Unit Analysis

AKA Dimensional Analysis

Chem II A

Unit Analysis

- Unit Analysis
  - A systematic method for solving problems in which units are carried thru the entire problem
    - units are multiplied together, divided into each other, or cancelled
  - Helps communicate your thinking
  - Helps ensure that solutions have the proper units
  - Uses conversion factors

Conversion Factors

- Conversion Factor
  - a fraction whose numerator and denominator are the same quantity expressed in different units
  - used to change from one unit to another

Conversion Factors

- Examples of Conversion Factors

12 in = 1 ft → $\frac{12\text{ in}}{1\text{ ft}}$ or $\frac{1\text{ ft}}{12\text{ in}}$

100 cm = 1 m → $\frac{100\text{ cm}}{1\text{ m}}$ or $\frac{1\text{ m}}{100\text{ cm}}$

Every relationship can give two conversion factors that are the inverses of each other. The value is the same.

Unit Analysis - One Conversion Factor

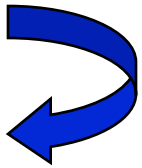
Example: A lab bench is 175 inches long. What is its length in feet?

Dimensional Analysis - One Conversion Factor

Example: A lab bench is 175 inches long. What is its length in feet?

Given: **175 in.**

Find: **Length (ft)**



Conversion factor:

$$\frac{12\ \text{in}}{1\ \text{ft}} \quad \text{or} \quad \frac{1\ \text{ft}}{12\ \text{in.}}$$

$$\text{ft} = 175\ \text{in} \times \frac{1\ \text{ft}}{12\ \text{in}} = 14.5833333\ \text{ft} = 14.6\ \text{ft}$$

Dimensional Analysis - One Conversion Factor

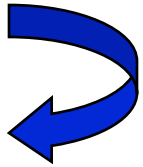
Example: A marble rolled 50.0 mm. How many meters did it roll?

Dimensional Analysis - One Conversion Factor

Example: **A marble rolled 50.0 mm. How many meters did it roll?**

Given: 50.0 mm

Find: dist. (m)



Conversion factor:

$$\frac{1000\ \text{mm}}{1\ \text{m}} \quad \text{or} \quad \frac{1\ \text{m}}{1000\ \text{mm}}$$

$$\text{m} = 50.0\ \text{mm} \times \frac{1\ \text{m}}{1000\ \text{mm}} = 0.05\ \text{m} = 0.0500\ \text{m}$$

Dimensional Analysis - One Conversion Factor

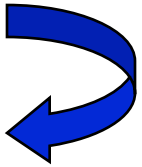
Example: In Germany, a salesman I was with drove at 185 km/hr. What was our speed in mi/hr?

Unit Analysis - One Conversion Factor

Example: **In Germany, a salesman I was with drove at 185 km/hr. What was our speed in mi/hr?**

Given: 185 km/hr

Find: mi/hr



Conversion factor:

$$\frac{1.609\ \text{km}}{1\ \text{mi}} \quad \text{or} \quad \frac{1\ \text{mi}}{1.609\ \text{km}}$$

$$\frac{\text{mi}}{\text{hr}} = 185\ \frac{\text{km}}{\text{hr}} \times \frac{1\ \text{mi}}{1.609\ \text{km}} = 114.97825\ \frac{\text{mi}}{\text{hr}}$$

Speed = 115 mi/hr