13.5 Solution concentration

- A conc is the amount of solute present in a specified amount of solvent or a specified amount of solution.
- Amount of solute/amount of solvent
  OR
  amount of solute/amount of solution.

13.6 Percentage of solute/ppm/ppb:

1. % by mass = $\dfrac{\text{mass of solute}}{\text{mass of soln.}}$ x 100

because

mass of soln. = mass of solute + mass of solvent

% by mass = $\dfrac{\text{mass of solute}}{\text{mass of solute + mass of solvent}}$ x 100

13.6 Percentage of solute/ppm/ppb:

2. % by volume= $\dfrac{\text{volume of solute}}{\text{volume of solution}}$ x 100

3. Mass-volume %= $\dfrac{\text{mass of solute (g)}}{\text{volume of solution (mL)}}$ x 100

Percentage of solute/ppm/ppb

- Ppm(m/m) = $\dfrac{\text{mass of solute}}{\text{mass of soln}}$ x 10^6
- Ppm (v/v)= $\dfrac{\text{volume of solute}}{\text{volume of solution}}$ x 10^6
- Ppm (m/v)= $\dfrac{\text{mass of solute (g)}}{\text{volume of solution (mL)}}$ x 10^6
- In ppb use 10^9 in the above formulas.

Problems

1) What is the % by mass concentration of sucrose in a solution made by dissolving 5.4 g sucrose in 75.0 g water?

2) How many grams of iodine must be added to 25.0 g of ethyl alcohol to prepare 5.00 % ethyl alcohol solution of iodine?

3) A solution is made by mixing 37.8 mL of methyl alcohol with 56.2 mL water to produce 80.0 mL of solution. What is the concentration of methyl alcohol in the solution expressed as % by volume methyl alcohol?

Problems

4) Vinegar is 5.0 % (m/v) aqueous solution of acetic acid. How much acetic acid in grams is present in one teaspoon , 5.0 mL of vinegar?

5) The concentration of NaF is 32.3 mg of NaF per 20.0 kg of tap water. Express this concentration in ppm and ppb.

Molarity:

Molarity= M= moles of solute/liters of solution.
- 6) Calculate the molarity of 57.2 g of NH4Br dissolved in enough water to give 2.15 L of solution.
- 7) How many grams of H3C6H5O7 are present in 125 mL of 0.400 M citric acid solution?
- 8) How many liters of 0.100 M aqueous solution of NaOH can be prepared from 10.0 g of NaOH?

problems

- 9) A 40.00 % by mass aqueous solution of formic acid (HCHO2) has a density of 1.098 g/mL What is the molarity of the solution?
- 10) A 2.342 M H2SO4 solution has a density of 1.142 g/mL How many grams of solvent are present in 25.0 mL of this solution?
- 11) A 0.900 M acetic acid solution has a density of 1.10 g/mL How many grams of solvent are present in 125 mL of this solution?

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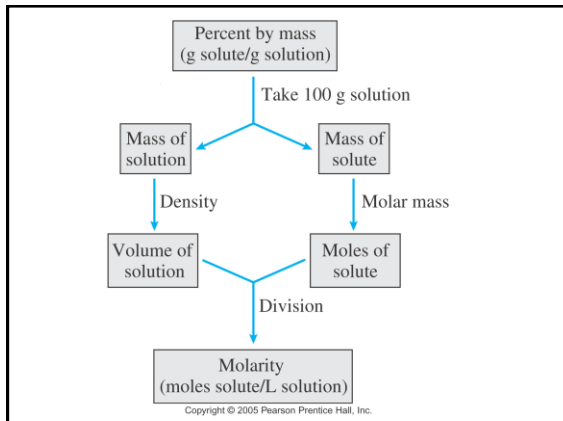
Dilution

- Process in which more solvent is added to a specific volume of solution to lower its concentration.
- M1 x V1 =M2 x V2.


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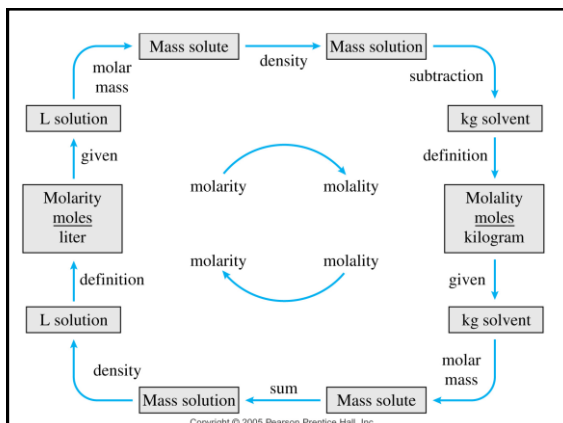
Problems

- 12) What is the molarity of the solution prepared by diluting 65mL of 0.95 M nitric acid solution to a final volume of 135 mL through addition of solvent?
- 13) How much solvent in milliliters must be added to 200.0 mL of 1.25 M NaCl solution to decrease its concentration to 0.770 M?
- 14) What is the molarity of the solution obtained by mixing 50.0 mL of 2.25 M HCl solution with 160.0mL of 1.25 M HCl solution?
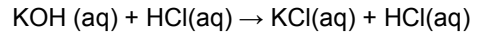
Problems

15) What volume of 0.30 M Cu(OH) 2 solution is needed to react with 500 mL of 0.100 M H3PO4 solution?

3 Cu(OH)2(aq) + 2H3PO4(aq) →

Cu3(PO 4)2 + 6 H2O(l)
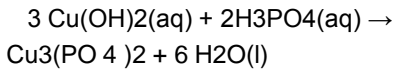
Problems

• 16) How many grams of KCl (molar mass = 74.55 g) will be produced from the reaction of 50.0 mL of 0.300 M KOH with excess HCl?

KOH (aq) + HCl(aq) → KCl(aq) + HCl(aq)

Problems

17) What volume, in liters, of 0.150 $Ba(OH)_2$ solution is needed to react completely with 0.200 L of a 0.300 M HNO3 solution according to the equation

Ba(OH)2 + 2HNO3 → Ba(NO3)2 + 2H2O