

Roller Coaster Lab

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

**Purpose Question:** How will the acceleration of the marble(s) be affected by the different ramp shapes?

**Research:** *(develop understanding)*

Where is the motor on a roller coaster? \_\_\_\_\_

How do roller coaster cars develop their speed? \_\_\_\_\_

**Prediction:** *(before you do the test)*

#1 – Which ramp will generate the most acceleration? Why? \_\_\_\_\_

#2 – Which marble has the most potential energy? Why? \_\_\_\_\_

**Experiment:** *(test your predictions)*

**Safety Issues:**

**Keep track of the marbles.** Have a plan to measure and collect your experiment without losing your marbles. No goofing around. Improper Lab behavior will negatively affect your entire team.

- Materials:**
- Roller Coaster Ramp
  - 2 Marbles (1 Large, 1 Small)
  - Meter Stick
  - iPad Timer (stopwatch)
  - Calculator

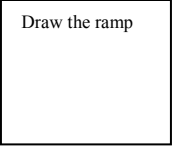
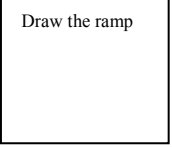
**Procedures: Remember**  **Safety First!!!**

1. Place the selected marble at the top of the ramp. Release the marble. Start the timer when the marble is released and stop the timer when the ball rolls \_\_\_\_\_ meter(s) past. Record your time in the data table.
2. Repeat step 1 two more times and find the average time. Record in the data table.
3. Repeat steps 1 and 2 for the other three ramps using the same marble.
4. Repeat steps 1 – 3 using the other size marbles

Ramp		Time it takes to roll _____ meter(s) (past the end of the ramp)			Average time for each ramp (tenth of sec)	Average Speed Distance = _____ Use Avg. Time for time variable
		Trial 1	Trial 2	Trial 3		
Small Marble	Red					
	Green					
	Yellow					
	Blue					
Large Marble	Red					
	Green					
	Yellow					
	Blue					

## Roller Coaster Lab

### Analysis:

1. Were your predictions correct? Explain in complete sentences. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. What is the **MASS** of the large marble? \_\_\_\_\_. Small marble? \_\_\_\_\_.
3. Which marble do you think has the most potential energy when sitting on top of the ramp (not released)? Explain why? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
4. Which marble had the fastest overall SPEED? \_\_\_\_\_ on which ramp? \_\_\_\_\_  
What was the **velocity** of the fastest marble? \_\_\_\_\_
5. Which ramp do you think had the shortest track? \_\_\_\_\_ Longest? \_\_\_\_\_
6. Which ramp (color) generated the fastest (average) speed? Explain why you think this happened? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ 
7. Which ramp (color) generated the slowest (average) time? Explain why you think this happened? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ 
8. Explain how each of Newton's Law(s) apply to this experiment? Connect each Law with a segment of the experiment. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
9. What force(s) acted upon the marble once it was released? \_\_\_\_\_  
How about when it stopped? \_\_\_\_\_
10. Calculate the total Gravitational Potential Energy (P.E.) for your marble on fastest ramp. The formula for calculating gravitational P.E. is mass x gravitational acceleration x height: **PE = m x g x h** (the mass must be in kilograms, the gravitational acceleration is always  $9.8\text{m/s}^2$ , and the height must be in meters). Your answer is in Joules (J).
11. Calculate the total Kinetic Energy (K.E.) for your marble on the fastest ramp. The formula for calculating P.E. is mass x velocity squared / two: **KE = m x v<sup>2</sup> / 2** (the mass must be in kilograms, and the velocity must be in meters per second) Your answer is in Joules (J).

## Roller Coaster Lab

Watch the BrainPop video "Potential Energy" and complete the activity below. NEXT, take the "Graded" video quiz and share your 1<sup>st</sup> score with Mr. Bridges.

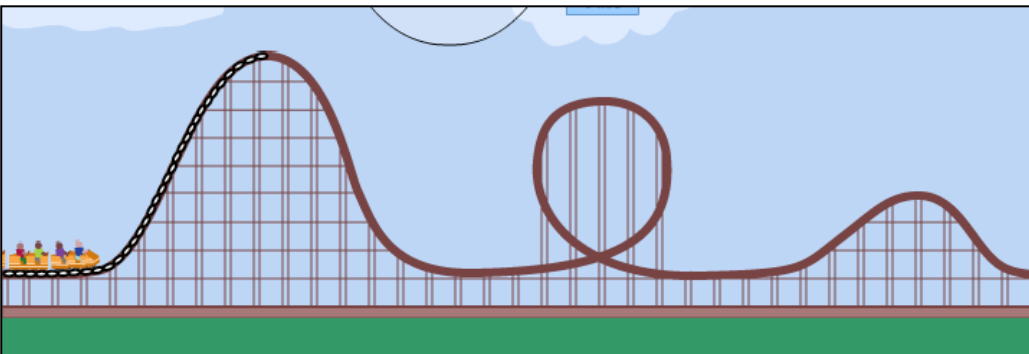
### FILL IN THE BLANK

Complete the following sentences with words from the word bank. All words will be used at least once. Some words may be used more than once.

**KINETIC    ELECTRICITY    COLLIDE    SPEED    MORE    DESTROYED    MASS    TRANSFERRED**

1. The amount of ..... energy an object has depends on its ..... and its .....
2. A fast-moving object with a lot of ..... will have a lot of kinetic energy.
3. An object with high mass and low ..... can have more kinetic energy than an object with low ..... and high speed.
4. If two objects have the same ....., the one moving faster will have ..... kinetic energy.
5. Kinetic energy can be ..... from one object to another when the objects .....
6. .... energy can be transformed to give us .....
7. Energy can be ..... and stored, but cannot be created or .....

**"Potential"**  
**Brain POP**  
**Quiz score:**  
/ 10



Watch the "Kinetic Energy" BrainPOP video and then answer the following questions below. Take the "Graded Quiz" and share your first score with Mr. B once completed.

Use this picture of a rollercoaster to answer the following questions.

1. When do the cars have the most POTENTIAL energy? Answer below and **circle** on the track
2. When do the cars have the most KINETIC energy? How can you tell? Answer below and **circle**
3. Does the roller coaster ever run out of potential energy? Explain

**"Kinetic"**  
**Brain POP**  
**Quiz score:**  
/ 10