Name:

# Roller Coaster Lab

**Purpose**: To show the relationships between kinetic and potential energy as a ball rolls down a roller coaster.

**Procedure:**

1. Position the photogate firmly against the bottom of the track at each position listed. (5, 15, 25, 40, 55, 70, 85, 100, 115, 125 cm)
2. Set the timer on interval mode. Press reset before starting any trial.
3. Release the marble by holding it against the peg at the top of the track. It is important to release in the same way each time.
4. Record the time it takes for the marble to pass through the photogate. If “A” is lit, this tells the time for the marble to pass through gate A. If “B” is lit, this tells the time for the marble to pass through gate “B”. If both lights are on, this will tell you the time it takes the marble to go from A to B.
5. Do three trials so that you can determine and average time.
6. For each photogate position measure the height to the center of the light beam. This is done by measuring to the center of the hole on the side of the photogate. All height measurements must be done from the top of the table.
7. Measure the mass in kilograms of the ball and record in the data table.
8. Measure the diameter of the ball and record in the data table.

**Calculations:**

1. Determine the gravitational potential energy of the marble at each location.
2. Determine the velocity of the ball at each location.
3. Determine the ball’s kinetic energy at each location using KE = ½ mv2.
4. Determine the ball’s rotational kinetic energy at each location using KER = 1/5 mv2.
5. Determine the total kinetic energy of the ball at each location.
6. Determine the ball’s total energy at each location.

**Analysis:**

1. On the same graph plot:

PEg vs. Position

Total KE vs. Position

Total Energy vs. Position

 2. On the sane graph plot:

 PEg vs. Height

 Total KE vs. Height

 Total Energy vs. Height

**Conclusions:**

1. How does the total kinetic energy compare to the potential energy during this experiment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Describe the relationship between the height and gravitational potential energy. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Describe the relationship between the height and kinetic energy. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. How does the total energy compare to the position throughout this experiment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Total Energy |  |  |  |  |  |  |  |  |  |  |
| m | PEg |  |  |  |  |  |  |  |  |  |  |
| 0.019 | Total KE |  |  |  |  |  |  |  |  |  |  |
| Diameter = | Rot KE |  |  |  |  |  |  |  |  |  |  |
|  | KE |  |  |  |  |  |  |  |  |  |  |
|  | Velocity |  |  |  |  |  |  |  |  |  |  |
|  | AveTime |  |  |  |  |  |  |  |  |  |  |
|  | TimeTrial #3 |  |  |  |  |  |  |  |  |  |  |
| kg | TimeTrial #2 |  |  |  |  |  |  |  |  |  |  |
| 0.0282 | TimeTrial #1 |  |  |  |  |  |  |  |  |  |  |
| Mass = | Height |  |  |  |  |  |  |  |  |  |  |
|  | Position | 0.05 | 0.15 | 0.25 | 0.4 | 0.55 | 0.7 | 0.85 | 1.0 | 1.15 | 1.25 |