# Molarity and Dilutions Worksheet

**1.** Calculate the final concentration of a solution that is made by dissolving 14.8 g of solid sodium hydroxide in 600.0 mL of solution.

**2.** If I add water to 100 mL of a 0.15 M NaOH solution until the final volume is 150 mL, what will the molarity of the diluted solution be?

**3.** If I add 25 mL of water to 125 mL of a 0.15 M NaOH solution, what will the molarity of the diluted solution be?

**4.** I have 345 mL of a 1.5 M NaCl solution. If I boil the water until the volume of the solution is 250 mL, what will the molarity of the solution be?

**5.** How much water would I need to add to 500 mL of a 2.4 M KCl solution to make a 1.0 M solution?

**6.** Calculate the number of mL of 2.00 M $HNO_3$ solution required to react with 216 grams of Ag according to the equation:

$$3\ Ag(s) + 4\ HNO_3(aq) \rightarrow 3\ AgNO_3(aq) + NO(g) + 2\ H_2O(l)$$

**7.** Calculate in mL the volume of 0.500 M NaOH required to react with 3.0 grams of acetic acid. The equation is: $NaOH(aq) + HC_2H_3O_2(aq) \rightarrow NaC_2H_3O_2(aq) + H_2O(l)$

**8.** Calculate the number of grams of AgCl formed when 0.200 L of 0.200 M $AgNO_3$ reacts with an excess of $CaCl_2$. The equation is:

$$2\ AgNO_3(aq) + CaCl_2(aq) \rightarrow 2\ AgCl(s) + Ca(NO_3)_2(aq)$$

**9.** Calculate the mass of AgCl formed when an excess of 0.100 M solution of NaCl is added to 0.100 L of 0.200 M $AgNO_3$.

**10.** Calculate: a) the mass of $BaSO_4$ formed when excess 0.200 M $Na_2SO_4$ solution is added to 0.500 L of 0.500 M $BaCl_2$ solution, and

b) the minimum volume of the $Na_2SO_4$ solution needed to precipitate the $Ba^{2+}$ ions from the $BaCl_2$ solution.

**11.** A sample of impure sodium chloride weighing 1.00 grams is dissolved in water and completely reacted with silver nitrate solution. The dried precipitate of AgCl has a mass of 1.48 grams . Calculate the percentage of NaCl in the original impure sample.

**12.** To neutralize the acid in 10.0 mL of 18.0 M $H_2SO_4$ that was accidentally spilled on a laboratory bench top, solid sodium bicarbonate was used. The container of sodium bicarbonate was known to weigh 155.0 g before this use and out of curiosity its mass was measured as 144.5 g afterwards. The reaction that neutralizes sulphuric acid this way is as follows: $H_2SO_4 + 2\ NaHCO_3 \rightarrow Na_2SO_4 + 2\ CO_2 + 2\ H_2O$

Was sufficient sodium bicarbonate used? Calculate the limiting reactant and the maximum yield in grams of sodium sulphate.

**13.** Barium nitrate and potassium sulphate solutions react and form a precipitate. What is the precipitate? How many mL of 0.40 M $Ba(NO_3)_2$ solution are required to precipitate completely the sulphate ions in 25 mL of 0.80 M $K_2SO_4$ solution?

**14.** What mass of silver chloride can be precipitated from a silver nitrate solution by 200 mL of a solution of 0.50 M $CaCl_2$?

Molarity and Dilutions Worksheet

**1.** Calculate the final concentration of a solution that is made by dissolving 14.8 g of solid sodium hydroxide in 600.0 mL of solution.

**C = n/V, we need to find n to do this calculation.**
**n = m/MM → n = 14.8 /40.0 = 0.370 mol**
**C = 0.370 mol/ 0.600 L = 0.617 M**

**2.** If I add water to 100 mL of a 0.15 M NaOH solution until the final volume is 150 mL, what will the molarity of the diluted solution be?

$M_1V_1 = M_2V_2$
**(0.15 M)(100 mL) = x (150 mL)**
**x = 0.100 M**

**3.** If I add 25 mL of water to 125 mL of a 0.15 M NaOH solution, what will the molarity of the diluted solution be?

$M_1V_1 = M_2V_2$
**(0.15 M)(125 mL) = x (150 mL)**
**x = 0.125 M**

**4.** I have 345 mL of a 1.5 M NaCl solution. If I boil the water until the volume of the solution is 250 mL, what will the molarity of the solution be?

$M_1V_1 = M_2V_2$
**(1.5 M)(345 mL) = x (250 mL)**
**x = 2.07 M**

**5.** How much water would I need to add to 500 mL of a 2.4 M KCl solution to make a 1.0 M solution?

$M_1V_1 = M_2V_2$
**(2.4 M)(500 mL) = (1.0 M) x**
**x = 1200 mL**

**1200 mL will be the final volume of the solution. However, since there's already 500 mL of solution present, you only need to add 700 mL of water to get 1200 mL as your final volume. The answer: 700 mL.**

**6.** Calculate the number of mL of 2.00 M $HNO_3$ solution required to react with 216 grams of Ag according to the equation:

$3\ Ag(s) + 4\ HNO_3(aq) \rightarrow 3\ AgNO_3(aq) + NO(g) + 2\ H_2O(l)$ **$1.34 \times 10^3$ ml $HNO_3$**

**7.** Calculate in mL the volume of 0.500 M NaOH required to react with 3.0 grams of acetic acid. The equation is: $NaOH(aq) + HC_2H_3O_2(aq) \rightarrow NaC_2H_3O_2(aq) + H_2O(l)$ **0.0999L or 100ml NaOH**

**8.** Calculate the number of grams of AgCl formed when 0.200 L of 0.200 M $AgNO_3$ reacts with an excess of $CaCl_2$. The equation is:

$2\ AgNO_3(aq) + CaCl_2(aq) \rightarrow 2\ AgCl(s) + Ca(NO_3)_2(aq)$ **5.73 g AgCl**

**9.** Calculate the mass of AgCl formed when an excess of 0.100 M solution of NaCl is added to 0.100 L of 0.200 M $AgNO_3$. **2.87 g AgCl**

**10.** Calculate: a) the mass of $BaSO_4$ formed when excess 0.200 M $Na_2SO_4$ solution is added to 0.500 L of 0.500 M $BaCl_2$ solution, and **58.3 g $BaSO_4$**

b) the minimum volume of the $Na_2SO_4$ solution needed to precipitate the $Ba^{2+}$ ions from the $BaCl_2$ solution. **1.25 L $Na_2SO_4$**

**11.** A sample of impure sodium chloride weighing 1.00 grams is dissolved in water and completely reacted with silver nitrate solution. The dried precipitate of AgCl has a mass of 1.48 grams . Calculate the percentage of NaCl in the original impure sample.

**(0.603 g pure NaCl/1.00 g impure NaCl) x 100% = 60%**

**12.** To neutralize the acid in 10.0 mL of 18.0 M $H_2SO_4$ that was accidentally spilled on a laboratory bench top, solid sodium bicarbonate was used. The container of sodium bicarbonate was known to weigh 155.0 g before this use and out of curiosity its mass was measured as 144.5 g afterwards. The reaction that neutralizes sulphuric acid this way is as follows: $H_2SO_4 + 2\ NaHCO_3 \rightarrow Na_2SO_4 + 2\ CO_2 + 2\ H_2O$

Was sufficient sodium bicarbonate used? Calculate the limiting reactant and the maximum yield in grams of sodium sulphate.

**Sufficient $NaHCO_3$ was used because all the $H_2SO_4$ was used up in this reaction. $H_2SO_4$ is the limiting reagent (L.R.) and 0.18 mol was used up. The maximum yield of $NaSO_4$ is 25.6 g.**

**13.** Barium nitrate and potassium sulphate solutions react and form a precipitate. What is the precipitate? How many mL of 0.40 M $Ba(NO_3)_2$ solution are required to precipitate completely the sulphate ions in 25 mL of 0.80 M $K_2SO_4$ solution?

**$Ba(NO_3)_2 + K_2SO_4 \rightarrow BaSO_4 = 2KNO_3$** **50 ml $Ba(NO_3)_2$**

**14.** What mass of silver chloride can be precipitated from a silver nitrate solution by 200 mL of a solution of 0.50 M $CaCl_2$?

**$2\ AgNO_3 = CaCl_2 \rightarrow 2AgCl = Ca(NO_3)_2$** **28.7 g AgCl**