**Name:**

**Lab Partner:**

**Course: AP Physics**

**Period:**

**Date:**

**AP Lab #6- Marble Energy**

**Purpose/ Problem:** To predict and verify the distance a marble rolled along a tilted ramp from a known height lands horizontally from a table of known height.

**Hypothesis:** The ball will land \_\_\_\_\_\_\_ horizontally from the table. (You determine the amount, based on your calculations from the analysis section. You will have to perform those calculations first and fill in the hypothesis afterwards.)

**Background:** (Do not include this section in your final write-up). You already know that the energy an object gains in being lifted is independent of the path it takes to get there and that energy is conserved as the object returns to the original elevation, as long as no significant external nonconservative forces act on the object. You can use this information to determine the speed of the object from the kinetic energy that it possesses. Furthermore, you know that an object launched horizontally undergoes a horizontal constant velocity and a vertical constant acceleration that are independent from each other. Knowing the initial velocity of the launch, you can determine the distance the object travels before finally landing. You will make use of all of these in predicting the landing spot of the projectile.

**Materials:** small plastic marble, board ramp, sheet of paper, ring stand, masking tape, meter stick or tape measure (remember to list what you actually used)

**Experimental Design & Procedure:**

Sketch up set up:

Δy

Δx

h

1. Set up the apparatus shown above. (you will describe the details in your written procedure)
   1. You will need to tape a few sheets of paper at the end of the ramp in a curving shape to make a smooth transition to the tabletop so that the ball moves horizontally without bouncing.
2. Measure the height from the tabletop (vertically) to where the ball is when it is released and whatever else you need to measure to determine the velocity of the ball just as it leaves the table horizontally.
3. Place the ball on the ramp and release it from rest. Record horizontal distance the ball travels from the edge of the table to the floor in the data table. Repeat this procedure at least four more times so that you have at least five trial values in the table.
4. Remember to get the height of the table to make sure you can calculate the final landing place!

**Observations & Data:**

Height of table:

|  |  |  |
| --- | --- | --- |
| Trial | Release Height of Marble on Ramp (m) | Horizontal Distance Traveled From Table (m) |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| Average |  |  |

**Analysis:**

1. Using the *average* values of the data in the table and showing all relevant work, calculate the velocity of the marble just as it leaves the table horizontally.
2. Using the launch velocity you calculated in step 1, and showing all relevant work, calculate the horizontal distance the ball is expected to travel once it leaves the table until it hits the ground. (This will be the value you use in your hypothesis.)
3. Compare the horizontal distance you just calculated (the theoretical value) to the   
   *average* value of the horizontal distances traveled from the table.

(Remember, "compare" means to find a percent difference)

1. What’s missing from our analysis? What is present that we are not measuring that might make up for the difference? Make a hypothesis here (that you will explore in more detail in the error analysis section in your conclusion.)

**Conclusion** (Make sure to observe the guidelines given in the previous labs)**:** What do you conclude from your analysis? Is this what you expected? Why? Be sure to   
 address the hypothesis you made in the Analysis section that attempts to account   
 for any differences between the hypothesized and experimentally measured values.

***Lab Report* Rubric**

**AP Physics 1 Lab #6: Marble Energy**

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Period\_\_\_\_\_\_\_\_\_

**15 pts**

Penalty Box (check means that there are problems in that area)

|  |  |
| --- | --- |
| □ lab notes not attached to lab report  □ doesn’t use third-person voice  □ lab framework is not followed (calculations not in analysis section, data tables not together in proper section, etc) | □ more than a few obvious spelling/grammatical errors  □ math is not easy to follow (original algebra not shown, plug-in not shown, unclear progression) |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Missing** | **Inadequate** | **Needs** **Improvement** | **Adequate** | **Points** |
| **Title, Heading, Purpose, Hypothesis, Materials** (1 pt) | | | | |  |
| **Diagrams & Data Tables**  (2 pt) | \* diagram is missing  \* data tables are missing or extremely vague (i.e. numerical values only) | \* diagram is unclear or unrelated  or has major omissions  \* data tables have major omissions  (i.e. table missing for a graphed set of data) | \* diagram is vague or has minor omissions  \* data tables have minor omissions  (i.e. units incorrect or missing) | \* diagram present & clear  \*diagram labeled and captioned as necessary  \* data tables clear and complete  \* tables include labels and proper units |  |
| **Procedure & Conclusion**  (4 pt) | \* procedure or conclusion extremely vague or missing altogether  \*unintelligible  \*missing: no attempt made to explain | \*major problems with procedure and conclusion  \*unclear with important details missing  \*lengthy/unrelated digressions  \*vague or ambiguous statements | \* minor problems with procedure and conclusion: unclear  \*vague details or omissions  \* effort required to comprehend the progression  \*unrelated digressions  \*All logical steps present, but in non-sequential order | \* procedure clear & complete, matching what was actually done  \* conclusion is drawn that is related to the purpose/problem  \* makes sense on 1st read-through  \* organized, sequential, argues from evidence  \*adjustment included  \*new result interpreted correctly |  |
| **Error Analysis**  (2 pt) | \*error analysis missing  \*emotional response  \*”miscalculation” or ”mistake”  \*”faulty equipment”  \*”human error” | \*estimated values not related to calculated results  \*no attempt/failed attempt to quantify  \*ambiguous, unclear language  \*missing necessary diagrams  \*incorrect statements | \*sources of error identified, but focus on non-major sources  \*estimated values unfounded or unreasonable--related loosely/not related to calculations  \*ambiguous, unclear language  \*incorrect statements | \*major sources identified & explored  \* quantified (amounts estimated)  \*shows effect on calculation  \*diagrams included |  |
| **Analysis Questions**  (6 pt) | These are graded question by question.  -please include questions along with the answers in the lab report- | | | |  |
| **Total :** | | | | |  |