# Study guide on mole fraction assignment

Mole Fraction Return to Solutions Menu The mole fraction is: moles of target substance divided by total moles involved The symbol for the mole fraction is the lower-case Greek letter chi, X. You will often see it with a subscript: xsolute is an example. Example #1 : 0. 100 mole of NaCl is dissolved into 100. 0 grams of pure H20. What is the mole fraction of NaCl? Solution: 100. 0 g / 18. 0 g rnoF1 = 5. 56 mol of H20 Add that to the 0. 100 mol of NaCl = 5. 56 + 0. 100 = 5. 66 mol total Mole fraction of NaCl = 0. 100 mol / 5. 66 mol = 0. 018 What is the mole fraction of the H20? 5. 56 mol / 5. 6 mol = 0. 82 By the way, another way to fgure out the last substance is 1. 00 minus (the total of all other mole fractions). In this case 1. 00 – 0. 018 = 0. 982. Remember that all the mole fractons in the solution should total up to one. Notice that the mole fraction has no units on it and is written as a decimal value. Do not change it to percent. Note of caution: you could see the term “ mole percent. ” It is simply the mole fraction mltiplied by 100. For example, in the problem Just below, the mole fraction of cinnamic acid is 0. 2885. Its mole percent would be 28. 85%. The ChemTeam advises gainst the use of the tem “ mole percent. However, do what your teacher desires you to do. Example #2: A solution is prepared by mixing 25. 0 g of water, H20, and 25. 0 gof ethanol, C2H50H. Determine the mole fractions of each substance. Solution: 1) Determine the moles of each substance: H20 25. 0 g / 18. 0 gmol = 1. 34 mol C2H50H 25. 0 g / 46. 07 vmol = 0. 543 mol 2) Determine mole fractions: H20 1. 34 mol / (1. 34 mol + 0. 543 mol) = 0. 71 C2H50H 0. 543 mol / (1. 34 mol + 0. 543 mol) = 0. 29 Example #3: A solution contains 10. 0 g pentane, 10. 0 g hexane and 10. 0 g benzene. What is the mole fraction of hexane?

Solution: 1) You need to determine the moles of pentane, hexane and benzene: to do this, you need the molecular weights. Here are the formulas: pentane: C5H12 hexane: C6H14 benzene: C6H6 2) When you have the moles of each, add them together. 3) Then, divide the moles of hexane by the total. Calculate the mole fractions of sugar and water. Solution: 1) Molality is moles solute / kg of solvent. Therefore we know our solution is: 1. 62 mol Cl 21-422011 1. 00 kg = 1000 g of water 2) Calculate the moles of water present: 1000 g / 18. 0152 gmol = 55. 50868 mol 3) Determine the mole fraction of the sugar: 1. 62 mol / (1. 2 mol + 55. 0868 mol) = 0. 028357 = 0. 0284 (to three sf) 4) you can calculate the mole fraction of the water by subtraction. Example #5: How many grams of water must be used to dissolve 100. 0 grams of sucrose (Cl 2H22011) to prepare a 0. 020 mole fraction of sucrose in the solution? Solution: 1) Determine moles of sucrose: 100. 0 g / 342. 2948 gmol = 0. 292145835 mol 2) Determine moles of water required to make the solution 0. 020 mole fraction of sucrose: 0. 020 = 0. 292 / (0. 292 + x) (0. 020) (0. 292 + X) = 0. 292 0. 00584 + 0. 02X = 0. 292 = 0. 28616 x = 14. 308 mol of H20 Comment: you can also do this: 0. 292 to 0. 2 as x to 0. 8 3) Determine grams of water: 14. 308 mol x 18. 015 gmol = 258. 0 g Example #6: Surprisingly, water (in the form of ice) is slightly soluble in liquid nitrogen. At -196 oc, (the boiling point of liquid nitrogen) the mole fraction of water in a saturated solution is 1. 00 x 10-5. Compute the mass of water that can dissolve in 1. 00 kg of boiling liquid nitrogen. Solution: 1) Use the definition of mole fraction to set up the following: xwater = moles water / (moles water + moles nitrogen) 1. 00 X 10-5 = x / (X + 71 . 3944041) I’m going to carry some guard digits until the end of the calculation. 2) Some algebra: 1 .

OOX 7. 139440411 x 10-4 = x 0. 99999x= 7. 139440411 x 10-4 x = 7. 139511806 x 10-4 mol of H20 3) Calculate grams of water from moles of water: 7. 139511806 x 10-4 mol x 18. 0152 gmol = 1. 2862 x 10-2 g 1. 29 x 10-2 g (to three sf) Example #7: What is the mole fraction of cinnamic acid in a mixture that is 50. 0% weight urea in cinnamic acid (urea = 60. 06 g/mol; cinnamic acid = 148. 16 g/mol) 50. 0 g is cinnamic 2) Convert grams to moles: urea: 50. 0 g / 60. 06 gmol = 0. 8325 mol cinnamic acid: 50. 0 g/ 148. 16 g/mol = 0. 3375 mol 3) Determine mole fraction of cinnamic acid: 0. 3375 mol / 1. 1700 mol = 0. 2885