1.2 Measurements in Experiments

Objectives

- **List** basic SI units and the quantities they describe.
- **Convert** measurements into scientific notation.
- **Distinguish** between accuracy and precision.
- **Use** significant figures in measurements and calculations.

Dimension vs Unit

- A *dimension* refers to the physical quantity (length, time)
- A *unit* refers to the numerical measurement of a dimension

5 meters 60 seconds

SI Units

- The SI units are internationally agreed upon fundamental units of measurement
- There are ______ base units

SI Base Units

SI Base Units		
Base Quantity	Base Unit	Symbol
Length	Meter	
Mass	Kilogram	
Time	Second	
Temperature	Kelvin	
Amount of Substance	Mole	
Electric Current	Ampere	
Luminous Intensity	Candela	

Not a Base Unit

- Some measurements cannot be measured with the 7 base units
- Derived units are formed by combining the seven base units with multiplication or division. For example, speeds are typically expressed in units of meters per second (m/s).

Extreme Measurements

- Very large or small numbers can be converted into scientific notation
- Diameter of the Earth = 12742000 meters

- Quick Examples

  4556 cm 0.00062 m

Converting

- You can also convert from one unit to another unit

  Kilo, Hecto, Deka, BASE UNIT, Deci, Centi, Milli

  K h da ?? D c m

- 1565 m = ________ km

- 2.5 km = __________ m

Combining Units

- You can also combine these units
  - They MUST have the same label

3 m * 2 m = _________________ m^2

3 m * 2000 mm = _______________ m^2

Accuracy and Precision

- **Accuracy** is a description of how close a measurement is to the correct or accepted value of the quantity measured.
- **Precision** is the degree of exactness of a measurement.
- A numeric measure of confidence in a measurement or result is known as uncertainty. A lower uncertainty indicates greater confidence.

Error

- Some ways to minimize error in experiments
  - Start measurements from 10 cm, NOT 0
  - Be aware of Parallax
- What determine the precision of a measurement?
  - The instrument (i.e. mass to 0.1 or 0.01)
  - i.e., hard to measure the thickness of a penny with a ruler that only goes down to cm

Significant Figures

- **Significant figures** in a measurement consist of all the digits known with certainty plus one final digit, which is somewhat uncertain or is estimated.

- The term significant **does not** mean certain.

Significant Figures Rules

- All nonzero digits in a measurement are significant, but not all zeros are significant.
- Zeros BETWEEN nonzero numbers ARE significant
- Zeros after the decimal and before a nonzero number are NOT significant
- Zeros after nonzero numbers but before the decimal are NOT significant
- Zeros after nonzero numbers AND after the decimal ARE significant

Refer to your handout

Sig Fig Quick Practice

- 123456
- 0.00250
- 1252300
- 50584.2302
- 12500.0

Sig Fig Rules

- Adding and subtracting
  - Cannot be more precise that the LEAST precise

21.32 + 150 =

Sig Fig Rules

- Multiplying and dividing
  - Cannot have more sig figs than the number with the least sig figs

5.2 * 456 =