Key

"Concentrate" On These

1) Calculate the molarity of each of these solutions:

a) 5.623 grams of $NaHCO_3$ is dissolved in enough water to make 250.0 ml of solution.

$5.623g\left(\frac{1mole}{84.008g}\right) = 0.066934$ mol $\qquad \frac{0.066934}{.250} = .26773$ $\boxed{.2677M}$

b) 184.6 mg of $K_2Cr_2O_7$ is dissolved in enough water to make 500.0 ml of solution.

$184.6mg\left(\frac{1g}{1000mg}\right)\left(\frac{1mole}{294.2}\right) = 6.2746\times10^{-4}$ mol $\qquad \frac{6.2746\times10^{-4}}{.5} = \boxed{0.001255M}$

2) Describe how you would prepare 1.0 liter of 0.20 Molar $NaIO_3$ solution from solid $NaIO_3$.

$0.20 = \frac{x}{1L}$ $\qquad 0.20mol\left(\frac{197.9g}{1mol}\right)$

$x = .20mol$ $\qquad = 39.58g$

At the scale, 4.0×10^1 g of $NaIO_3$ would be weighed out. This would be placed in an empty beaker and enough water added to make a final solution volume of 1L

3) How would you prepare 3.20 liters of a 0.50 molar H_2SO_4 solution from concentrated (18.0 molar) H_2SO_4?

$18.0(x) = 0.50(3.20)$

$x = 0.08888\ L$

89mL

89mL of the 18.0M stock solution would be placed into an empty container. Then enough water would be added until the new solution had a volume of 3.20L.

4) A solution of ethanol (C_2H_5OH) in water is prepared by dissolving 10.0 ml of ethanol (density: 0.79 g/ml) in enough water to make 250.0 ml of solution. What is the molarity of this ethanol in this solution?

$10.0mL\left(\frac{0.79g}{1mL}\right) = 7.9g$ $\qquad 7.9g\left(\frac{1mol}{46.068g}\right) = 0.171485$ $\qquad \frac{0.171485mol}{.250L}$

$= 0.68594$ $\boxed{0.686M}$

5) A solution is prepared by dissolving 10.8 grams of ammonium sulfate in enough water to make 100.0 ml of stock solution. A 10.0 ml sample of this stock solution is added to 50.0 ml of water. Calculate the concentration of ammonium sulfate in this final solution.

$10.8g\left(\frac{1mol}{132.144g}\right) = 0.081729$ mol $\qquad \frac{0.081729mol}{.1L} = 0.817290$ $\uparrow M_1$

$(0.817290)(.01) = x(.060)$

$x = 0.136215$

$\boxed{0.136M}$

$(NH_4)_2SO_4$

6) Calculate the concentration of each ion present in each of the following ionic solutions.

a) 0.100 grams of $MgCl_2$ in 100.0 ml of solution. $\qquad \frac{0.100g}{95.219g/mol} = 0.00105mol$ $\qquad .00105$

b) 55.1 mg of NH_4Br in 500.0 ml of solution. $\qquad \frac{.0551g}{97.942g/mol} = 5.625\times10^{-4}$ $\qquad .0005625$

c) 0.208 grams of $AlCl_3$ in 250.0 ml of solution. $\qquad \frac{.2089}{133.339g/mol} = 0.00156$ $\qquad .00156$

$.00105mol\left(\frac{1molMg}{1molMgCl_2}\right)$

$[Mg^{+2}] = .0105M$

$[Cl^{-1}] = .0210M$

$[NH_4^{+1}] = .00113M$

$[Br^{-1}] = .00113M$

$[Al^{+3}] = .00624M$

$[Cl^{-1}] = .0187M$

7) 0.150 grams of of the ionic compound Na_2CO_3 is dissolved in H_2O to give 1.0 liter solution. What is the concentration of the Na^+ ion in the solution?

$0.150g\left(\frac{1mol}{105.99}\right) = 0.001415mol$ $\left(\frac{2mol\ Na^+}{1mol\ Na_2CO_3}\right) = 0.002830$ mol Na^+ $/1L$ $=$ $\boxed{0.0028M\ of\ Na^+}$

8) A solution is prepared by dissolving 0.5842 grams of oxalic acid ($H_2C_2O_4$) in enough water to make 100.0 ml of solution. A 10.00 ml aliquot (portion) of this solution is then diluted to a final volume of 250 ml. What is the molarity of the final oxalic acid solution?

$0.5842g\left(\frac{1mol}{90.036}\right) = 0.0064885$ $\qquad \frac{0.0064885}{.1} = 0.064885$ $\uparrow M_1$

$(0.064885)(.01) = M_2(.250)$

$\boxed{M_2 = 0.0026M}$

9) How many grams of $Pb(NO_3)_2$ would be recovered from 756 ml of a 0.651 molar solution of $Pb(NO_3)_2$ if all the water was removed?

$0.651M = \frac{x}{.756L}$

$x = 0.492156$ mol

$0.492156mol\left(\frac{331.22g}{1mol}\right) = 163.0119$

$\boxed{163g\ Pb(NO_3)_2}$

Key

MORE PROBLEMS!

1. Calculate the volume of solution required in each of the following:

a. 1.00 mole of sulfuric acid (H_2SO_4) from a 6.00 M solution

$6.00 = \frac{1.00}{x}$ $x = 0.16666$ **0.167 L**

b. 5.00 g of sodium bromide from a 0.100 M solution

NaBr $5.00\,g\left(\frac{1\,mol}{58.44\,g}\right) = 0.085557\,mol$ $0.100 = \frac{0.085557}{x}$ $x = 0.85557$

0.856 L

c. 7.65 mg of calcium chloride from a 1.4 M solution

$CaCl_2$ $7.65\,mg\left(\frac{1\,g}{1000\,mg}\right)\left(\frac{1\,mol}{110.98\,g}\right) = 6.89313 \times 10^{-5}\,mol$ $1.4 = \frac{6.89313 \times 10^{-5}}{x}$ $x = 4.92236 \times 10^{-5}$

$x = 4.92 \times 10^{-5}$ L

d. 3.50 moles of nitric acid (HNO_3) from a 3.0 M solution

$3.0 = \frac{3.50}{x}$ $x = 1.1666$

$x = 1.17$ L

2. Calculate the number of grams of solute necessary to prepare the following solutions.

a. 500 ml of a 0.10 M sodium hydroxide solution

NaOH $0.10 = \frac{x}{.500}$ $x = .05$ mole $.05\,mol\left(\frac{39.998\,g}{1\,mol}\right) = 1.999$

2 g

b. 250 ml of a 0.020 M calcium chloride solution

$CaCl_2$ $0.020 = \frac{x}{.250}$ $x = .005\,mol$ $0.005\,mol\left(\frac{110.98\,g}{1\,mol}\right) = 0.5549$

0.55 g

3. What volume of 12.0 M HCl would you need to make 3.80 liters of 1.65 M HCl ?

$M_1V_1 = M_2V_2$

$(12.0)V_1 = (1.65)(3.80)$

$V_1 = 0.5225$

$V_1 = 0.523$ L

4. You've just made 2.0 liters of cherry Kool-aid that has a dextrose ($C_6H_{12}O_6$) concentration of 0.35 molar. How many grams of sugar (dextrose) would you have to add to the Kool-aid to increase the dextrose concentration to 0.50 molar . (assume no change in volume)

$0.35 = \frac{x}{2.0}$ $x = 0.70\,mol$

$0.50 = \frac{x}{2.0}$ $x = 1\,mol$

$1 - 0.70 = 0.30\,mol$ added.

$0.30\,mol\left(\frac{180.156\,g}{1\,mol}\right) = 54.0468$

54 g additional is added

5. How would you make 1.25 liters of 0.75 molar HCl solution from a stock solution with a molarity of 12.1.

$M_1V_1 = M_2V_2$

$(12.1)V_1 = (0.75)(1.25)$

$V_1 = 0.077479$

$V_1 = 0.0775$ L