

# Announcements

Monday, March 09, 2009

Pre and post MC due 2 weeks (Mar 23).

Lecture quiz 2 in D2L (covering Ch 5 & 6) will be available Tues AM, due Mar 23.

Discussion assignment 1 replies due Mar 23.  
Assignment 2 will start after spring break.

Exp 8 tonight, exp 4 on Mar 23, Exp 14 on Mar 30.

## Converting to elements in a formula

$$\begin{aligned} 4.28 \text{ mol Na}_2\text{SO}_4 &= ? \text{ mol Na} \quad \star \\ &= ? \text{ mol S} \\ &= ? \text{ mol O} \end{aligned}$$

First, make a conversion factor from the chemical formula itself (called a mole ratio):

(when making a mole ratio from a formula, always consider 1 mole of the complete formula, and use the subscripts to find moles of each element)

$$\begin{aligned} 1 \text{ mol Na}_2\text{SO}_4 \text{ contains... } &\underline{2} \text{ mol Na} \\ &\underline{1} \text{ mol S} \\ &\underline{4} \text{ mol O} \end{aligned}$$

$$4.28 \text{ mol Na}_2\text{SO}_4 = ? \text{ mol Na}$$

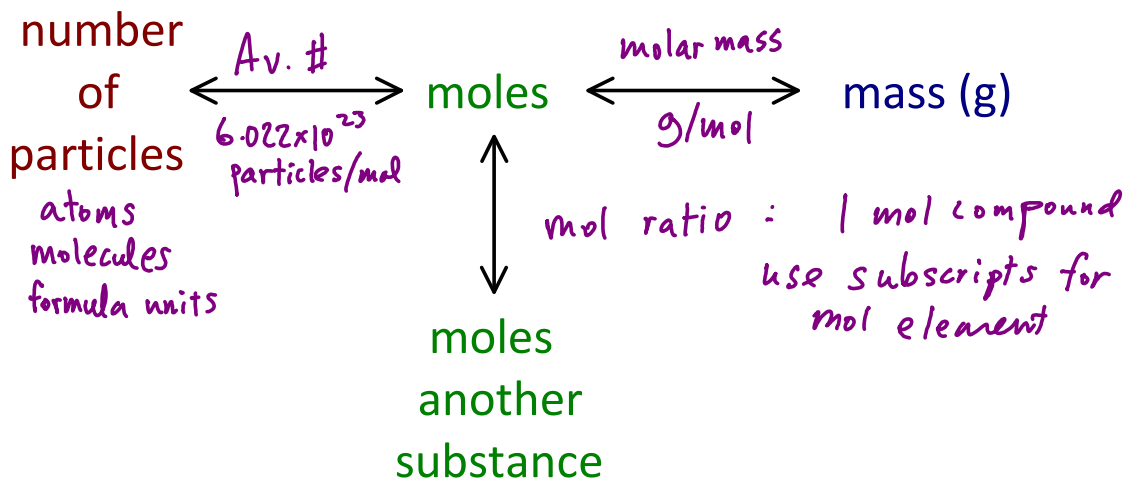
$$4.28 \cancel{\text{ mol Na}_2\text{SO}_4} \times \frac{2 \text{ mol Na}}{1 \cancel{\text{ mol Na}_2\text{SO}_4}} = \boxed{8.56 \text{ mol Na}}$$

On your own:

$$\begin{aligned} 4.28 \text{ mol Na}_2\text{SO}_4 \text{ contains: } &? \text{ mol S} \quad (4.28 \text{ mol S}) \\ &? \text{ mol O} \quad (17.1 \text{ mol O}) \\ &? \text{ Na atoms} \quad (5.15 \times 10^{24} \text{ Na atoms}) \\ &? \text{ g Na} \end{aligned}$$

$$4.28 \text{ mol Na}_2\text{SO}_4 \times \frac{2 \text{ mol Na}}{1 \text{ mol Na}_2\text{SO}_4} \times \frac{22.99 \text{ g Na}}{1 \text{ mol Na}} = \boxed{197 \text{ g Na}}$$

# Calculations with mole ratio



10.0 g NaCl contains how many grams Na?

g NaCl  $\rightarrow$  mol NaCl  $\rightarrow$  mol Na  $\rightarrow$  g Na

$$10.0 \text{ g NaCl} \times \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} \times \frac{1 \text{ mol Na}}{1 \text{ mol NaCl}} \times \frac{22.99 \text{ g Na}}{1 \text{ mol Na}} = 3.93 \text{ g Na}$$

4.9 g K<sub>2</sub>CO<sub>3</sub> contains how many grams K?

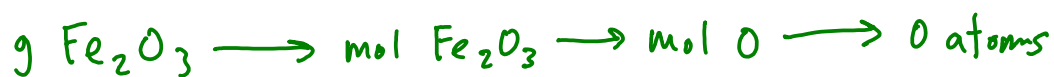
g K<sub>2</sub>CO<sub>3</sub>  $\rightarrow$  mol K<sub>2</sub>CO<sub>3</sub>  $\rightarrow$  mol K  $\rightarrow$  g K

$$4.9 \text{ g K}_2\text{CO}_3 \times \frac{1 \text{ mol K}_2\text{CO}_3}{138.21 \text{ g K}_2\text{CO}_3} \times \frac{2 \text{ mol K}}{1 \text{ mol K}_2\text{CO}_3} \times \frac{39.10 \text{ g K}}{1 \text{ mol K}} = 2.8 \text{ g K}$$

only place we use subscripts from formula  $\rightarrow$  MM always per 1 mol

More calculations

How many oxygen atoms are in 2.85 g Fe<sub>2</sub>O<sub>3</sub>?



$$2.85 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} \times \frac{3 \text{ mol O}}{1 \text{ mol Fe}_2\text{O}_3} \times \frac{6.022 \times 10^{23} \text{ O atoms}}{1 \text{ mol O}}$$

$$= 3.22 \times 10^{22} \text{ O atoms}$$

How many grams of Cu<sub>2</sub>O can be formed from 12.0 g of copper?

$$12.0 \text{ g Cu} \times \frac{1 \text{ mol Cu}}{63.55 \text{ g Cu}} \times \frac{1 \text{ mol Cu}_2\text{O}}{2 \text{ mol Cu}} \times \frac{143.1 \text{ g Cu}_2\text{O}}{1 \text{ mol Cu}_2\text{O}} =$$

$$\boxed{13.5 \text{ g Cu}_2\text{O}}$$

2:1 ratio      Cu<sup>+</sup> / O<sup>2-</sup> → copper (I) oxide

## Mass percent composition

**Mass percent composition**: what percent of a compound's total mass comes from each element?

What is the mass % P in  $\text{Ca}_3(\text{PO}_4)_2$ ?

Write out the compound's molar mass calculation:

$$\begin{array}{r} 3(40.08) \\ \boxed{2(30.97)} \\ 8(16.00) \\ \hline 310.18 \text{ g/mol } \text{Ca}_3(\text{PO}_4)_2 \end{array} \quad \begin{array}{l} 3(\text{Ca}) \\ 2(\text{P}) \\ 8(\text{O}) \end{array}$$

What is the mass of 1 mol  $\text{Ca}_3(\text{PO}_4)_2$ ?

$$310.18 \text{ g } \text{Ca}_3(\text{PO}_4)_2$$

What's the mass of P in 1 mol of  $\text{Ca}_3(\text{PO}_4)_2$ ?

$$2(30.97) = 61.94 \text{ g P}$$

$$\text{Mass \%} = \frac{\text{element mass}}{\text{total compound mass}} \times 100\%$$

$$\frac{61.94 \text{ g P}}{310.18 \text{ g } \text{Ca}_3(\text{PO}_4)_2} \times 100\% = 19.97\% \text{ P}$$

What's the mass % Na in NaCl, NaBr, and  $\text{Na}_2\text{S}$ ?

$$\text{NaCl: } \frac{22.99 \text{ g}}{58.49} \times 100\% = 39.34\% \text{ Na}$$

$$\text{NaBr: } \frac{22.99 \text{ g}}{102.9 \text{ g}} \times 100\% = 22.34\% \text{ Na}$$

$$\begin{array}{r} \text{Na}_2\text{S:} \\ 45.98 \text{ g} \\ \hline 78.04 \text{ g} \\ \times 100\% \\ = 58.92\% \end{array}$$