Honors Lab

This activity is courtesy of Keith Geller and Colin Quinton at Palo Alto High School. They use it with their Honors Physics classes in 2000.

I. 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 quantities you will need to know, collect the required data, and perform the necessary calculations to determine the value you are looking for.
C. You will figure out how you will go about making your measurements.

II. Rules :

A. Your group may contain up to three persons. Your partner must be someone who has the same teacher as you and is an Honors Physics Student at PAHS. No exceptions.
B. You will be assigned a task at random by your teacher
C. You may trade tasks with another group by mutual consent.
D. The data collection must be completed by the end of the day. The write-up will be collected at the beginning of the class on Tuesday, May 11.
E. In the collection of data, some estimation is allowed, but only insofar as it is used to approximate values that could not possibly be arrived at using readily available equipment. All estimates require justification/explanation as to their validity and accuracy.
F. You will be supplied with a vertical accelerometer and a horizontal accelerometer/quadrant. You will be required to supply all other equipment needed. Note that there will not be enough equipment for all groups to have a set of equipment all at the same time. There will be about one set for every 2-3 groups.

III. The Final Report :

A. Structure of Report
   a. Purpose: State the task you are assigned.
   b. Materials: List the materials used.
   c. Procedure: Write a summary of the procedure you created.
   d. Data: Record ALL measured values. Also, record data tables that include ALL values generated, including calculated values.
   e. Calculations: Show how you calculated any values, not directly measured, that appear on your data table.
   f. Conclusion/Analysis: State you results FIRST. Then a discussion in which you identify possible sources of error based on their likely effect on your data, relating to what you expected your results to be and how the actual results differed.
   g. Note - attach raw data that you took to the back of the report.
B. Rules
   a. We do not expect your report to be long (probably Å 3 pages), but we do expect it to be clear, readable, thorough, and accurate.
   b. If your results seem made-up, unreasonable, or too similar to those of other groups, your results will be disqualified.

IV.Your Group's Topic :

Fill in topic here: ____

The topics that Geller and Quinton gave their classes are listed here:

1. Power output of the motor that lifts the train to the top of the Demon
2. Centripetal acceleration of the car at the top of the first loop of the Demon
3. Amount of energy lost between the top of the first hill and the top of the second loop of the Demon.
4. Amount of Work done by friction between the top and bottom point of the first hill of the Grizzly.
5. Angle and magnitude of the centripetal force on the riders at the first major turn of the Grizzly (assume a 50-kg rider).
6. On the Grizzly, find the magnitude of the normal force between a 50-kg rider and her seat while passing over the first hump of the Grizzly. The first "hump" is not the hill at the start.
7. Force of friction that stops the train at the end of the ride on the Grizzly.
8. Energy lost due to (wind) friction during the drop (before the braking action occurs) of the Drop Tower.
9. Force required to stop the module during the braking segment of the Drop Tower. You may assume that the braking force is constant once braking begins (it isn't).
10. Average wind friction force between the moment of release and bottom on a rider of Xtreme Skyflyer. Assume a rider mass of 50 kg.
11. Tension force in each cable supporting a rider of Xtreme Skyflyer at the moment the rider reaches the bottom after the release. Assume a mass for the rider of 50 kg.
12. Maximum total mechanical energy per kilogram of a train on Flight Deck.
13. Typical force of impact between two cars in Rue le Dodge.
14. Coefficient of friction between track and train for the Grizzly during the first major descent.
15. Actual mechanical advantage of the inclined conveyer belt on Rip Roaring Rapids.
16. The normal force acting on the train at the top of the first loop on Flight Deck.
17. The percent of total mechanical energy lost due to friction after the first series of falls and loops on the Vortex.
18. The average stopping force of the water on the boat at the bottom of the final drop on the Whitewater Falls ride.
19. The coefficient of friction acting on a person standing on the carousel while moving without holding on to any horses.
20. The percent difference between the normal force acting on a person at the top of the circle as compared to the bottom of the circle while moving at top speed vertically on Orbit.
21. The force applied by the outer person on the inner person sitting in the same car (next to each other) as they reach an "outer-most point" on the Centrifuge scrambler ride.
22. Power used to lift all of the people in the elevator riding to the top of the Star Tower.
23. The normal force acting on a person sitting in an Orbit car at maximum horizontal velocity just before the ride starts to lift.
24. The force of the floor on each 50-kg person at the top of the first loop on the ride Vortex.

Some of the original items from Geller and Quinton have been dropped due to rides no longer at California's Great America. Some rides experienced name changes, too. Otherwise, this was the assignment they actually gave their students in 2000.