MOLARITY

Molarity (M): the concentration of solute in a solution expressed as the number of moles of solute dissolved in 1L of solution.

$$\text{Molarity (M)} = \frac{\text{Moles of solute}}{\text{Litres of solution}}$$

To make a 1M solution of NaCl – dissolve 1 mole of NaCl (58.5g) in 1L of water.

What is the molarity of a solution if water is added to 2 moles of glucose to make 5L of solution?

$$\frac{\text{2 mol glucose}}{\text{5L}} = 0.4\text{M (mol/L)}$$

Problem

1. A saline solution contains 0.9g of NaCl per 100 ml of solution what is its molarity?

1 mole = 58.5g
? mol = 0.9g

0.9/58.5 x 1 = 0.015 mol

$$\text{Molarity (M)} = \frac{\text{Moles of solute}}{\text{Litres of solution}} = \frac{\text{0.015 mol}}{\text{0.1L}} = 0.15\text{M}$$

2. How many grams of solute are present in 1.5L of 0.2M Na_2SO_4 ?

Molarity x Litres = moles

$$\frac{\text{0.2 mol}}{\text{1L}} \times 1.5\text{L} = 0.3 \text{ mol}$$

1 mole = 142 g
0.3 mol = 0.3 x 142g = 42g of Na_2SO_4

3. How many grams of potassium iodide (KI) must you dissolve in 500 ml of water to produce a 0.06M solution? (5g)

4. A salt solution has a volume of 250 ml and contains 0.7 mol of NaCl. What is the molarity of the solution? (2.8M)

5. 2L of a solution contains 36g of glucose ($C_6H_{12}O_6$). What is the molarity of the solution? (0.1M)

6. How many moles of solute are in 250 ml of 2M $CaCl_2$? How many grams of $CaCl_2$ is this? (0.5 mol and 55g).

7. Calculate the number of moles and grams of solute in each solution.

   a) 1L of 0.5M NaCl.
   b) 500 ml of 2M KNO_3.
   c) 250 ml of 0.1M $CaCl_2$.
   d) 2L of 0.3M Na_2SO_4.

MAKING DILUTIONS

The number of moles of solute does not change when a solution is diluted.

Number of moles before dilution = Number of moles after dilution.

Moles of solute = $M_1V_1 = M_2V_2$

M_1 and V_1 = the initial solution's molarity and volume.
M_2 and V_2 = the final solution's molarity and volume.

Problem

How would you prepare 100 ml of 0.4 M $MgSO_4$ from a stock solution of 2M $MgSO_4$?

$$M_1V_1 = M_2V_2 \qquad V_1 = \frac{M_2V_2}{M_1} = \frac{0.4M \times 100\ ml}{2M} = 20\ ml$$

Add 80 ml of water to make up to 100ml.

You have the following stock solutions 2M NaCl, 4M KNO_3, and 0.5 M $MgSO_4$. Calculate the volumes you must dilute to make the following solutions.

a) 500 ml 0.5M NaCl.
b) 2L of 0.2M $MgSO_4$.
c) 50 ml of 0.2M KNO_3.