

PHYSICS PROJECT — Amusement Park Day — Alternative Assignment

Name _____ Partners _____

1. Structure:

- a. You will be given a puzzle to solve: finding a value for a Physics-related quantity as it relates to a specific point on a specific ride.
- b. Your task is to: design a method for measuring the needed values, collect the required data, perform the necessary calculations to determine the value you are looking for, and write a brief lab report of your process and results.
- c. You will work as an individual, although other students may assist you in collecting data.
- d. You will be assigned a task at random by your teacher.
- e. Data collection must be completed by the end of the day at the amusement park.
- f. Not all problems require being on the ride to collect data. Use data collection techniques appropriate for your problem.
- g. In the collection of data, some estimation is allowed, but only for values that could not possibly be reasonably measured. *All estimates require justification/explanation (calculations and blurbs) as to their validity and accuracy.* Digital photos are a great way to document your estimations process.
- h. Some measurement values may be available online. You may use these values to compare to your own measurements or estimations as a matter of interest, but use your own measurements or estimations for your calculations.
- i. Your problem may require vertical or horizontal acceleration measurements. These are possible using simple devices, but you may also find it more convenient to use an accelerometer app on a smartphone.
- j. Other data collection devices that you may find useful: a timer, a still camera, a video camera, a clinometer, and a calculator. A smartphone with appropriate apps will perform these functions.
- k. The primary means of measuring horizontal distances at the park is by pacing. Record your pace here:

- l. If you run into problems at the park, contact the instructor by text or phone. If your ride is not operating for some reason, there's no need to call. Just solve the same problem for a different ride.

2. The Final Report:

- a. The final report will be word-processed, with a paper version submitted in class and a PDF version emailed to the instructor by _____
- b. The report should be 3-5 pages in length, and include:
 - i. *Purpose*: State the task you are assigned.
 - ii. *Materials*: List the materials used.
 - iii. *Procedure*: Write a brief summary of the procedure you developed to answer your problem.
 - iv. *Data*: Include data tables of ALL measured values, and annotated photos or diagrams used in your data collection.
 - v. *Calculations*: Show how you calculated any values used in developing your solution to the problem. Be sure to provide plentiful blurbs (comments) on your strategy. Clearly state your final answer to the problem at the end of this section.
 - vi. *Experimental Error Discussion*: Discuss significant sources of error, their likely effect on your results, and provide quantitative analysis where possible regarding the degree of error.
 - vii. *Summary*: Include a brief restatement of your problem, the procedure used to solve the problem, the results of your analysis and calculations, and experimental error.
 - viii. Attach raw data that you took to the back of your report.

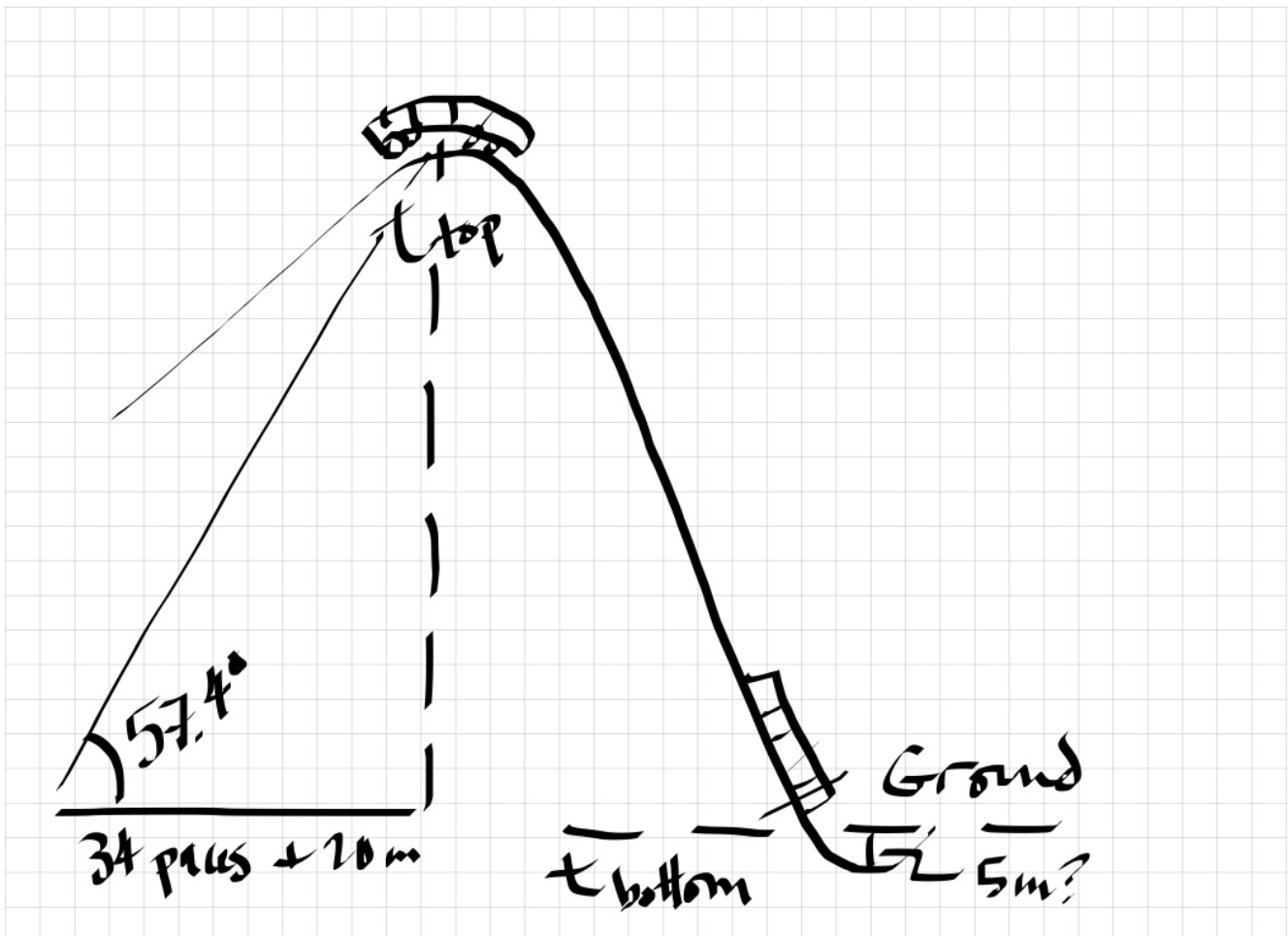
3. Your Topic:

The total energy lost to various types of friction during the descent on the first drop of Goliath.

4. Collected Data:

In order to determine the energy lost during the initial drop, you decide to use an energy analysis of the ride. In order to determine the gravitational and potential energies for the first drop, you collect the following data using pacing, video shot at the park, and estimation:

- length of my pace = 0.83m
- length of Goliath rollercoaster train = 12.5 paces
- time for one train to pass uppermost point on first hill = 11.3 s
- distance from base of uppermost point to viewpoint = 34 paces + estimated 20 m
- at viewpoint, angled from horizontal to sight at top of hill (measured with iHandy Level) = 57.4°
- time for train to enter tunnel near bottom = 0.28 s
- estimated depth of tunnel *below* ground = 5 meters



Based on the measurements collected, determine the amount of energy lost by the rollercoaster on this hill. Compare values calculated with values available online and calculate percent error in your results, assuming the values posted online are correct.