

## Chemical Calculations – Mixed Problems- 2026

### Percent Solutions

1. If 10.0 mL of acetic acid ( $\text{HC}_2\text{H}_3\text{O}_2$ ) is diluted with water to a total solution volume of 200. mL, what is the percent by volume of acetic acid in solution?
2. A 75.0 gram sample of a solution contains 18.7 grams of potassium iodide. What is the mass percent of this solution?
3. A 900. mL solution is known to contain 150. mL of ethanol. Calculate the volume percent of this solution.
4. How many grams of magnesium sulfate are required to make 250. g of a 1.6% solution?
5. A solution contains 2.7 grams of  $\text{CuSO}_4$  in 75 g of solution. What is the percent mass of the solution?

### Mole Fractions

1. If 42.0 grams of calcium chloride is dissolved in 600. grams of water, what is the mole fraction of calcium chloride in water?

2. If 600.0 grams of potassium iodide is dissolved in 1300. grams of water, what is the mole fraction of potassium iodide in water?
3. If 550.0 grams of potassium nitrate are dissolved in 750. grams of water, what is the mole fraction of potassium nitrate in water?
4. If 70.0 grams of HCl are added to 200. grams of water, what is the mole fraction of HCl in water?

### **Molality**

1. A saline solution contains 12.0 moles of NaCl in 2.00 kg of water. What is its molality?
2. How many moles of calcium chloride are necessary to dissolve in 250. grams of water to make a 2.0m solution?

3. How many kilograms of solvent would be needed if you use 5.00 moles of sodium chloride to produce a  $6.00 \text{ mol dm}^{-3}$  solution?
4. How many grams of table sugar (sucrose:  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) should be dissolved in 3.50 kilograms of water to make a  $1.15 \text{ mol kg}^{-1}$  solution?

### Dilutions

1. How would you prepare 100. mL of 0.40 M  $\text{MgSO}_4$  from a stock solution of 2.0 M  $\text{MgSO}_4$ ?
2. Describe how to prepare 500. mL of 0.250 M NaOH solution starting from 6.00 M NaOH solution.
3. If 650 mL of water is added to 250. mL of 0.20 M KBr what is the new molarity?
4. How much water should be added to 400. mL of a 2.50 M sodium chloride solution to dilute it to a 1.00 M solution?

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## Mixed Problems

1. Calculate the molality of a 20.0 percent by weight aqueous solution of  $\text{NH}_4\text{Cl}$ .
2. What is the mole fraction of ethanol,  $\text{C}_2\text{H}_5\text{OH}$ , in an aqueous solution in which the ethanol concentration is  $4.6 \text{ mol dm}^{-3}$ ?
3. A solution of toluene (molecular weight 92.1) in benzene (molecular weight 78.1) is prepared. The mole fraction of toluene in the solution is 0.100. What is the molality of the solution?
4. A bottle of wine contains 12.5% ethanol by volume. The density of ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) is  $0.789 \text{ g/cm}^3$ . Calculate the concentration of ethanol in wine in terms of molality, and mass percent.  
  
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5. An aqueous antifreeze solution is 40.0% ethylene glycol ( $\text{C}_2\text{H}_6\text{O}_2$ ) by mass. The density of the solution is  $1.05 \text{ g/cm}^3$ . Calculate the molality, molarity and mole fraction of the ethylene glycol.
6. A solution is prepared by mixing 25.0 g ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ) with 100.0 g water to give a final volume of 120 mL. Calculate the molarity, mass percent, mole fraction and molality of ethanol in this solution