Molarity

Name_____

1. Calculate the mass of sodium phosphate required to make 500. ml of 0.350 M solution?
   a. After the solution is produced, what is the molarity of the sodium ions in this solution?

2. What is the molarity when 8.75 g of ammonium chloride is dissolved to produce 200. ml of a solution?

3. If you wanted to use up all 10.0 grams of sodium hydroxide that you have available, to produce a 1.0 M solution, what size volumetric flask should you get off the shelf to use?
   a. How many moles of sodium ions, and how many moles of hydroxide ions are present in this solution?

4. What volume of 1.00 M stock solution of sulfuric acid should you measure out to produce 500. ml of 0.0250 M solution.

5. If you diluted 10.0 ml of 12 M HCl to 2.0 L, what would be the concentration of the new solution?

6. How many millimoles of aluminum chloride are present in 100.0 ml of a 0.025M solution?
   a. How many millimoles of aluminum ions would be present in this solution?

P F7 (pg 2 of 2) **Molarity** Name_____

1. Calculate the mass of sodium phosphate required to make 500. ml of 0.350 M solution?
   a. After the solution is produced, what is the molarity of the sodium ions in this solution?

$M = \frac{mols}{V(L)}$ *thus* $M \times V = mol$ *thus* $0.35M \times 0.5L = 0.175mol\ of\ Na_3PO_4$

Na_3PO_4 MM = 3(23) + 31 + 4(16) = 164 g/mol $0.175mol \times \frac{164g}{1mol} = 28.7g$

when Na_3PO_4 dissolve it dissociates into ions: $Na_3PO_4 \rightarrow 3Na^+ + PO_4^-$ thus $0.35M \times \frac{3Na^+}{1Na_3PO_4} = 1.05M\ Na^+ ions$

2. What is the molarity when 8.75 g of ammonium chloride is dissolved to produce 200. ml of a solution?

NH_4Cl MM = 14 + 4(1.01) + 35.5 = 53.5 g/mol $8.75g \times \frac{1mol}{53.5g} = 0.164mol$

$M = \frac{mols}{Liter}$ *thus* $M = \frac{0.164}{0.2L} = 0.817M$

3. If you wanted to use up all 10.0 grams of sodium hydroxide that you have available, to produce a 1.0 M solution, what size volumetric flask should you get off the shelf to use?
   a. How many moles of sodium ions, and how many moles of hydroxide ions are present in this solution?

NaOH MM = 23 + 16 + 1 = 40 g/mol $10g \times \frac{1mol}{40g} = 0.25mol$

$M = \frac{mols}{V(L)}$ *thus* $Vol(L) = \frac{mol}{M}$ *thus* $Vol(L) = \frac{0.25mol}{1M}$ *thus* $V = 0.25L = 250ml$

when NaOH dissolve it dissociates into ions: $NaOH \rightarrow Na^+ + OH^-$ thus $0.25mol \times \frac{Na^+}{1NaOH} = 0.25mol\ Na^+ ions$

4. What volume of 1.00 M stock solution of sulfuric acid should you measure out to produce 500. ml of 0.0250 M solution.

since $M = \frac{mols}{Liter}$ *thus* $M \times V = mol$ when diluting, mols of concentrated = mols of diluted, thus $M_{conc} \times V_{conc} = M_{dil} \times V_{dil}$

$1M \times V_{conc} = 0.025M \times 500ml$ **V = 12.5 ml**

(Note that I used ml not Liters, either unit will work, since in the dilution equation there are two volumes, their units work together if they are the same. Using just the molarity equation, you must always be in liters.)

5. If you diluted 10.0 ml of 12 M HCl to 2.0 L, what would be the concentration of the new solution?

Use the "dilution equation" $M_{conc} \times V_{conc} = M_{dil} \times V_{dil}$ $12M \times 10ml = M_{dil} \times 2000ml$ **M = 0.06 M**

(Note that in the dilution equation there are two volumes, so you may work in ml, but you must use ml on both sides of the equation. Using just the molarity equation, you must always be in liters.)

6. How many millimoles of aluminum chloride are present in 100.0 ml of a 0.025M solution?
   a. How many millimoles of aluminum ions would be present in this solution?
   b. How many milli moles of chloride ions would be present in this solution?

since $M = \frac{mols}{Liter}$ *thus* $M \times V(in\ mL) = millimol$ $0.025M \times 100ml = 2.5mmol$ of $AlCl_3$

when $AlCl_3$ dissolve it dissociates into ions: $AlCl_3 \rightarrow Al^+ + 3\ Cl^-$ (for Cl ions, this is a buy 1 get 3 total)

thus $2.5mmolAlCl_3 \times \frac{1Al^+}{1AlCl_3} = 2.5mmol\ Al^{3+} ions$ and $2.5mmolAlCl_3 \times \frac{3Cl^-}{1AlCl_3} = 7.5mmol\ Cl^- ions$