SPH3U: The Art of Measurement

Recorder: _____
Manager: _____
Speaker: _____
0 1 2 3 4 5

Measurements are the backbone of all science. Any scientific ideas, no matter how slick, are only as good as the measurements that have confirmed them. Without careful measurements, science is mostly guess work and hunches – suspicions and rumours.

A. The Meter Stick

The most basic scientific tool is the meter stick. But, do you know how to use it? For this investigation you will need one meter stick

1. Examine the markings on the meter stick. What is the size of the smallest interval marked on it?

2. Three students use the meter stick to measure the height of a desk and each reports their results: 95 cm, 94.8 cm, and 95.03 cm respectively. Considering the intervals marked on the meter stick, which result illustrates the best use of this measuring device? Explain.

The term *significant figures* describes which digits in a number or measurement are physically meaningful or reliable.

3. How many significant figures are in the measurement you chose in question A2?

4. Measure the height of your desk and record the measurement with an appropriate number of significant figures.

5. Two students each measure the length of a running shoe. One student records a result of "285". The other student measures the same shoe and records the result "27.9". How can two measurements of the same thing be so different … or are they? Explain by describing what critical element is missing from each measurement.

6. Two students make a measurement using the metre stick. One student measures the thickness of a text book to be 5.15 cm. The other student measures the length of a pencil to be 18.4 cm. Which measurement is more *precise*? Offer an explanation and mention what you think the word *precision* means.

B. The Stopwatch

Now we will examine another common measuring device. You will need one stop watch

A student drops a pencil from a 1.00 m height. Another student times the fall. The stopwatch readout looks like this after the timing:

0:00.45

1. Write this reading as a number in standard notation with units of seconds (s).

2. What is the precision of the stopwatch according to its display (i.e. to the nearest …)?

3. Perform the measurement four times, record the times below and calculate an average time.

				Avg:

4. How many significant figures are reasonable to use when writing down the calculated average? Explain.

General Guideline for Significant Figures: When performing calculations, write the intermediate results with one extra significant figure and the final answer with no more significant figures than the piece of data with the least. This is a handy but very approximate rule of thumb. In university you will learn a mathematical system for determining the error in your calculated results which will replace this handy rule.

In traditional notation, there can be some ambiguity about the number of significant figures a measurement has. Use scientific notation for clarity (clearly specifying the number of significant figures) or for convenience (very large or small numbers). Never write down all the digits your calculator computes – they are not always significant!

5. The whole class times how long it takes one student to run from the class, down to the cafeteria and back, simply by observing the classroom clock. The computed average of the class measurements is 78.6176548 s. Explain how to write this calculator result in an appropriate way.