

Answer on Question #71530 – Chemistry – General Chemistry

- a) Calculate the vapour pressure of a 1.0% by mass aqueous ethylene glycol, $C_2H_4(OH)_2$ solution at $0^\circ C$.
- b) What is the vapour pressure of 0.10 M NaOH (aq) at $80.0^\circ C$?

Solution:

a) $p^0 (H_2O)$ at $0^\circ C = 4.6$ torr

1.0 % by mass means 1.0 g of ethylene glycol in 100 g of solution

$$m(H_2O) = 100 - 1.0 = 99.0 \text{ g}$$

$$n(H_2O) = 99.0 \text{ g} / 18.02 \text{ g/mol} = 5.49 \text{ mol}$$

$$n(C_2H_4(OH)_2) = 1.0 \text{ g} / 62.07 \text{ g/mol} = 0.016 \text{ mol}$$

$$\chi(H_2O) = 5.49 / (5.49 + 0.016) = 0.997$$

$$p = p^0 \times \chi \text{ (Raoult's law)}$$

$$p = 4.6 \times 0.997 = 4.586 \text{ torr}$$

b) $p^0 (H_2O)$ at $80.0^\circ C = 355.1$ torr

0.1 mol NaOH in 1000 mL(g) of solution

$$m(NaOH) = 0.1 \text{ mol} \times 40 \text{ g/mol} = 4 \text{ g}$$

$$m(H_2O) = 1000 - 4 = 996.0 \text{ g}$$

$$n(H_2O) = 996.0 \text{ g} / 18.02 \text{ g/mol} = 55.27 \text{ mol}$$

$$\chi(H_2O) = 55.27 / (55.27 + 0.1) = 0.998$$

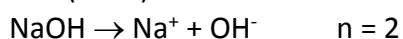
$$p = p^0 \times \chi = 355.1 \times 0.998 = 354.5 \text{ torr}$$

For electrolytes

$$\Delta p_{\text{experim}} = i \times \Delta p_{\text{teoret}} = 2 \times 0.6 = 1.2 \text{ torr}$$

$$\Delta p_{\text{teoret}} = 355.1 - 354.5 = 0.6 \text{ torr}$$

$$i = \alpha(n - 1) + 1 = 1 \times 1 + 1 = 2$$



$$p = 355.1 - 1.2 = 353.9 \text{ torr}$$

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