Lab: Free-Form Gravity Lab AP Physics

Background

There is one type of lab-related AP question for which we have done very little. It is the scenario in which you are put in the teacher's shoes, provided with specific lab equipment and asked to design an experiment using what has been made available to you. You don't know enough E&M to do something like this in that field, but you are now a wizard in Classical Newtonian Mechanics . . . so that is where we are going in this lab.

Objectives

Assuming you have all of the pieces of equipment list below, your task is to create TWO different lab protocols from which you can determine the acceleration of gravity *g*. Each approach should be accompanied by a sketch, an equipment list (you may not use all the pieces listed below) and a step-by-step explanation of how the experiment should be done (this should be written so that another student could follow your instructions to the conclusion of the lab). Once outlined, you will follow your protocol, do the experiment and calculate *g*.

And as an additional twist, one of your approaches should require the use of a linear graph the slope of which is related to *g* (you might think a bit about a pendulum here).

And as an added thrill, you will be required to make a 30 second (or less) video of you executing the data taking for ONE of your lab. (You'll have to take data for both labs, but you only have to make a video for one, your choice.)

TECHNICAL HINT: The way teachers create labs like this is to find a mathematical relationship that has the desired parameter along with easily measurable quantities. Set up a situation in which that relationship is relevant, take data, then use the relationship to determine the desired parameter. That is what you'll need to do here . . .

Equipment

Set of weights;
Balance (or some way to measure a weight's mass--a bathroom scale would do);
Length of string;
Meter stick (or some other appropriate length-measuring device);
Stop watch;
Cell phone (but no use of Tracker software);
Metronome;

Procedure

1.) You may brainstorm in groups of three. Include the name of your partners on your cover sheet. Having said that, EACH STUDENT MUST TO DO THEIR OWN WRITE-UP IN THEIR OWN WORDS.
2.) This lab will have a Part A and a Part B. Part A will be devoted to your first procedure and its implementation. Part B will be devoted to your second procedure and its implementation.
3.) Include a 30 second (or less) video of you taking data for ONE of the procedures outlined below.
4.) FOR PART A:
    a.) State the relationship to be exploit in attempting to determine the acceleration of gravity.
    b.) List the pieces of equipment to be used in executing the experiment.
    c.) Write out the protocol. You don't have to be super wordy here, but say enough so that another student might follow your protocol and do your experiment. (Don't be bashful about demanding multiple runs.)
    d.) Follow the protocol yourself and determine the acceleration of gravity.
    e.) Compare your value to the accepted value of 9.8 m/s/s and comment appropriately.
5.) FOR PART B, repeat the instructions for #2 for your second experiment.