Measurements

SI Units

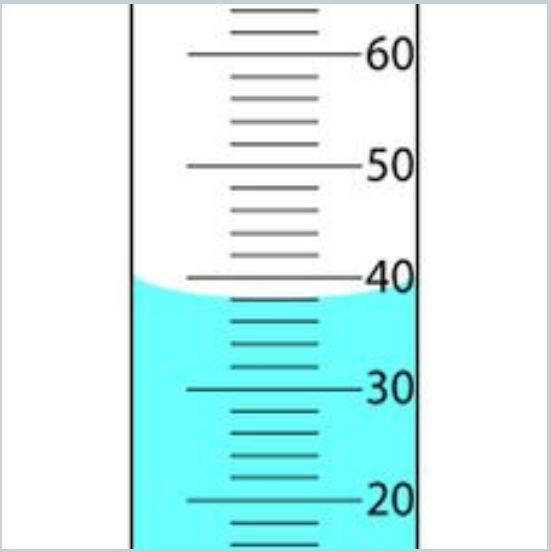
- Scientific units that standardize measurements in scientific studies.
- SI Units:
  - Mass: kilograms (kg)
  - Volume: liters (L)
  - Length: meters (m)
  - Temperature: Kelvin (K)
  - Amount of substances: moles (mol)

Common Units

- Units that are more common in experiments.
- Common units:
  - Mass: grams (g)
  - Volume: milliliters (mL)
  - Length: centimeters (cm)
  - Temperature: degrees Celsius (°C)
  - Amount of substance: moles (mol)

Taking measurements in lab

- Accurate reading are necessary in lab, the closer you can be to the true value the better
- Estimate the last digit of any measurement
- How to read equipment?
  - Graduated cylinder and the meniscus
  - Balance
  - Thermometer
  - Length

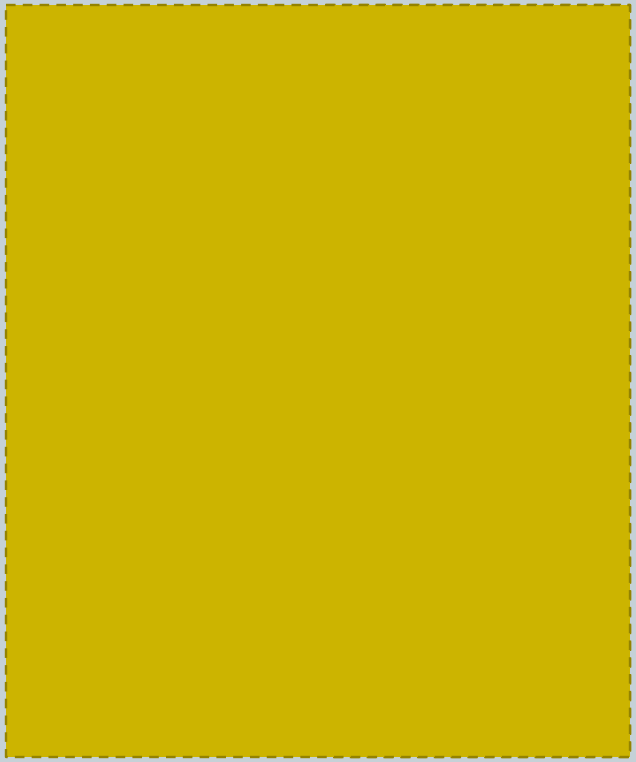


Metric System

- Why use it?
  - Universally understood…except 3 countries
  - Makes conversions more simple
  - Prefixes allow for simpler conversions

Common Prefixes

- Kilo k
- Hecto h
- Deka dk
- Deci d
- Centi c
- Milli m



Unit Conversions

- Used to change units into more usable form, or to get a common unit between measurements
- Examples:

1. 365.8 mm to dm
2. 2.74 g to kg
3. 0.152 g to cg
4. 50 000 kL to L
5. 0.0243 mL to cL

Significant Figures

- Used to help in making measurements more precise
- Last digit of any measurement is going to be estimated by YOU
- Follows a specific set of rules
- ALL MATH IN CHEMISTRY MUST USE SIG FIG RULES!!
  - Exceptions will be told to you when necessary

Significant Figures

- Non-zero digits are **ALWAYS** significant
- *Sandwiched* zeros are **ALWAYS** significant
- Zeros at the *end* of a number *containing a decimal* are significant
- Numbers that are “counted” are considered to have infinite significant figures

Adding/Subtracting

- When adding or subtracting, you count only the sig figs AFTER the decimal
- Examples:
  - 7.459 km + 82.3 km – 0.02 km
  - 1701 g - 50 g + 40 g

Multiplying/Dividing

- When multiplying and dividing, you count ALL SIG FIGS

- Examples:
  - 651 cm x 75 cm
  - 14.75 L ÷ 2.5 L

Mathematical Operations with Both

When performing calculations that involve both addition/subtraction and multiplication/division…

The Multiply and Divide Rule WINS!!!

1. 2.0 * 1.008g + 16.0 g =

2. (13.8 - 2.05) / 10.00 =

Scientific Notation

- Sometimes measurements are too large or too small to be useful
- Change them into a format that makes the data more organized.
- Can be used to help with unit conversion

Scientific Notation M.mm x 10^n

- M.mm
  - first digit a # 1 -9
  - only one nonzero to the left of the decimal point
- n = an integer
  - # of places decimal was moved to get the M.mm value
- Ex: 17 020 km = 1.70 X 10^4 km
  0.004999 g = 5.00 X 10^{-3} g

Scientific Notation cont…

- Helpful hints:
  - If the number is larger than 1 in ordinary notation, the exponent will be positive
  - If the number is smaller than 1 in ordinary notation, the exponent will be negative

Scientific Notation Practice

Perform the following calculations and write the answers in scientific notation, with the correct number of significant figures and unit.

1. 2.07×10^2 m + 650. m =
2. 48.0g / 12.01 mol =
3. 1.289 mol Carbon atoms * 6.02x1023 atoms/mol