Answer on Question #43843 - Chemistry - Other

Question:

The density of a 56.0% by weight aqueous solution of 1-propanol is 0.8975 g/cm³. What is the mole fraction of the compound?

Solution:

Let us consider 1 cm³ of the solution. Mass of 1 cm³ of the solution m_s = 0.8975 g.
Mass of 1-propanol in this amount of the solution:
$m_p = m_s \cdot \omega_p = 0.8975 \cdot 0.560 = 0.5026$ g
Mass of water:
$m_w = m_s - m_p = 0.8975 - 0.5026 = 0.3949$ g
Number of moles of 1-propanol:
$n_p = m_p / M_p = 0.5026 / 60.095 = 0.0084$ mole
where M_p – molar weight of 1-propanol.
Number of moles of water:
$n_w = m_w / M_w = 0.3949 / 18.015 = 0.0219$ mole
where M_w – molar weight of water.
Mole fraction of 1-propanol:
$x_p = n_p / n_{total} = n_p / (n_p + n_w) = 0.0084/(0.0084+0.0219) = 0.2772$

Answer: 0.2772