FLINN SCIENTIFIC

Name_____

# Roller Coaster Worksheet

## Observations

## Data Table

Diameter of the marble: _____

Mass of the marble: _____

Height of Release Point (0 cm): _____

| Track Region | Track Position | Height above Tabletop | Transit Time | | | | |
|---|---|---|---|---|---|---|---|
| | | | Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 |
| **Lowest Point of the First Valley** | | | | | | | |
| **Highest Point of the Second Hill** | | | | | | | |
| **30-cm Height Track Position 1** | | 30.0 cm | | | | | |
| **30-cm Height Track Position 2** | | 30.0 cm | | | | | |
| **30-cm Height Track Position 3** | | 30.0 cm | | | | | |
| **End of Track** | 130.0 cm | | | | | | |

## Results Table

| Track Region | Track Position | Height above Tabletop | Average Speed |
|---|---|---|---|
| **Lowest Point of the First Valley** | | | |
| **Highest Point of the Second Hill** | | | |
| **30-cm Height Track Position 1** | | 30.0 cm | |
| **30-cm Height Track Position 2** | | 30.0 cm | |
| **30-cm Height Track Position 3** | | 30.0 cm | |
| **End of Track** | 130.0 cm | | |

# Roller Coaster Worksheet, continued

## Analysis and Post-Lab Questions

1. Calculate the average speed of the marble at each Track Position (in cm/s). Show all calculations and enter results in the Results Table. *Hint:* Divide the marble diameter by the average "Transit Time" at each position.

2. Graph the Average Speed versus the Track Position.
3. Where along the track does the marble roll with the greatest speed?

4. Graph the Average Speed versus the Height above the Tabletop. What conclusions can be made from the graph?
5. Theoretically, on a frictionless surface, the marble should have the same speed at positions that are at the same height. How does the speed of the marble compare at the three different 30-cm height positions? Explain any discrepancies.

6. Imagine riding in a roller coaster or traveling on a bicycle that follows a similar path as the Roller Coaster Track. Would you feel heavier or lighter traveling down the inclined portion? Would you feel heavier or lighter in valley as you begin to travel up the curved path? Relate these experiences to the forces that affect the marble traveling along the Roller Coaster Track and explain why the marble does not travel at the same speed for each 30-cm height position.

## Advanced Post-Lab Questions

7. Calculate the potential energy of the marble at each Track Position. *Hint:* Convert grams to kilograms and centimeters to meters to obtain the unit of joules (J).

8. Because the marble rolls down a tract, or rail, Equation 7 must be modified slightly to account for this condition. The total kinetic energy ($KE_T$) of the marble will be equal to approximately ¾ $mv^2$. Use this equation to calculate the kinetic energy of the marble at each Track Position. *Hint:* Convert grams to kilograms and centimeters per second to meters per second to obtain the unit of joules (J).

9. Compare the total energy of the marble at each Track Position with the initial potential energy of the marble. What relationship exists between the kinetic and potential energy of the marble?