

## Introduction: Laboratory & Measurement

**Unit:** Laboratory & Measurement

Topics covered in this chapter:

The Scientific Method .....	31
The AP <sup>®</sup> Physics Science Practices .....	36
Designing & Performing Experiments .....	40
Random vs. Systematic Error .....	50
Uncertainty & Error Analysis.....	53
Significant Figures .....	64
Graphical Solutions (Linearization) .....	73
Keeping a Laboratory Notebook .....	77
Internal Laboratory Reports.....	83
Formal Laboratory Reports .....	91

The purpose of this chapter is to teach skills necessary for designing and carrying out laboratory experiments, recording data, and writing summaries of the experiment in different formats.

- *The Scientific Method* describes scientific thinking and how it applies to physics and to this course.
- *The AP<sup>®</sup> Physics Science Practices* lists & describes the scientific practices that are required by the College Board for an AP<sup>®</sup> Physics course.
- *Designing & Performing Experiments* discusses strategies for coming up with your own experiments and carrying them out.
- *Random vs. Systematic Error, Uncertainty & Error Analysis, and Significant Figures* discuss techniques for estimating how closely measured data can quantitatively predict an outcome.
- *Graphical Solutions (Linearization)* discusses strategies for turning a relationship into a linear equation and using the slope of a best-fit line to represent the quantity of interest.
- *Keeping a Laboratory Notebook, Internal Laboratory Reports, and Formal Laboratory Reports* discuss ways in which you might record and communicate (write up) your laboratory experiments.

Calculating uncertainty (instead of relying on significant figures) is a new and challenging skill that will be used in lab write-ups throughout the year.

Use this space for summary and/or additional notes:

**Standards addressed in this chapter:****MA Curriculum Frameworks (2016):**

This chapter addresses the following MA science and engineering practices:

**Practice 1:** Asking Questions and Defining Problems

**Practice 2:** Developing and Using Models

**Practice 3:** Planning and Carrying Out Investigations

**Practice 4:** Analyzing and Interpreting Data

**Practice 6:** Constructing Explanations and Designing Solutions

**Practice 7:** Engaging in Argument from Evidence

**Practice 8:** Obtaining, Evaluating, and Communicating Information

AP®

**AP® Physics 2 Learning Objectives & Science Practices:**

This chapter addresses the following AP Physics 1 science practices:

**SP 4.1** The student can justify the selection of the kind of data needed to answer a particular scientific question.

**SP 4.2** The student can design a plan for collecting data to answer a particular scientific question.

**SP 4.3** The student can collect data to answer a particular scientific question.

**SP 4.4** The student can evaluate sources of data to answer a particular scientific question.

**SP 5.1** The student can analyze data to identify patterns or relationships.

**SP 5.2** The student can refine observations and measurements based on data analysis.

**SP 5.3** The student can evaluate the evidence provided by data sets in relation to a particular scientific question.

**Skills learned & applied in this chapter:**

- Designing laboratory experiments
- Estimating uncertainty in measurements
- Propagating uncertainty through calculations
- Writing up lab experiments

Use this space for summary and/or additional notes: