble moves one diameter. Therefore, the distance traveled is the diameter of the marble, and the time taken is the time from clamp A.

The speed of the marble is it's diameter divided by the time from clamp A.

$$\text{speed} = \frac{\text{diameter}}{\text{time from clamp A}}$$



Procedures:

1 – Put the clamp in each of the places shown on the front page.

2 – Measure the height and speed of the marble at each place.

3 – Write your data down in the table below.

The light beam passes through the center of the marble so you should measure the height from the table to the center of the hole for the light beam.

Extremely important step for positions 2,4 and 6

- **Make sure that the heights for positions 2, 4 and 6 are exactly the same.**
- **You should be approximately halfway between the top and the bottom of a hill, but the height above the table surface must be the same for all 3 positions.**

Position #	Height above table surface to nearest .01 cm	Time from clamp A to .0001 seconds	Distance traveled by marble to .01 cm	Speed of Marble to nearest .01 cm/sec
1				
2				
3				
4				
5				
6				
7				

Analysis of Data

2 – At which two numbered positions did the marble have the greatest kinetic energy and explain how you determined this?

_____

_____

_____

Notice the height above the table surface for when the speed of the marble is fast as well as when it is slow.

3. Is the relationship between the speed of the marble and the height above the table a direct relationship or is it an indirect relationship?

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Overall Conclusion : 1-State if your original hypothesis was correct or incorrect. This should be based on the best information collected from the experiment. 2-If it was incorrect, give the correct answer, again based on the best information collected from the experiment. 3-Include a brief numerical summary and comparison of the data collected during the experiment telling how it supports your answer for the hypothesis.

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Sources of Error: Identify two things that people may have done incorrectly that would have caused them to get totally different answers from the rest of the class. **These errors must be unique, in other words they have not been applicable in previous labs**. They must be **new** sources of error. Be **specific** about what might have been done.

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