

Overview

The Experimental Design and Analysis (LAB) question is the third free-response question in Section 2 of the AP Physics 1 exam. It assesses students' ability to design a scientific investigation, analyze laboratory data, identify patterns, and justify claims from evidence. The core structure of this question type closely mirrors the Experimental Design questions used on AP Physics 1 exams from 2015 through 2024, so practicing those previous questions is strongly recommended.

Points and Timing

- Worth 10 points out of 40 total points in Section 2.
- Suggested time: 25 to 30 minutes out of 100 minutes total in Section 2.

Typical Question Structure

An Experimental Design and Analysis question follows this general pattern:

- **Design a procedure:** Describe how to collect data to test a claim, including steps to reduce experimental uncertainty.
- **Describe the graph:** Explain how to plot the data so that the slope of the best-fit line can be used to determine a specific variable.
- **Linearize the data:** Rearrange a given equation into slope-intercept form ($y = mx + b$) to identify what quantities to plot on each axis.
- **Plot data and draw a best-fit line:** Plot the appropriate quantities on the provided graph and draw a best-fit line through the data.
- **Calculate from the graph:** Use the slope of the best-fit line to calculate an experimental value of the target variable.

Example from the AP Physics 1 Course and Exam Description (FRQ #3 on [pages 196-198](#))

The liquid density question in the AP Physics 1 CED illustrates the typical Experimental Design and Analysis structure clearly:

- **Part a:** Describe an experimental procedure to collect data needed to determine the density of the liquid, including steps to reduce experimental uncertainty. This is the design a procedure step.
- **Part b:** Describe how the data from part a could be plotted to create a linear graph and how the slope of that graph would be used to determine the density of the liquid. This is the describe the graph step.
- **Part c(i):** Given a data table and equation, indicate which quantity to plot on the horizontal axis to yield a linear graph whose slope can be used to calculate the acceleration due to gravity. This is the linearize the data step.

- **Parts c(ii) and c(iii):** Plot the appropriate quantities on the graph, then draw a best-fit line through the data. This is the plot data and draw a best-fit line step.
- **Part d:** Calculate an experimental value of the acceleration due to gravity using the slope of the best-fit line. This is the calculate from the graph step.

Key Takeaways

- Keep your experimental design as simple as possible. The more complicated the design, the more time it takes to describe, and time is limited on the AP exam.
- Read the entire question before answering any part. The design of the experiment, the data collected, and the graph are all interconnected, so you need to understand the full picture before starting.
- To reduce experimental uncertainty, mention performing multiple trials and varying the relevant quantity being measured (e.g., changing initial height, initial velocity, or object position).
- When drawing diagrams, label every item. AP graders will not guess what objects you have drawn. Only include measurements that are actually needed; writing more than necessary can hurt your score.
- When graphing: label both axes with units, plot data so it uses more than half the graph area, and draw a best-fit line with roughly half the points above and half below.
- To find a starting point when designing an experiment, consult the equation sheet. Identify equations that involve the variables in the problem, and use those to determine what data to collect, what equipment is needed, and what the graph should look like.
- All Experimental Design and Analysis questions in the Ultimate Exam Slayer practice exams and the Ultimate Review Packet follow this same structure, which is also what to expect on the actual AP Physics 1 exam.