

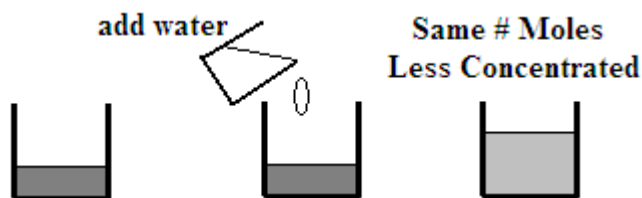
1. **New Concept: Dilution!!!** When you add water to a solution, the solution becomes **less concentrated** but still contains **the same amount of dissolved material solute**. So, the moles of dissolved material is the same in the original and the diluted solution. Dilution problems can easily be calculated using:

Moles solute before dilution = Moles solute after dilution

and $M = \text{mol} / L$,
or $\text{mol} = M L$

$$\text{moles before} = \text{moles after}$$

$$(\text{Molarity})(\text{Volume}) = (\text{Molarity})(\text{Volume})$$



Ex: A liter of 5.0 M silver nitrate is diluted to a volume of 2.0 liters by adding water. What is the new concentration of the diluted silver nitrate?

$$M V \text{ before} = M V \text{ after}$$

$$(5.0 M) (1.0 L) = (M) (2.0 L)$$

$$M \text{ after} = 2.50 M$$

a) You add water to 100 mL of a 6.0 M solution until the final volume is 1.50 L. What is the new concentration of the solution? (0.40 M)

b) You want to make 1.0 L of 0.100 M nitric acid solution. How many liters of 4.0 M nitric acid solution need to be added to water to create the solution? (0.025 L)

c) You have 1 gallon of 15 % chocolate milk. How many gallons of 2.5 % chocolate milk can you make? (6 gallons)

2. You have the following stock solutions available: 2.0 M NaCl, 4.0 M KNO₃, and 0.50 M MgSO₄. Calculate the volumes you must dilute to make the following solutions.

a. 500 mL of 0.50 M NaCl (130 mL)

b. 2.0 L of 0.20 M MgSO₄ (0.80 L)

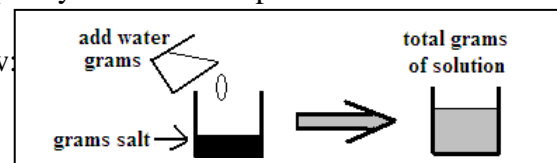
3. How many mL of a 3.50 M solution are required to be added to water to form 2.00 L of a 1.50 M solution?
(857 mL)
4. What is the new concentration if 850. mL of water are added to 1.50 L of a 2.00 M solution? (1.28 M)

6. The other concentration: Percentage Mass

When you have the percentage mass of solute you can make "an equality line" for 1 step conversions.

For example, if you have a 5 % NaCl solution (table salt) you know:

5 % NaCl, 95 % H₂O, 100 % Total



You can then make a chemical equality line for this solution --- PRETEND YOU HAVE 100 g TOTAL

5 g NaCl = 95 g H₂O = 100 g total (they are chemically equivalent for this solution, not really equal)

For Example: The maximum concentration of "chemical X" is a 25% X solution in water.

Complete the equality: _____ g X = _____ g H₂O = _____ g Total

- How many grams of 'X' are in 200. grams of solution? (50 g)
- How many grams of water are needed to make the solution if you have 100 grams 'X'? (300 g)
- What is the total mass of the solution needed to deliver 60.0 grams of 'X'? (240 g)
- You have 120 grams of water. What is the maximum number of grams of 'X' that can be dissolved in this amount of water? (40 g)
- You have 800 grams of solution. How many grams of the solution are water (H₂O)? (600 g)