# Exercise Chapter 4
# The Properties of Mixtures

by
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# Self Test 1

- Calculate the molality of a sulfuric acid containing 24.4 g of sulfuric acid in 198 g of water. The molar mass sulfuric acid is 98.08 g/mol.
  - Ans: 1.26 m

# Self Test 2

- Determine the mole fraction of glycine molecules in 0.14 *m* $NH_2CH_2COOH$ (aq).
  - Ans: $X_{gly} = 2.52.x\ 10^{-3}$

# Self Test 3

- What is the total volume of a mixture of 50 g of ethanol and 50 g of water at 25$^{o}$C?

- Given $M_{water}$ = 18g/mol
  $M_{ethanol}$ = 46.07g/mol.

- (Refer to figure 6.1 in textbook)

- Ans = 110cm$^{3}$

# Self Test 4

Use figure 6.1 to calculate the mass density of a mixture of 20 g of water and 100 g of ethanol.

Ans = 0.84 g $cm^{-3}$

# Self Test 5

At $25^{O}C$, the density of a 50% by mass ethanol/water solution is $0.914 gcm^{-3}$. Given that the partial molar volume of water in the solution is $17.4 cm^3 mol^{-1}$, what is the partial molar volume of the ethanol?

Ans = $56.4 cm^3 mol^{-1}$

# Self Test 6

$N_2$ and $O_2$ are mixed to form air at 298.15K. Mole fraction of $N_2$ and $O_2$ are 0.78 and 0.22, respectively. Compute the molar Gibbs of energy mixing. Then, find the molar entropy of mixing. Thus, evaluate whether the mixing was spontaneous or not.

Ans = -1.2kJ/mol, 4.38 J/mol.K, Spontaneous mixing because $\Delta G < 0$

# Self Test 7

- Suppose now that argon is added to the mixture to bring the composition closer to real air with mole fraction 0.78, 0.21, 0.0096, respectively. What is the new molar Gibbs energy and entropy? Is the mixing spontaneous?

  Ans: -1.4 kJ/mol, 4.71 J/mol.K, spontaneous.

# Self Test 8

- A solution is prepared by dissolving 1.5 mol $C_{10}H_8$ in 1 kg of benzene. The vapour pressure of pure benzene is 12.6 kPa at 25$^{o}$C. What is the partial vapour pressure of benzene in solution?

  Ans: 11.3 kPa

# Authors Information

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