Announcements

Monday, October 05, 2009

Exam 1 average: 77.6%

Please consult the answer key in D2L and use the blank version to quiz yourself. Learn from your mistakes!

MasteringChemistry due dates:

- Ch 4: Fri, Oct 9
- Ch 5: Fri, Oct 23
- Ch 6: Fri, Oct 30

Lab report due dates:

- Exp 5: Mon, Oct 12
- Exp 6: Mon, Oct 19

The next round of graded lab reports will be returned to you this week.

Solution concentration and stoichiometry

Most chemical reactions in this course take place in solution (dissolved in water)

$$\text{Any concentration} = \frac{\text{amount solute}}{\text{amount solution}}$$ total

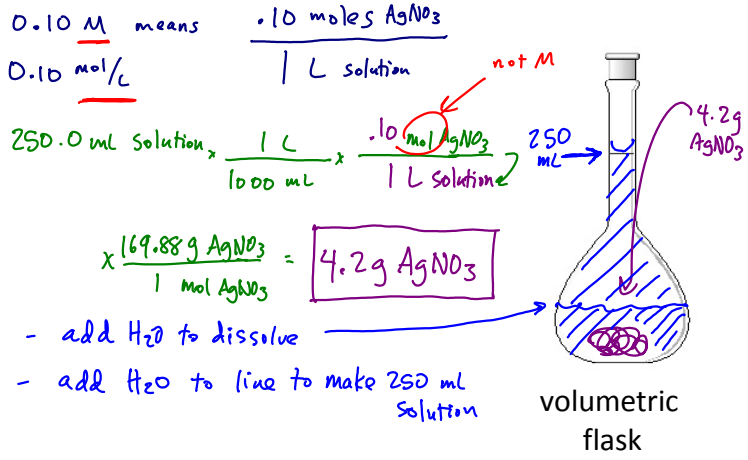
$$\text{Molarity (M)} = \frac{\text{moles of solute}}{\text{liters of solution}}$$

molar

For instance, a 0.50 M $AgNO_3(aq)$ solution is called a 0.50 "molar" silver nitrate solution

1 liter of this solution contains .50 moles of $AgNO_3$

How do you prepare 250.0 mL of a 0.10 M $AgNO_3(aq)$ solution? (Use the given molarity as a conversion factor between moles solute and liters solution)



volumetric flask

7.5 g $CuCl_2$ are dissolved in water to make 500.0 mL of solution. What is the molar concentration of this solution?

molar concentration = molarity = $\frac{\text{mol } CuCl_2}{\text{L solution}}$

$7.5\text{ g } CuCl_2 \times \frac{1\text{ mol } CuCl_2}{134.45\text{ g } CuCl_2} = .055783\text{ mol } CuCl_2$

$500.0\text{ mL} \times \frac{1\text{ L}}{1000\text{ mL}} = .5000\text{ L}$

$M = \frac{.055783\text{ mol}}{.5000\text{ L soln}} = .11\text{ M}$

A reaction calls for 0.241 g K_2CO_3. How many mL of 0.125 M $K_2CO_3(aq)$ should be added?

molar mass K_2CO_3: 138.21 g/mol

$0.241\text{ g } K_2CO_3 \times \frac{1\text{ mol } K_2CO_3}{138.21\text{ g } K_2CO_3} \times \frac{1\text{ L soln}}{.125\text{ mol } K_2CO_3} \times \frac{1000\text{ mL}}{1\text{ L}}$ (.125 M)

$= 13.9\text{ mL}$

Dilution: solvent is added to make a solution more dilute (less concentrated)

When adding water to a solution, what happens to the number of moles of **solute**? stays constant

$M = \frac{\text{mol solute}}{\text{L soln}}$ → mol solute = $M \cdot$ L soln (inversely proportional)

Dilution equation: $M_1V_1 = M_2V_2$

before dilution / after dilution

3 of 4 variables

Concentrated sulfuric acid is 18.0 *M* $H_2SO_4(aq)$. How do you make 10.0 L of 1.50 M $H_2SO_4(aq)$ by dilution?

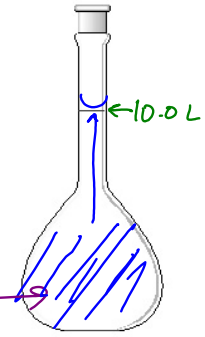
V_2 M_2

Solve for V_1

vol. flask

$\frac{M_1V_1}{M_1} = \frac{M_2V_2}{M_1} = \frac{(1.50\text{ M})(10.0\text{ L})}{(18.0\text{ M})}$

$= 0.833\text{ L}$ of concentrated sulfuric acid



Molarity converts between…

mol solute $\overset{M}{\longleftrightarrow}$ L solution

So, molarities can be used in stoichiometry problems along with the mole ratio from the balanced chemical equation.

How many grams of lead(II) iodide can be formed by mixing 1.0 mL of 0.50 M lead(II) nitrate solution with 2.0 mL 0.30 M sodium iodide solution?

molar mass 460.99 g/mol

$Pb(NO_3)_2 + 2\,NaI \rightarrow PbI_2 + 2\,NaNO_3$

1.0 mL, 0.50 M $Pb(NO_3)_2$ | 2.0 mL, 0.30 M NaI | ? g PbI_2

$$1.0\text{ mL } Pb(NO_3)_2 \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{.50\text{ mol } Pb(NO_3)_2}{1\text{ L}} \times \frac{1\text{ mol } PbI_2}{1\text{ mol } Pb(NO_3)_2} = 5.0\times10^{-4}\text{ mol } PbI_2$$

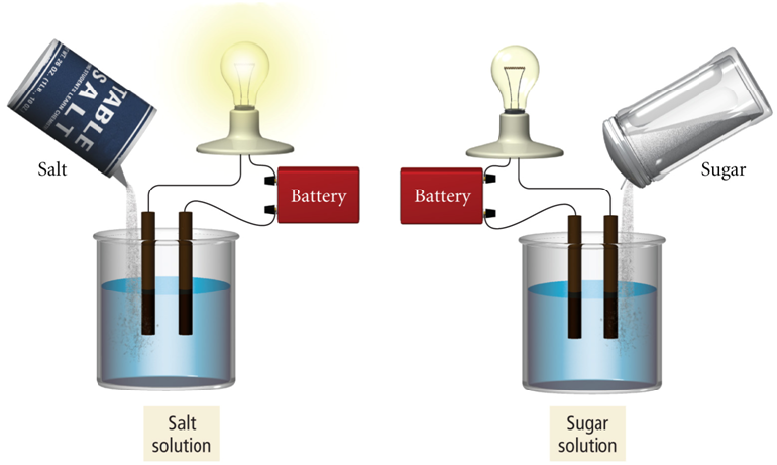
$$2.0\text{ mL NaI} \times \frac{1\text{ L}}{1000\text{ mL}} \times \frac{.30\text{ mol NaI}}{1\text{ L}} \times \frac{1\text{ mol } PbI_2}{2\text{ mol NaI}} = 3.0\times10^{-4}\text{ mol } PbI_2$$

Lim React

$$3.0\times10^{-4}\text{ mol } PbI_2 \times \frac{460.99\text{ g } PbI_2}{1\text{ mol } PbI_2} = \boxed{0.14\text{ g}}$$

Electrolyte: solute that causes solution to conduct electricity

Nonelectrolyte: solute that does not cause solution to conduct electricity



Solute	Electrolyte?	Nonelectrolyte?
Deionized water H_2O (molecular)		X
NaCl (Na^+ Cl^-) ionic	X	
$C_{12}H_{22}O_{11}$ (sugar) molecular		X
NH_4Cl (NH_4^+, Cl^-)	X	
C_3H_6O acetone		X