Name_____Period_____Date_____

**Standard 4:Forces Acting on Moving Objects**
**Lab Test: Marble Roll**

**Test Question:** How can you make a marble take the **longest** time to cross the length of a table?

**Task to Complete:** Design a system that takes a marble the **longest** time to cross the length of a table.

**Development Questions:** Briefly discuss the following questions with your group. Write your answers using complete sentences.

1. How does gravity affect the motion of an object?

2. What part will gravity play in causing a marble to roll across the length of a table?

3. How does friction affect a moving object, specifically a marble that is rolling across a table?

4. What are some ways to get a marble to roll across a table as fast as possible?

5. What changes can you make to get a marble to move as slowly as possible and still make it across the table?

6. How does the potential and kinetic energy of the marble affect its motion across the table?

**Materials (for a group of four):**

- Marble
- Building blocks
- Meter sticks
- Old textbooks
- Ruler, paint sticks
- Tape
- Stopwatch/timer
- Miscellaneous supplies: paper, plastic wrap, string, etc.

**Procedure:**

1. Run a control test, which is the **time it takes for the marble to roll across the table without any barriers or changes to the surface of the table**. Repeat 3 times, take the average and record all data. (Think about the potential energy the marble needs before it can roll down the table! What do you have to do?!!?)
2. Selecting from the materials provided, develop a way to test the motion question: **How can you make a marble take the longest time to cross the length of a table?** You may use any arrangement of barriers you want, but with these guidelines:
   - The marble must travel from one narrow edge of the table to the other narrow edge of the table.
   - Do not touch the marble once it has been released, either directly (e.g., finger, pencil, etc.) or indirectly (e.g., wiggling the table).
   - Measure the time it takes starting when the marble is released and ending when it rolls off the opposite edge of the table.
3. Draw a sketch of the control and at least **<u>two</u>** configurations of barriers used during the investigation. Describe the effect the barriers or obstacles had on the marble's movement in each diagram.

| **Sketch of Control** | **Sketch of Configuration 1**<br>Changes to the table to increase the marble rolling time | **Sketch of Configuration 2:**<br>Changes made to Sketch #1 to increase the marble rolling time |
|---|---|---|
| | | |

**Data Table:**

| **Trial #** | **Control: Roll the marble across the table without any barriers or changes to the table surface.** | | **Configuration 1** | | **Configuration 2** | |
|---|---|---|---|---|---|---|
| | **Time (sec)** | **Distance (cm)** | **Time (sec)** | **Distance (cm)** | **Time (sec)** | **Distance (cm)** |
| **Time trial 1** | | | | | | |
| **Time trial 2** | | | | | | |
| **Time trial 3** | | | | | | |
| **Average** | | | | | | |

Write your longest average time on the board once your group has completed the trials and filled in your data chart.

**Analysis and Conclusions:** (Write your answers using complete sentences.)

1. What were some challenges (at least two) your group had changing the motion of the marble? Describe the adjustments you had to make to your barrier system.

2. What factors or ideas were effective in creating a long travel time? Explain.

3. If you had more time to complete this assignment, what would you do differently? Explain.