

Exercise 11.1a

Solution Concentration

Name: _____

Date: _____ Per: _____

Percentage by Mass/Percentage by Volume

To find either the percent by mass or percent by volume, simply divide the amount of solute by the amount of solution and multiply by 100 to express the fraction as a percentage:

$$\frac{\text{mass or volume solute}}{\text{mass or volume solution}} \times 100 = \% \text{ by mass or volume}$$

To work backward from a percentage to find the mass or volume of solute or total mass or volume of the solution, write the percent concentration as a fraction (percent/100) and use proportions:

Example: Find the mass of solute needed to make 400. g of a 3.50 % solution.

$$\frac{3.5g}{100g} = \frac{x}{400g}$$

DIRECTIONS: Answer the following in the space provided.

- Calculate the percentage by mass of 120. g NaCl dissolved in 200. g water.
- Calculate the mass of solute in a 4.50 % solution with a mass of 1500. g.
- Calculate the mass of 6.00 % solution where the solute has a mass of 60.0 grams.
- Calculate the percentage by mass of 20.0 g KBr dissolved in 380. g water.
- Calculate the mass of solute in a 15.0 % KNO_3 solution with a mass of 3.50 kg.
- Calculate the percentage by volume of 14.0 ml ethanol dissolved in 45.0 ml of water.
- Calculate the percentage by volume of 30.0 ml ethanol dissolved in 600.0 ml of water.
- Calculate the volume of a 12.0 % solution where the solute has a volume of 300. ml.
- Calculate the mass of solute in a 15.0 % solution with a mass of 1000. g.
- What is the percent by volume of ethanol in a solution that contains 35ml of ethanol dissolved in 115ml of water?
- What mass of water must be added to 255g of NaCl to make a 15% by mass aqueous solution?
- A 1500. g sample of bleach solution has a 3.62% percent by mass of the solute sodium hypochlorite (NaOCl).
 - How many grams of NaOCl are in the solution?
 - How many grams of solvent are in the solution?

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Molarity

$$\text{molarity (M)} = \frac{\text{moles solute}}{\text{volume solution (L)}}$$

Molality

$$\text{molality (m)} = \frac{\text{moles solute}}{\text{kilogram solvent (kg)}}$$

To work backward from a molarity (or molality) to find the number of moles of solute or volume of solution, write the molarity as a ratio (molarity/1 L) and use proportions:

Example: Find the moles of solute needed to make 4.00 L of a 3.50 M solution.

$$\frac{3.50 \text{ mol}}{1 \text{ L}} = \frac{x}{4.00 \text{ L}}$$

DIRECTIONS: Answer the following in the space provided.

- What is the molarity of an aqueous solution containing 40.0 g of glucose in 1.50 L of solution?
- What is the molarity of a bleach solution containing 9.50 g of NaOCl per liter of bleach?
- Calculate the molarity of 1.60 L of a solution containing 1.55 g of dissolved KBr.
- Calculate the molality of 4.00 mol of NaCl dissolved in 2000. g H₂O.
- Calculate the mass of solvent needed to make a 3.40 m solution using 1.50 moles of solute.
- Calculate the mass of KCl needed to make a 2.00 m solution using 4.50 kg of solvent.
- Calculate the molality of 117 g of NaCl in 1200. mL of water.
- Calculate the molarity of 316 g of MgBr₂ in 859 mL of solution.
- Calculate the molarity of 4.67 g of Ca(C₂H₃O₂)₂ in 465 mL of solution.
- Calculate the molality of 199 g of NiBr₂ in 599 g of water.
- Calculate the molality of 9.87 x 10⁻³ g of AgClO₂ in 0.333 kg of water.
- Calculate the moles of solute needed to make a 3.50 m solution using 4.00 kg of solvent.

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Mole Fraction (X)

To find the mole fraction divide the number of moles of solute by the total moles of solution:

$$\frac{\text{moles solute}}{\text{moles solution}} = \text{mole fraction}$$

Dilutions

To calculate molarity or volume when diluting a stock solution, the formula used is:

$$M_1V_1 = M_2V_2$$

1. Calculate the mole fraction of 80.0 g NaOH in 72.1 g H₂O.
2. Calculate the mole fraction of 4.00 moles of Mg(OH)₂ dissolved in 16.0 moles of H₂O.
3. If you dilute 20.0 ml of a 3.50 M solution to make 100. ml of solution, what is the molarity of the dilute solution?
4. What volume of a 3.00 M KI stock solution would you use to make 0.300 L of a 1.25 M KI solution?
5. 560 mL of water is added to 340 mL of a 0.50 M NaBr solution, what will the new concentration be?
6. 250 mL of 0.10 M lithium acetate solution is diluted to a volume of 750 mL, what will the concentration of this solution be?
7. 750. mL of 0.500 M sodium chloride solution is left uncovered on a windowsill and 150. mL of the solvent evaporates, what will the new concentration of the sodium chloride solution be?
 - a. To what volume would water need to be added to the evaporated solution above to create a solution with a concentration of 0.25 M?