# The Analysis of Experimental Uncertainty in AP Physics 1 and 2

The following paragraphs describe the expectations for the depth of understanding of experimental uncertainty that will be assessed on the AP Physics 1 and 2 exams and the expectations for laboratory work to be presented to colleges and universities. Greater proficiency in reasoning about experimental uncertainty is expected of students in AP Physics 2.

**Exam Expectations for Analysis of Uncertainty:** On the AP Physics 1 exam, students will not need to calculate uncertainty but will need to demonstrate understanding of the principles of uncertainty. On the AP Physics 2 exam, students may be expected to calculate uncertainty. In general, multiple-choice questions on both exams will deal primarily with qualitative assessment of uncertainty, while free-response laboratory questions may require some quantitative understanding of uncertainty as described below.

Experiment and data analysis questions on the AP Physics 1 and AP Physics 2 exams will not require students to calculate standard deviations, or carry out the propagation of error or a linear regression. Students will be expected to estimate a line of best fit to data that they plot or to a plot they are given. Students may be expected to discuss which measurement or variable in a procedure contributes most to overall uncertainty in the final result and on conclusions drawn from a given data set. They should recognize that there may be no significant difference between two reported measurements if they differ by less than the smallest difference that can be discerned on the instrument used to make the measurements. They should be able to reason in terms of percentage error and to report results of calculations to an appropriate number of significant digits. Students are also expected to be able to articulate the effects of error and error propagation on conclusions drawn from a given data set, and how results and conclusions would be affected by changing the number of measurements, measurement techniques, or the precision of measurements. Students should be able to review and critique an experimental design or procedure and decide whether the conclusions can be justified based on the procedure and the evidence presented.

**Laboratory Expectations for Analysis of Uncertainty:** Some colleges and universities expect students to submit a laboratory notebook to receive credit for laboratory courses. Given the emphasis on time spent in the laboratory, students should be introduced to the methods of error analysis including and supported by mean, standard deviation, percentage error, propagation of error, and linear regression, or the calculation of a line of best fit. Colleges will expect students to be familiar with these methods and to have carried out the procedures on at least some of the laboratory experiments they undertake, particularly since the use of computers and calculators have significantly reduced the need for students to perform computations on their own.