Name:_____ Date:_____

Mr. Croom's Physics Chapter 1: Scientific Tool Box

Understanding Precision and Accuracy

For many students, the distinction between precision and accuracy is NOT clear. A measurement can be precise, accurate, both or neither. These terms can refer to either a data set as a whole or an individual measurement.

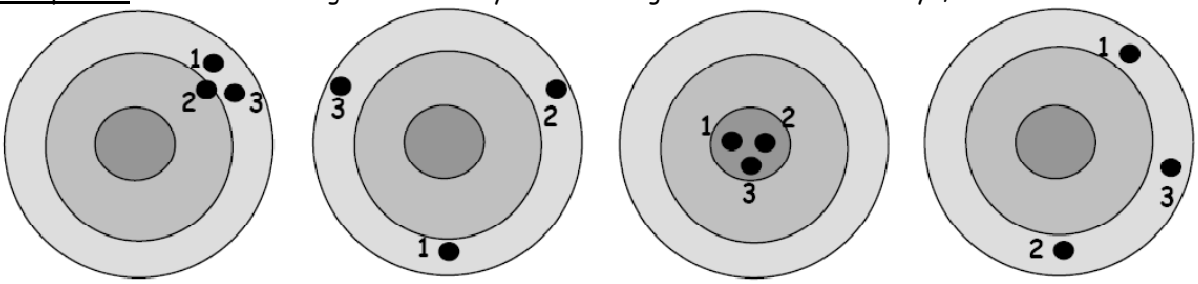
Precision

degree of exactness to which a measurement can be reproduced (consistency)
limited by the smallest division on the measuring device
example: The smallest division on a meter stick is a millimeter

Accuracy

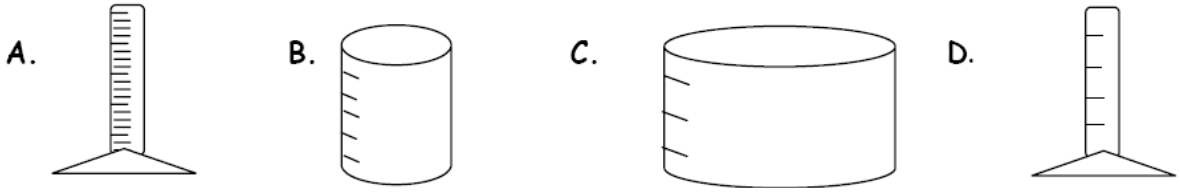
extent to which a group of data agrees with the accepted value
usually indicated by a percent error calculation

Example one: Consider the targets below. If your ultimate goal is to hit the bulls-eye, are these shots:



A. Precise or Accurate? B. Precise or Accurate? C. Precise or Accurate? D. Precise or Accurate?

For target "A", the shots are relatively close together, however, they are nowhere near the bull's-eye. These shots would be considered "precise", but NOT accurate.
For target "B", the three shots are scattered and are therefore not precise. However, the average of the data set is accurate.
For target "C", all three shots landed in the bulls-eye region. Therefore, the shots are precise and all three are accurate.
For target "D", all three shots are scattered and are not near the bull's-eye. The shots are neither precise nor accurate.



Example two: A student is asked to measure the volume of a small steel ball. Which of the following instruments would give the most precise measurement?

For precision, both the size of the device and the spacing of the unit divisions are important.
Therefore, the most precise measurement would be acquired with instrument "A".

Created by Jeff Alaimo

Uncertainty – tells the degree of accuracy and precision in a measurement or result.

Examples of uncertainty in measurements are:

- centigram balance ±0.01 g
- 10 ml graduated cylinder ±0.1 ml
- -10 to 110ºC thermometer ±0.2ºC
- metric ruler ±0.5 mm

Because of this uncertainty we state our final results with their error range.

Example

- Final temperature 28.8±0.2°C
- initial temperature 22.4±0.2ºC
- Change in temperature (Δ T) 6.4±0.4°C

Since knowing the uncertainty in a piece of data is so important there are lots of rules that must be accounted for. These rules are call the rules of error propagation. We will not be directly covering them in this course, but most college level physics 1 labs require you to learn these rules, so plan on learning them in the future.