Experiment zero (Lab intro) Spring 2021
PHYS221 Introduction to measurement & error analysis data sheet
http://relativity.phy.olemiss.edu/~thomas/

NAME________________________ Section_____ Date_________

In this lab you will measure various quantities using either an analog device (which does not have a digital display, e.g., a ruler or triple beam balance) or a device with a digital display (e.g., a digital caliper).

The readability (or precision) of any type of device is defined as the smallest quantity that can be read from (i.e., measured by) that device.

The uncertainty of an analog device is generally (**but not always**) defined as **½ of the readability** of the scale.

The uncertainty of a digital device is generally defined as **the readability** of the digital display.

Part one- Readability and uncertainty of a measuring instrument

Instrument	Readability (include units)	Uncertainty (include units)
ruler		+/-
protractor		+/-
triple beam balance		+/-
electronic (digital) balance		+/-
Vernier caliper		*Use readability* +/-

Part two-Measurement of dimensions of metal block.

Please note that dimensions (lengths) of the sides of the blocks are denoted as **long**, **medium** and **short.**

All measurements must have units when applicable and all uncertainties should be written using one significant figure. For example (51.5 +/- 0.5) cm. *This can also be written as 51.5 +/- 0.5 cm*

Length $\pm$ Absolute uncertainty of length

Dimension (length) measured	Ruler (include units)	Caliper (include units)
long$\pm\delta$long		
medium$\pm\delta$medium		
short$\pm\delta$short		**25.40 +/- mm**

How to calculate fractional of percent error.

Say you are given a measurement with an absolute uncertainty of (51.5 +/- 0.5) cm. To convert to fractional (percent) uncertainty you would do the following calculation:

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$$(51.5 \pm 0.5)cm \quad \rightarrow \quad 51.5\ cm \pm \frac{0.5\ cm \times 100}{51.5\ cm} \quad \rightarrow \quad 51.5\ cm \pm 0.9709\ \%.$$

Since all uncertainties (in a lab of this type) should be written with one significant figure, we write

$$51.5\ cm \pm 1\ \%.$$

Note that the fraction (i.e., the percent term) has no units since the cm canceled.

Length $\pm$ Per cent (fractional) uncertainty of length.
Show all work (i.e., fractional uncertainties calculations) on the back of the page.

Dimension (length) measured	Ruler	Caliper
long $\pm\delta_{\%}$ long		
medium $\pm\delta_{\%}$ medium		
short $\pm\delta_{\%}$ short		**25.40 +/-**

Part 3- Measurement of mass (of a coin). Give measurements with both absolute and percent uncertainties.

Mass of coin using triple beam balance.

Mass of coin using digital balance.

Part 4-Mass and weight of a cell phone. 'Google' the weight of your cell phone (*convert to kilograms*) and then determine its weight. Weight = mass times acceleration of gravity (use $9.800 m / s^2$)

Post Lab questions

1. Do you think a digital measuring device is inherently better than an analog device of the same type? Explain your answer. (Don't spend too much time on this one).

2. Are both masses of the coin in part 3 the same when (absolute) uncertainty is considered? Explain your answer.

3. Google "the weight of an apple". How many apples would it take to equal the weight of your cell phone. Show all work.

4. What is the readability of the English (upside down) scale on the ruler in the photo used in this experiment. Web address below (there are two correct answers):

https://relativity.phy.olemiss.edu/~thomas/weblab/221_exp_procedures_spr2006/221_COVID19_Items/0_Covid_Intro_lab/Experiment%20zero%20photos%20use/1_RULER%201_USE.JPG