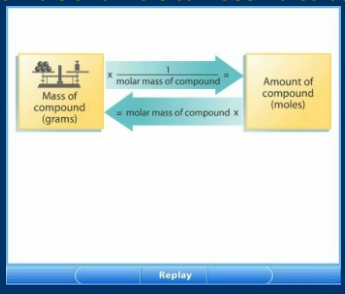
Mass to Mole and Mole to Mass Calculations



Dimensional Analysis

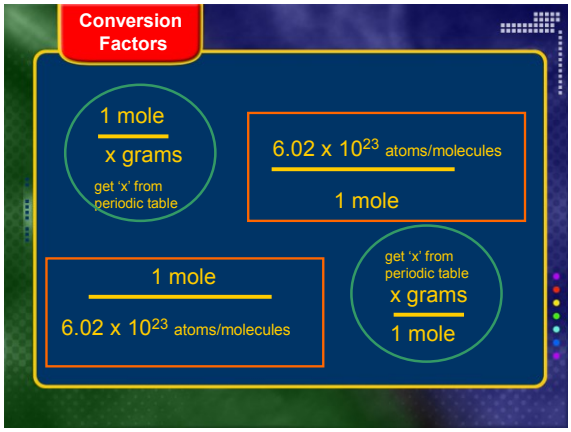
- What are the dimensions of a chemical reaction?
  - grams (g)
  - moles (mol)
  - kilograms (kg)
  - moles (mol)
  - liters (L) [1 mole of any gas occupies 22.4 L at STP]
  - moles (mol)
  - milliliters (ml)
  - moles (mol)
  - atoms or molecules

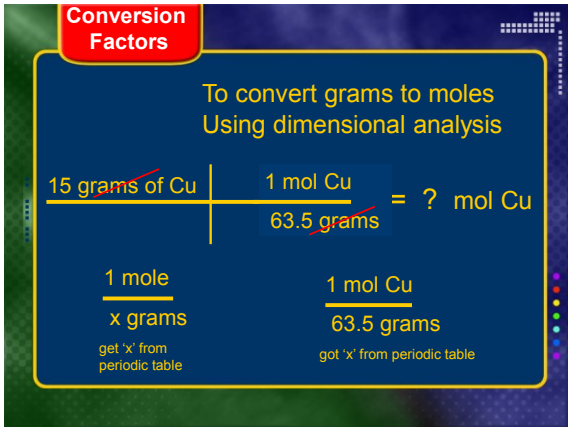
Calculations

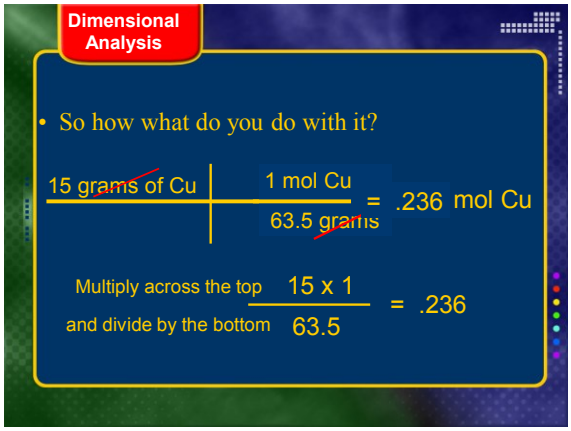
use molar mass conversion factors — *use Avogadro's number conversion factors*

Grams ⟷ Moles ⟷ Atoms

Everything must go through Moles!!!


Conversion Factors
1 mole
x grams
get 'x' from periodic table
6.02 x 10^23 atoms/molecules
1 mole
1 mole
6.02 x 10^23 atoms/molecules
get 'x' from periodic table
x grams
1 mole


Conversion Factors
To convert grams to moles
Using dimensional analysis
15 grams of Cu
1 mol Cu
63.5 grams
= ? mol Cu
1 mole
x grams
get 'x' from periodic table
1 mol Cu
63.5 grams
got 'x' from periodic table


Dimensional Analysis
So how what do you do with it?
15 grams of Cu
1 mol Cu
63.5 grams
= .236 mol Cu
Multiply across the top
and divide by the bottom
15 x 1
63.5
= .236

Dimensional Analysis

Let's Practice!

- Convert 44 grams of water to moles

Conversion Factors

To convert moles to grams
Using dimensional analysis

$$\frac{2.5 \text{ mol of Cu}}{} \left| \frac{63.5 \text{ g of Cu}}{1 \text{ mol Cu}} \right. = \text{? g Cu}$$

$\frac{\text{x grams}}{1 \text{ mole}}$ get 'x' from periodic table

$\frac{63.5 \text{ grams}}{1 \text{ mol Cu}}$ got 'x' from periodic table

Dimensional Analysis

- So how what do you do with it?

$$\frac{2.5 \text{ mol of Cu}}{} \left| \frac{63.5 \text{ g}}{1 \text{ mol Cu}} \right. = 158.75 \text{ g Cu}$$

Multiply across the top and divide by the bottom $\frac{2.5 \times 63.5}{1} = 158.75$

Dimensional Analysis

Let's Practice!

- Convert 44 moles of water to grams

Conversion Factors

To convert molecules to moles
Using dimensional analysis

$$\frac{5 \times 10^{35} \text{ molecules of } CO_2}{\frac{1 \text{ mole}}{6.02 \times 10^{23} \text{ atoms/molecules}}} = ? \text{ mol } CO_2$$

Conversion Factors

To moles to molecules
Using dimensional analysis

$$\frac{6.7 \text{ mol of } CO_2}{\frac{6.02 \times 10^{23} \text{ atoms/molecules}}{1 \text{ mole}}} = ? \text{ molecules } CO_2$$

Conversion Factors

How many atoms of Cu are present in 35.4 g of Cu?

How many atoms of Cu are present in 35.4 g of Cu?

$$35.4\ \text{g Cu} \times \frac{1\ \text{mol Cu}}{63.5\ \text{g Cu}} \times \frac{6.02 \times 10^{23}\ \text{atoms Cu}}{1\ \text{mol Cu}}$$

$= 3.4 \times 10^{23}$ atoms Cu