![C:\Users\Owner\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\BST9SWYT\MCj02929620000[1].wmf]()Dealing With

Experimental Uncertainty

In physics, we construct models to describe reality. We test these models by taking measurements and comparing the results of those measurements with the predictions of our models. Comparing results with predictions is not simply a matter of asking if two numbers are equal. No measurement is ever perfectly exact; all real measurements have some uncertainty. Thus, in order to compare our measurements with our predictions, we need to know how uncertain our measurements are.

There are three main sources of experimental uncertainty. Each source must be dealt with in your lab work. The first source of experimental uncertainty is the mistake. Misreading a scale on a meter, or writing down the wrong digit in a number are examples of mistakes. Mistakes should be corrected when they are discovered. If a measurement was misread or written down incorrectly, draw a line through the incorrect number and redo the measurement. If a calculation was done improperly, draw a line through the incorrect calculation and redo it. Sometimes one discovers that all the measurements on a lab were done improperly. If that is the case, and time allows, all the measurements should be redone. That is why it’s a good idea to know approximately what values are expected for a measurement, so you can immediately see if your values are reasonable.

The second source of experimental uncertainty are systemic errors. Although they are called systemic errors, they should not be confused with mistakes. A systemic error results from the way the measurement was taken and always affects the measurement the same way. For example, a measurement involving a string may assume the string does not stretch. However, real strings may stretch, and so the string was actually longer when it was being used than when it was measured beforehand. Systemic uncertainty results in measurements that are inaccurate, that is to say, although the measurements may agree with each other, they deviate from the real or expected value in a consistent way. Causes of systemic errors should be dealt with if possible. Those that can’t be corrected should be discussed in the conclusion section of your lab report.

The third source of experimental uncertainty are called random errors. Again, although they are called errors, they are not mistakes, but are inherent variations in repeated measurements that cannot be predicted. Air currents and power supply fluctuations are examples of things that can cause random errors. Because random errors cause repeated measurements to deviate from each other, random errors result in measurements that are less precise than they otherwise would be. Sources of random error should be identified in the conclusion section of your lab report.

The rule of thumb is, deal with mistakes in the lab; deal with systemic and random errors in the lab report.