**Roller Coaster Science Name: .**

Team members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Task: Design and construct a roller coaster using 1.83 meters of tubing and a marble as the car.

* The roller coaster must have at least two hills (downward slopes).
* The hills may be different sizes.
* A loop can count as a hill.
* The marble is dropped in the tubing at the top of the hill. You cannot add any energy to the system to help your vehicle complete its route,
* You may use walls, tables, chairs, boxes, or any other approved material to support your roller coaster.

Materials: Tubing, marble, stopwatch, meter stick, masking tape, plastic cup, and any other approved materials.

Procedure:

|  |
| --- |
| Sketch |

1. Design your rollercoaster collaboratively. Sketch your roller coaster in the box and include any design notes.
2. Gather materials and cut your tubing open for your track.
3. Measure and mark your track at three different distances (0.60m, 1.20m, and 1.83m).
4. Construct and secure your roller coaster.
5. Measure and record the height of your hills. Record the dimensions in your sketch.
6. Measure and record the mass of the marble.
7. Test your roller coaster. Record the time as it crosses each of the three marked distances in Table 1. Time at least three trials and average your times.
8. Calculate the potential energy and kinetic energy and record them in Table 2.
9. Create a graph with Distance (m) on the x-axis and Energy (J) on the y-axis. Plot and label both kinetic energy and potential energy on your graph.

Data:

Mass of marble: \_\_\_\_\_

Table 1: Time

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Distance (m) | Time 1 (s) | Time 2 (s) | Time 3 (s) | Average (s) | Speed (m/s) |
| 0.60 |  |  |  |  |  |
| 1.20 |  |  |  |  |  |
| 1.83 |  |  |  |  |  |

Table 2: Energy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Distance (m) | Height (m) | Speed (m/s) | Potential Energy (J) | Kinetic Energy (J)  |
| 0.00 |  |  |  |  |
| 0.60 |  |  |  |  |
| 1.20 |  |  |  |  |
| 1.83 |  |  |  |  |

Graph:



Analysis:

1. Using your graph, describe the relationship between potential, kinetic, and total energy.
2. Describe the energy conversions that occur on a roller coaster.
3. Does your data show that you lost or gained any energy? Does your data confirm or contradict the Law of Conservation Energy? Why or why not?
4. Propose an explanation for any data that does not support the Law of Conservation of Energy.
5. Describe how the Law of Conservation of Energy affects your roller coaster.