AP PHYSICS LAB NOTEBOOK INFORMATION

GENERAL STYLE OF NOTEBOOK:

The notebook will contain a record of what you did, how you did it, and your results. Your records should be formal, neat, and complete enough so that any reasonably knowledgeable person familiar with the subject (other students, teacher, etc.), can read the entries, understand exactly what you did, and, if necessary, repeat your experiment.

You will make all entries in your notebook in black or blue ink. Pencil is unacceptable (easily erased or smeared). If you make a mistake, draw a **single line** through the mistake. Never erase anything! Never remove any papers from you lab notebook.

Most importantly, **your notebook needs to be set up for the experiment the day *before* the experiment!** When you come into the lab period, it is presumed that you will have read the lab procedure, understood the material, and prepared your notebook with the information that follows.

OUTLINE OF A NOTEBOOK ENTRY

- TITLE OF EXPERIMENT
  Make the title descriptive enough that the reader can find information quickly.

- **DATE PREFORMED LAB**

- **NAME(S) OF PARTNERS**

- **OBJECTIVE**
  Should be an elaboration of the title. What does the lab set out to accomplish.

- **THEORY**
  Explain the concepts used in the experiment, and if applicable, a mathematical relationship and/or derivation.

- **EQUIPMENT LIST**
  List all equipment used in experiment

- **EXPERIMENT SET-UP**
  Include a sketch of the equipment set-up. If diagram is included in handout, simply copy that diagram. Leave a space if there is no diagram and you are not sure what it would look like.

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- **TABLE OF OBSERVED DATA**
  These tables should be constructed before you come to lab that day. All data should be clearly labeled with units and logically organized.

  All data will be directly entered into your lab notebook in either blue or black ink. Incorrect data should be lined out (single line only) with explanation off to the side. If the entire table is incorrect, draw an "X" over the table, with explanation of why it was incorrect. A corrected data table would be placed at the end of the lab.

- **TABLE OF CALCULATED RESULTS**
  All calculations should be neatly entered in a Calculation Table. Remember to label results properly. You must show the work for every type of calculation that you do. Including expression, solving for proper variable, substitution of numbers, and your result circled.

- **GRAPH(S)**
  When graphs are needed, they should be done using Graphical Analysis. All graphs must have a descriptive title, X and Y axes labeled with quantity and units. These graphs should be neatly trimmed and placed in your notebook using Scotch tape.

- **DISCUSSION**
  You should summarize your findings in paragraph form. Discussions usually contain:

  % difference of % error

  $$\% \text{ difference} = \frac{|Value_2 - Value_1|}{|Value_2 + Value_1|/2} \times 100$$

  $$\% \text{ error} = \frac{|Exp\ Value - Known\ Value|}{Know\ Value} \times 100$$

- **SOURCES OF EXPERIMENTAL ERROR**
  "Experimental error" refers to variability in results due to limitations in the experimental design (reason for multiple trials). In this section, list observed reasons that you feel may have contributed to errors in your experiment, including problems with equipment, difficulties in reading the equipment, or limitations of the design. Only mention specific sources of error that you feel may have affected the outcome of the experiment. An example would be; "The average final velocity of the pendulum was 15.6% smaller then it was at the top, which we presume is at least partly

caused by loss of energy due to air friction as the pendulum swung down." Do not use "human error."

- **QUESTIONS**
  Answers to questions should be in complete sentences.

- **CONCLUSION**
  A short, one paragraph summary of the results of the experiment. Did you fulfill the purpose/objective of the experiment? Remember, we are unable to "prove" anything; we will never prove Newton's Second/Third Law, Ohm's Law, etc. Better to say confirm results. It is not appropriate to include any reference to how you liked/disliked the experiment or blame your lab partner for poor results.

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GALILEO'S RAMP

Date: September 13, 2000,

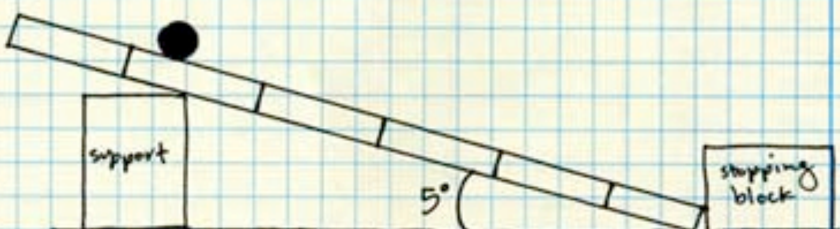
Lab Partner: Adelia, Liz, Beth, Greg, Sonja, Marisol, Elise

Objective: The objective of this lab is to investigate the relationship between distance and time for an object rolling down an incline.

Theory: It is difficult to measure the motion of a free-falling object. However, by using Galileo's method to measure the motion of an object going down an inclined plane, we can better understand some of the physics of a true free-falling object.

Equipment: 3-meter ramp, steel ball bearing, or low-friction cart, stopwatch, masking tape, meter stick, protractor, ramp supports

Setup:



Procedure:

1. Set up ramp with an angle of incline around 5°.

2. Divide ramp's length into 6 equal parts and mark the 6 positions with pieces of tape. These will be used as release points. Block bottom of ramp with a stopping block to allow you to hear when object reaches the bottom.

Procedure (continued):

3. Use a stopwatch to measure the time it takes the object to roll down the ramp from each of the 6 release points. For accuracy, use a ruler to hold the object at the starting point, and pull away quickly to release uniformly. Do several practice runs to minimize error. Record at least 3 timings from each release position.

4. Repeat steps 2-3 with the incline set at an angle 5° steeper.

Data Table:

6° RAMP

Release Position	Trial	Times (s)	Average
1 (50 cm)	1	1.04 s	1.2125 s
	2	1.16 s	
	3	1.28 s	
2 (100 cm)	1	2.35 s	2.2525 s
	2	2.25 s	
	3	2.19 s	
3 (150 cm)	1	2.53 s	2.6025 s
	2	2.59 s	
	3	2.69 s	
4 (200 cm)	1	3.16 s	3.0625 s
	2	3.00 s	
	3	3.09 s	
5 (250 cm)	1	3.31 s	3.405 s
	2	3.43 s	
	3	3.50 s	
6 (300 cm)	1	3.66 s	3.7075 s
	2	3.73 s	
	3	3.79 s	

diameter of ball: 1.3 cm

Trial 4: ok!

Dist.	Time
50 cm	1.37 s
100 cm	2.22 s
150 cm	2.65 s
200 cm	3.00 s
250 cm	3.35 s
300 cm	3.75 s

$$\text{Average} = \frac{t1 + t2 + t3 + t4}{4}$$

{ show one sample calculation! (Say, with first set of data)

example:

$$\text{Average} = \frac{1.04s + 1.16s + 1.28s + 1.37s}{4} = 1.2125s$$

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Data Table:

11° RAMP

Release Point	Trial	Time (s)	Average
1 (50 cm)	1	1.12 s	
	2	1.10 s	
	3	1.04 s	1.0725 s
	4	1.03 s	
2 (100 cm)	1	1.50 s	
	2	1.35 s	
	3	1.50 s	1.4625 s
	4	1.50 s	
3 (150 cm)	1	1.91 s	
	2	1.78 s	
	3	1.81 s	1.8325 s
	4	1.88 s	
4 (200 cm)	1	2.22 s	
	2	2.13 s	
	3	2.34 s	2.22 s
	4	2.19 s	
5 (250 cm)	1	2.40 s	
	2	2.28 s	
	3	2.53 s	2.38 s
	4	2.31 s	
6 (300 cm)	1	2.62 s	
	2	2.62 s	
	3	2.63 s	2.625 s
	4	2.63 s	

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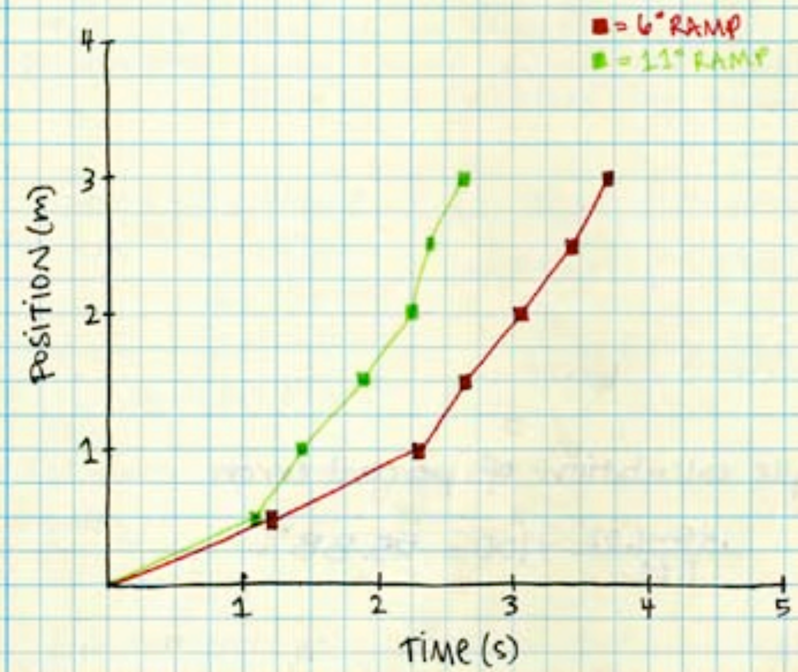
Graph of Results:



We graphed the position-time data in a scatter plot on our calculator, a TI-86. Through trial and error, we found an equation in the form of: $x = x_i + v_i t + \frac{1}{2}at^2$, or
$y = y_i + v_i x + \frac{1}{2}ax^2$ on the calculator, which matched the plotted points most closely.

Because the initial velocity of the ball is zero, and because the initial displacement is also zero, the equation reduces to:

$x = \frac{1}{2}at^2$ or $y = \frac{1}{2}ax^2$ on the calculator.

By trial and error, we found the function:

$y = .5(.45)x^2$

to most closely match our scattered points. (for 6° ramp)

What about for the 11° ramp?

By trial and error, we found the function:

$y = .5(.87)x^2$

to most closely match our scattered points for the 11° ramp.

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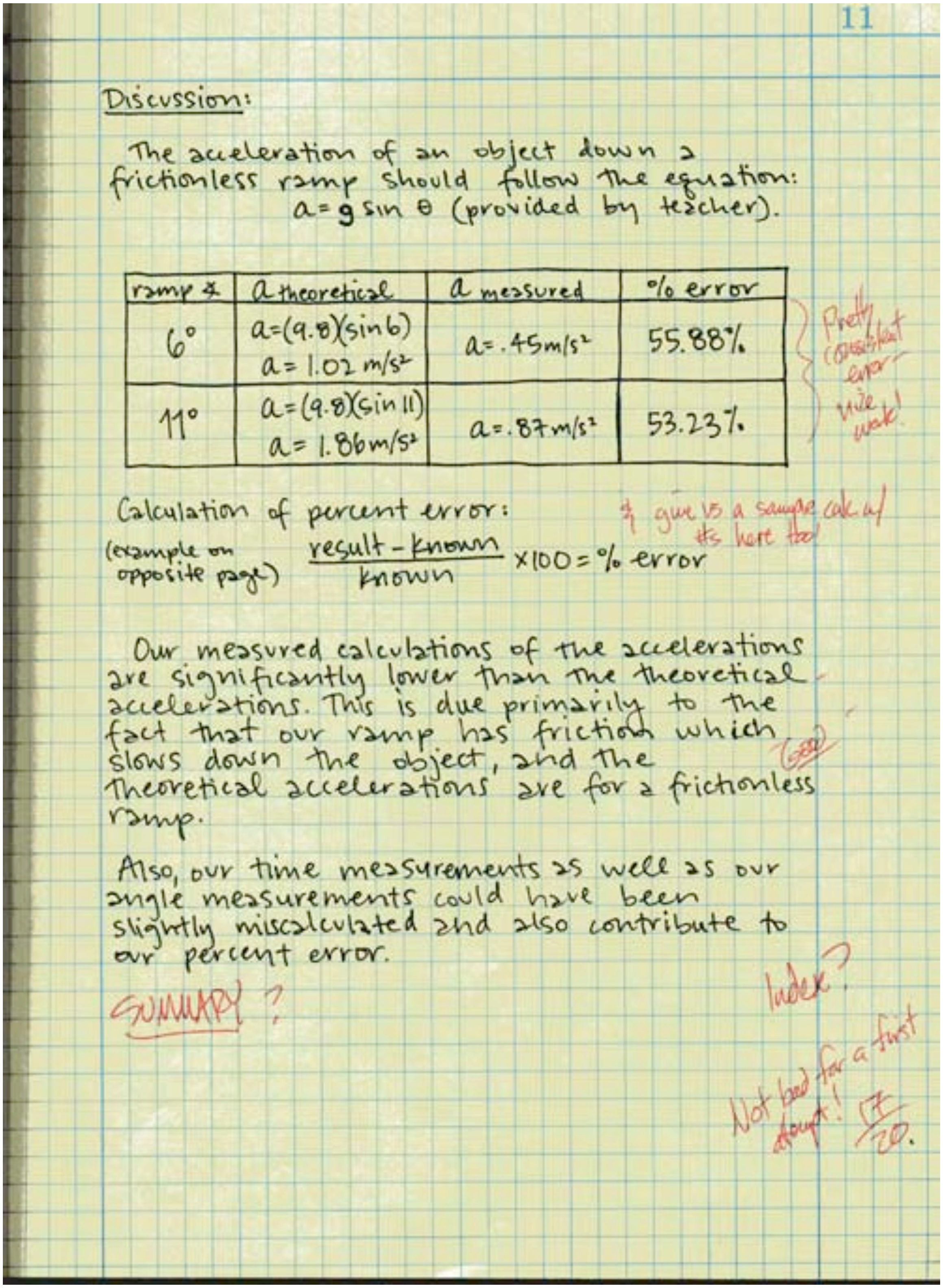

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Discussion:

The acceleration of an object down a frictionless ramp should follow the equation:

$a = g \sin \theta$ (provided by teacher).

ramp ∡	a theoretical	a measured	% error
6°	$a = (9.8)(\sin 6)$ $a = 1.02\ m/s^2$	$a = .45 m/s^2$	55.88%
11°	$a = (9.8)(\sin 11)$ $a = 1.86 m/s^2$	$a = .87 m/s^2$	53.23%

Pretty consistent error — nice work!

Calculation of percent error:

(example on opposite page) $\frac{\text{result} - \text{known}}{\text{known}} \times 100 = \%$ error

½ give us a sample calc w/ #s here too!

Our measured calculations of the accelerations are significantly lower than the theoretical accelerations. This is due primarily to the fact that our ramp has friction which slows down the object, and the theoretical accelerations are for a frictionless ramp. (good)

Also, our time measurements as well as our angle measurements could have been slightly miscalculated and also contribute to our percent error.

SUMMARY ?

Index?

Not bad for a first draft! 17/20.