**Molarity:**
Formula: $M = \frac{\text{mole solute}}{\text{L of solution}}$

All Possible Units: M, molar, [#], $\frac{\text{mole}}{\text{L}}$

A saline solution contains 0.90 g NaCl in exactly 100. mL of solution. What is the molarity of the solution?

How many moles of solute are present in 1.5L of 0.24M $Na_2SO_4$?

1. Calculate the molarity of 0.060 moles $NaHCO_3$ in 1500 mL of solution.

$M = \frac{\text{mole}}{\text{L}} = ? = \frac{0.060\text{mole}}{1.500\text{L}} = 0.040\text{M of } NaHCO_3 \text{ solution}$ (2 s.f.)

or [0.040] or 0.040 mole/L or 0.040 molar

1000 mL = 1 L

2. What is the molar concentration of 1.0 mol of KCl dissolved in 750 mL of solution?

1000mL=1L

$M = \frac{\text{mole}}{\text{L}} = ?$ $\frac{1.0\text{ mole}}{0.750\text{mL}} = 1.3\text{M}$ or [1.3] or $1.3\frac{\text{mole}}{\text{L}}$ or 1.3 molar KCl solution (2 s.

3. Calculate the molarity of 29.25 grams of NaCl in 2.0 liters of solution.

$g = MM_{NaCl} = \frac{58.44\text{g}}{1\text{mole}}$ $M = \frac{\text{mole}}{\text{L}} = ?$

$29.25\text{g NaCl} \left| \frac{1\text{mole NaCl}}{58.44\text{g NaCl}} \right. \Rightarrow \frac{0.5005\text{ mole NaCl}}{2.0\text{ L}} \rightarrow 0.25\text{M NaCl solution}$ (2 s.f.)

4. Calculate the molarity of 34 grams of sugar, $C_{12}H_{22}O_{11}$ 500 mL of solution.

$M = \frac{\text{mole}}{\text{L}} = ?$

$MM = 342.24\text{g/mole}$

$34\text{g } C_{12}H_{22}O_{11} \left| \frac{1\text{mole}}{342.24\text{g}} \right. = \frac{0.099\text{ mole}}{0.500\text{L}} = 0.20\text{M } C_{12}H_{22}O_{11}$ solution (2s.

5. Calculate the number of moles of NaCl contained in 0.500L of a 1.5M solution.

? moles $M = \frac{\text{mole}}{\text{L}}$ $L \cdot M = \frac{\text{? moles}}{\text{L}} \cdot \text{L}$ $\frac{1.5\text{mole}}{\text{L}} \cdot 0.500\text{L} = 0.75\text{ mole NaCl}$ (2 s.f.)

8. How many grams of NaCl are contained in the solution discussed in problem #5 ?

$MM_{NaCl} = \frac{58.44\text{g}}{1\text{mole}}$

$0.75\text{mole NaCl} \left| \frac{58.44\text{g NaCl}}{1\text{mole NaCl}} \right. = 43.83\text{g} = 44\text{g NaCl}$ (2 s.f.)

9. Calculate the number of moles of NaOH contained in 250 mL of a 0.05M solution.

$\frac{0.05\text{mole}}{\text{L}} \times 0.250\text{L} = 0.0125\text{ mole} = 0.01\text{ mole}$ (1 s.f.)

Remember # $M = \frac{\#\text{ mole}}{\text{L}}$

10. How many grams and moles of solute are there in 250 mL of a 0.10M $CaCl_2$ solution?

$\frac{0.10\text{ mole}}{\text{L}} \times 0.250\text{L} = 0.025\text{ mole}$

$0.025\text{mole CaCl}_2 \left| \frac{110.98\text{g CaCl}_2}{1\text{mole CaCl}_2} \right. = 2.8\text{g C}$

2 s.f.

**Molarity by Dilution:**

Formula: $M_1V_1 = M_2V_2$

How many milliliters of a stock solution of 2.00M $MgSO_4$ would you need to prepare 100.0 mL of 0.400M $MgSO_4$?

1. If 125 mL of a 0.15M NaOH solution is diluted to a final volume of 150 mL what will the molarity of the diluted solution be?

$V_1 = 125mL$
$M_1 = 0.15M$
$V_2 = 150mL$
$M_2 = ?$

$\frac{M_1V_1}{V_2} = \frac{M_2V_2}{V_2} = \frac{125mL \times 0.15M}{150mL} = 0.13M$ (2 s.f.)

2. If 100. mL of a 0.15 M NaOH solution is diluted to a final volume of 175 mL, what will the molarity of the diluted solution be?

$V_1 = 100.mL$
$M_1 = 0.15M$
$V_2 = 175mL$
$M_2 = ?$

$\frac{M_1V_1}{V_2} = M_2 = \frac{0.15M \times 100.mL}{175mL} = 0.086M$ (2 s.f.)

3. How many liters of a 0.050 M HCl solution can be made by diluting 250 mL of 10.M HCl?

$V_1 = ?$
$M_1 = 0.050M$
$V_2 = 250mL$
$M_2 = 10.M$

$\frac{M_1V_1}{M_1} = \frac{M_2V_2}{M_1} = \frac{250mL \times 10.M}{0.050M} = 5.0 \times 10^4 mL = 50.L$

4. 345 mL of a 1.5 M NaCl solution is boiled until the volume of the solution is 250. mL, what is the new molarity of the solution ?

$V_1 = 345mL$
$M_1 = 1.5M$
$V_2 = 250.mL$
$M_2 = ?$

$\frac{M_1V_1}{V_2} = M_2 = \frac{345mL \times 1.5M}{250.mL} = 2.1M$

5. How many liters will be made when 500 mL of a 2.4M KCl solution is diluted to a 1.0 M solution?

$V_1 = 500mL$
$M_1 = 2.4M$
$M_2 = 1.0M$
$V_2 = ?$

$\frac{M_1V_1}{M_2} = V_2 = \frac{500mL \times 2.4M}{1.0M} = 1200$ 1 s.f.

$1200mL = 1000mL = 1L$

**Extra Credit:** $Na(s) + 2\,H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$ Suppose that 10.0 g of sodium reacts completely with 1.00 L of water and the final solution volume is 1.00L. What is the molarity of the NaOH solution formed by this reaction?

See me to ✓