Measurement, Uncertainty, and Data Analysis
Activity #1: Measurement
Teacher Notes

Purpose: Allow students to practice making scientific measurements, and, more important, reporting their measurements correctly, with correct significant figures and uncertainty.

Set-up: Collect a 6-8 measuring devices with different resolutions and a number of things to be measured.   You may wish to include a faulty measuring device at one or more stations to demonstrate systematic error, which you will soon be covering in class. (Not zeroing a balance might do the trick, depending on how observant your students are! Also, you could create a "ruler" with increments labeled as cm but actually corresponding to 0.5 inch.) Some nice measuring devices to include would be: a set of calipers, an electronic balance (maybe 2 or 3 with different resolutions), a triple-beam balance, a graduated cylinder, a stopwatch. Put each measuring device with an object to be measured at different "stations" around the room. Label each station so that students can proceed from one to the next.

Prior Knowledge: Students could do this activity at the very start of the year or the unit; as long as they have some familiarity with measurement, they should be able to record their values. Depending on the time allowed, you may want to have them complete the activity, then go over the basics of uncertainty (see the Power Point, "Measurement and Error," then have them revisit the activity to add in uncertainty values to their measurements.

Target Audience: This activity is intended for introductory physics students, or any science student requiring an introduction to measurement and uncertainty.   This is probably best suited to older high school students, but could be modified (removal of uncertainty ranges) to make it more suitable for younger high school students or even middle school students.

Materials Needed: measuring devices, objects to measure, and sufficient space to set up 6-8 measuring stations around the lab.

Measurement, Uncertainty, and Data Analysis
Activity #1: Measurement
Student Worksheet

Station 1
1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, ± (0.5)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 2
1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, ± (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 3

1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, $\pm$ (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 4

1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, $\pm$ (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 5
1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, ± (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 6
1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, ± (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 7

1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, ± (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.

Station 8

1. Look at the measuring device provided. What is the smallest increment marked?

2. What uncertainty do you anticipate in your measurement? (Hint: often, ± (0.1)* (the smallest increment provided) is a good estimate of your uncertainty, but it may not apply in every case.

3. What are the units of the measuring device?

4. Make your measurement, being sure to include units and your uncertainty.