Appendix B: Percent Error and Percent Difference

When reporting your experimental result, you will compare it to either an accepted value or an experimental value measured using a different procedure to check for consistency.

Comparing an experimental value to a theoretical value

Percent error is used when comparing an experimental result E with a theoretical value T that is accepted as the "correct" value.

$$\text{percent error} = \frac{|T - E|}{T} \times 100\% \tag{1}$$

For example, if you are comparing your measured value of 10.2 m/s^2 with the accepted value of 9.8 m/s^2 for the acceleration due to gravity g, the percent error would be

$$\text{percent error} = \frac{|9.81 - 10.2|}{9.81} \times 100\% = 4\% \tag{2}$$

Often, fractional or relative uncertainty is used to quantitatively express the precision of a measurement.

$$\text{percent uncertainty} = \frac{\text{uncertainty}}{E} \times 100\% \tag{3}$$

The percent uncertainty in this case would be

$$\text{percent uncertainty} = \frac{0.39}{10.2} \times 100\% = 3.82\% \tag{4}$$

Comparing two experimental values

Percent difference is used when comparing two experimental results E_1 and E_2 that were obtained using two different methods.

$$\text{percent difference} = \frac{|E_1 - E_2|}{\frac{E_1+E_2}{2}} \times 100\% \tag{5}$$

Suppose you obtained a value of 9.95 m/s^2 for g from a second experiment. To compare this with the result of 10.2 m/s^2 from the first experiment, you would calculate the percent difference to be

$$\text{percent difference} = \frac{|9.95 - 10.2|}{\frac{9.95+10.2}{2}} \times 100\% = 2.5\% \tag{6}$$