

**EXERCISE: Solution,  
Concentration Units**

(Use separate sheet to show your work and answers)

1. Percentage Concentration:

a) A solution is labeled 35.0 % (v/v) ethanol.

How many mL of ethanol are needed to prepare 250 mL of this solution?

87.5 mL  
alcohol

b) If you need 25.0 mL of ethanol (pure), what volume of this solution should you measure out?

71.4 mL  
sol'n

2. Dilution: How would you prepare 100 mL of 0.10 M NaCl solution from 0.50 M NaCl solution available on the shelf? (filling in the following blanks will help you solve this problem step by step.)

The NaCl solutions

initial (1)

diluted (2)

molarity (M)

$M_1 = 0.50 \text{ M}$

$M_2 = 0.10 \text{ M}$

moles of solute present

moles = 0.010

moles = 0.010

Using  $V_1M_1 = V_2M_2$ , solve for  $V_1 =$  20.0 mL

Enter volume of solution here

$V_1 =$  20.0 mL

$V_2 = 100. \text{ mL}$

Using the above calculation, can you now write a procedure for preparing 100 mL of 0.10 M NaCl solution?

3. From Molarity to % (m/m):

Calculate the % (m/m) concentration of 6.00 M  $\text{H}_2\text{SO}_4$ . The density of the 6.00 M  $\text{H}_2\text{SO}_4$  solution is 1.34 g/mL.

43.97% m/m  $\text{H}_2\text{SO}_4$

4. Relating moles to % composition:

a) How many moles of NaCl are contained in 150 g of a 1.25 % (m/m) NaCl solution? 0.0321 mol NaCl

b) You need 0.150 mole of KOH for a reaction. Available is some 2.50 % (m/v) KOH solution. What volume of the solution is needed?

337 mL sol'n

2.

5. 135 g of solution contain 18.5 g of dissolved salt. What is the percentage of the salt in the solution?  $13.7\% (m/m)$
6. Calculate the percentage concentration of a solution prepared by dissolving 5.29 g of calcium chloride in 81.0 g of water.  $6.13\% (m/m)$
7. Sodium carbonate is one of the most widely used sodium compounds. How many grams are required by an analytical chemist to prepare 400. mL of 0.800 M  $\text{Na}_2\text{CO}_3$  solution?  $33.9 \text{ g Na}_2\text{CO}_3$
8. If 75.0 g of  $\text{NH}_3$  is needed for the reaction, how many mL of concentrated ammonia solution (15.0 M) is required?  $0.294 \text{ L} = \cancel{294 \text{ mL}} 294 \text{ mL}$
9. How many moles of solute are in 65.0 mL 2.20 M NaOH?  $0.143 \text{ mol NaOH}$
10. The density of 18.0% HCl is 1.09 g/mL. Calculate its molarity (M).  $5.38 \text{ M}$
11. 0.150 M NaCl is to be the source of 8.33 g of dissolved solute. What volume of solution is needed?  $0.949 \text{ L} = 949 \text{ mL}$
12. How many milliliters of concentrated nitric acid, 16 M  $\text{HNO}_3$ , will you use to prepare 750. mL 0.50 M  $\text{HNO}_3$ ?  $23 \text{ mL of } 16 \text{ M HNO}_3$

$$\begin{aligned} \#11. \quad & 8.33 \text{ g NaCl} \times \left( \frac{1 \text{ mol NaCl}}{58.5 \text{ g}} \right) \times \left( \frac{1 \text{ L}}{0.150 \text{ mol}} \right) \times \left( \frac{1000 \text{ mL}}{1 \text{ L}} \right) \\ & = 949 \text{ mL} \end{aligned}$$