

6 A Property of Matter

Lab B: Mass and Acceleration

Name _____

AP Physics B

How does the mass of an object affect its acceleration? The goal of this experiment will be to find the relationship between mass and acceleration when a constant unbalanced force is applied.

You will again be using air tracks and gliders for this experiment. At your lab station are three gliders. The two red gliders each have a mass of 300 g or 0.300 kg. The gold glider has a mass of 0.150 kg. (Please note that some of the gold gliders work best if they travel in the direction indicated by the large arrow pennaed on one side.) The gliders can be hooked together in various combinations. *Please note that the weight holder has its own mass which must be included in the total mass of the system.*

You will be writing your own lab report this time. Your lab group must first design an experiment to determine how mass and acceleration are related. Study the equipment available at your lab station. Design your experiment so that you will have data for **five** different mass values. Be certain that you can answer these questions without notes:

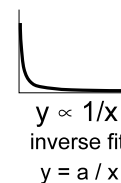
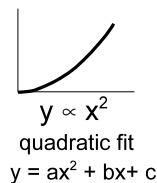
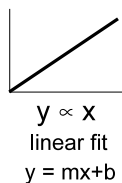
1. What are the independent and dependent variables?
2. What quantities will you hold constant, at what values, and how will you accomplish that?
3. What data must you collect, and what standards of reproducibility will you enforce? (How many trials will you take? How close must the data be before continuing to another trial?)
4. What is the best order to the data collection which will minimize human error?

Before you take any data, design a data table which is clear and consistent. Use the tables from previous experiments as models. Don't forget that your table needs to have space for calculated quantities as well as raw data. Have one person in the group construct your planned data table on a sheet of notebook paper. After your group has agreed on a procedure and a data table, **present your experiment to Mr. M for approval.**



DO NOT CONTINUE UNTIL YOUR EXPERIMENT IS APPROVED.

Now conduct your experiment. You will need to graph your data and analyze it. The data will fall into one of the categories at right, and you should have the computer perform the appropriate fit. (Select the "Automatic Curve Fit" function from the "Analyze" menu.)



- Your lab report must be neatly written or typed; typed reports should be **double-spaced**
- Each student will submit a report, with his or her own unique description of the procedure & conclusions
- Do not use first person in the report (no "I" or "we", etc.)
- Past tense is appropriate

YOUR REPORT MUST INCLUDE THE FOLLOWING:

Purpose - a statement of the relationship you were exploring (note that you probably did not formulate a hypothesis but merely tested to see what relationship, if any, existed between the variables)

Procedure - thoroughly describe what you did, including the equipment used, the set-up, and address the four numbered questions listed above (or a list of procedures written in the imperative mood; be sure the four questions are addressed)

Data - your data table (it must be neat; you can use Word or Excel to create it) and your graph printout

Conclusions

- a verbal statement of the relationship you discovered, including the type of curve fit
- an equation that fits the data (substitute proper variable symbols and appropriate rounded values from your best-fit line or curve)
- a discussion of the sources of systematic error in the experiment (see reverse for definition of error types)

Types of Laboratory Error

Type	Examples	Prevention	Discussion
personal error (mistakes)	mis-reading a scale or incorrectly rearranging an equation or calculating a figure	check against lab partners' work; redo parts of lab as needed when error discovered	none ; should be corrected before lab is submitted
systematic error	miscalibration or uncontrolled variables (e.g. friction); includes unavoidable timing errors	calibrate equipment when possible; think through procedures to minimize error	identify any uncontrollable variables (do not include variables causing random error)
random error	estimating the last digit on a scale reading; minor variations in temperature or air pressure	eliminate when possible; can never be completely eliminated	none

INSTRUCTIONS FOR USING SCHOOL COMPUTERS TO GENERATE THE REPORT:

- If you print using a school computer, make sure you are printing to a printer that has "110" as part of its name (physics is lab 110).
- Remember that printed reports should be double-spaced.
- Use your virtual locker at <http://bps-ok.org/locker.html> if you need to send your report to/from school