Question #73565, Chemistry / Physical Chemistry / Completed

The vapor pressure of pure water at 50C is 0.1217 atm. The vapor pressure of a solution containing 90g of a non-volatile organic compound in 1000g of water at the same temperature is 0.1184 atm. Calculate the molar mass of the organic compound by assuming the solution is dilute.

Solution

$\Delta p = 0.1217 \text{ atm} - 0.1184 \text{ atm} = 0.0033 \text{ atm}$

$\Delta p / p = n_x / n_x + n_{water}$

So $n_x / n_x + n_{water} = \Delta p / p = 0.0033 \text{ atm} / 0.1217 \text{ atm} = 0.027$

$n_{water} = 1000 \text{ g} / 18 \text{ g/mol} = 55.56 \text{ mol}$

$n_x \approx 1.55 \text{ mol}$

$n_x = m/M$; $M_x = m / n_x = 90 \text{ g} / 1.55 \text{ mol} \approx 58.12 \text{ g/mol}$.

Answer: 58.12 g/mol.