

## Announcements

Wednesday, February 25, 2009

**Ch 6 MC is up - it's due Monday, Mar 9.**

**Quiz 2** is on Monday, March 9, covering the last bit of chapter 5 and chapter 6 (6.1-6.7 assigned).

**Exp 14** is next week.

**Discussion assignment 1** will be posted in D2L discussion boards Thursday.

## Chapter 6: Chemical composition

Chemical composition questions involve amounts of substances...

How many grams Na are in 10 g NaCl? (It's not 5 g Na!)

**The mole**: convenient way of counting very large numbers of atoms or molecules

1 pair = 2 objects

1 dozen = 12 objects

1 mole =  $6.022 \times 10^{23}$  objects (measurement)

Avogadro's number

How many dozen candy bars are 173 candy bars?

$$\overset{\cdot}{\overset{\cdot}{173}} \text{ candy bars} \times \frac{1 \text{ doz candy bars}}{12 \text{ candy bars}} = 14.4 \text{ doz candy bars}$$

How many moles of Al are in  $1.24 \times 10^{15}$  Al atoms?

$$1.24 \times 10^{15} \text{ Al atoms} \times \frac{1 \text{ mol Al}}{6.022 \times 10^{23} \text{ Al atoms}} = \boxed{2.06 \times 10^{-9} \text{ mol Al}}$$

$$1.24 \times 10^{15} \div 6.022 \times 10^{23}$$

$$1.24 \times 10^{15} \div (6.022 \times 10^{23})$$

How many H<sub>2</sub>O molecules are in 4.8 mol H<sub>2</sub>O?

$$4.8 \text{ mol H}_2\text{O} \times \frac{6.022 \times 10^{23} \text{ H}_2\text{O molecules}}{1 \text{ mol H}_2\text{O}} = \boxed{2.9 \times 10^{24} \text{ H}_2\text{O molecules}}$$

## Mass and moles

**Counting by mass** is a way to count a large number of objects by measuring their mass.

If there are 80 nails per pound, how many nails are in 4.5 lb nails?

$$4.5 \text{ lb nails} \times \frac{80 \text{ nails}}{1 \text{ lb nails}} = 360 \text{ nails}$$

### Relationship of mass and moles:

By definition, 1 mol of carbon-12 atoms has a mass of exactly 12 g

1 carbon-12 atom has a mass of 12 amu  
1 mol carbon-12 atoms has a mass of 12 g

12
Mg
24.31

Atomic number = 12 (# protons)

Atomic mass = 24.31 amu

Molar mass = 24.31 g/mol  
MM

there are 24.31 g Mg in 1 mol Mg

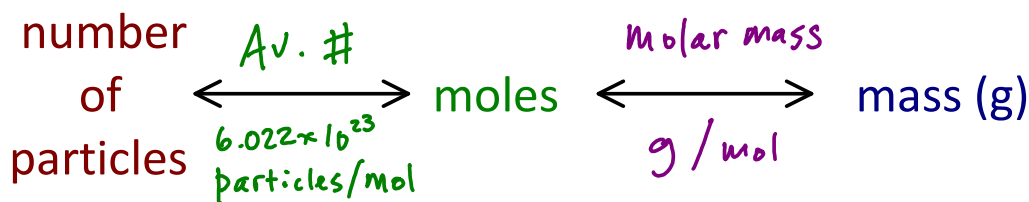
What is the mass of 17.0 mol Al? MM Al = 26.98 g/mol

$$17.0 \text{ mol Al} \times \frac{26.98 \text{ g Al}}{1 \text{ mol Al}} = 459 \text{ g Al}$$

How many moles Si are in 248.36 g Si? (MM Si 28.09 g/mol)

$$248.36 \text{ g Si} \times \frac{1 \text{ mol Si}}{28.09 \text{ g Si}} = 8.842 \text{ mol Si}$$

## Mole calculations



How many S atoms are in 8.32 g S?  $\text{g S} \rightarrow \text{mol S} \rightarrow \text{S atoms}$

$$8.32 \text{ g S} \times \frac{1 \text{ mol S}}{32.07 \text{ g S}} \times \frac{6.022 \times 10^{23} \text{ S atoms}}{1 \text{ mol S}} = \boxed{1.56 \times 10^{23} \text{ S atoms}}$$

What is the average mass (in g) of 1 iron atom?

$$1 \text{ atom Fe} \times \frac{1 \text{ mol Fe}}{6.022 \times 10^{23} \text{ Fe atoms}} \times \frac{55.85 \text{ g Fe}}{1 \text{ mol Fe}} = \boxed{9.274 \times 10^{-23} \text{ g}}$$

### Molar mass of compounds

What is the mass in g of 12.0 mol H<sub>2</sub>O?

You must first calculate the molar mass of H<sub>2</sub>O:

$$2 \text{ H} = 2 (1.008 \text{ g/mol})$$

$$1 \text{ O} = 1 (16.00 \text{ g/mol})$$

$$18.016 \text{ g/mol}$$

$$2 \times 1.008 + 16.00 =$$

$$12.0 \text{ mol H}_2\text{O} \times \frac{18.016 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} = \boxed{216 \text{ g H}_2\text{O}}$$

How many mol O<sub>2</sub> are in 82.3 g oxygen? *diatomic elements*

molar mass of O<sub>2</sub>: 2 (16.00 g/mol) *exist as molecules (pair of atoms)*

$$82.3 \text{ g O}_2 \times \frac{1 \text{ mol O}_2}{32.00 \text{ g O}_2} = \boxed{2.57 \text{ mol O}_2}$$

