

# **Raoult's Law**

## **Worksheet**

6 Practice Problems

Organic Chemistry Tutor

1. 30.0 g of glucose is dissolved in 500. mL of water at 25° C. What is the vapor pressure of the solution? (The vapor pressure of water is 23.8 torr at 25° C and the density of water is 1g/mL)

3. How many grams of glucose must be added to 250. g of water at 40° C to create a solution with a vapor pressure of 54.0 torr? (The vapor pressure of water at 40° C is 55.3 torr)

2. 40.0 g of  $\text{CaCl}_2$  is dissolved in 600. mL of water at 25° C. What is the vapor pressure of the solution? (The vapor pressure of water is 23.8 torr at 25° C and the density of water is 1g/mL)

4. 60.0 g of a non-dissociating and non-volatile solute was dissolved in 300. g of water at 29° C. The vapor pressure of the solution was observed to be 28.5 torr. What is the molar mass of the solute? (The vapor pressure of water at 29° C is 30 torr)

5. 30 mL of Heptane ( $C_7H_{16}$ ) is mixed with 50 mL of Toluene ( $C_7H_8$ ). The densities of Heptane and Toluene are 0.68 g/mL and 0.87 g/mL respectively. The vapor pressure of Heptane and Toluene at 20°C are 40 torr and 21 torr respectively. (a) What is the mole fraction of each substance in the solution? (b) What is the partial pressure of each substance above the solution? (c) What is the vapor pressure of the solution? (d) What is the mole fraction of each substance in the vapor phase?

6. 2 mol of substance A mixes with 3 moles of substance B. The vapor pressures of substance A and B are 500 torr and 200 torr respectively. The vapor pressure of the solution is observed to be 294 torr. Is this an ideal solution or is there a deviation from Raoult's law? If so, is it a positive or negative deviation?

## Answers:

1. 23.7 torr
2. 23.1 torr
3. 60.1 g
4. 68.5 g/mol

5a.  $X(\text{Heptane}) = 0.3013$ ,  $X(\text{Toluene}) = 0.6987$

5b.  $P(\text{C}_7\text{H}_{16}) = 12.05$  torr,  $P(\text{C}_7\text{H}_8) = 14.67$

5c.  $P(\text{solution}) = 26.72$  torr

5d.  $X(\text{C}_7\text{H}_{16}) = 0.451$ ,  $X(\text{C}_7\text{H}_8) = 0.549$

6a.  $P(\text{observed solution}) = 294$  torr <  $P(\text{ideal solution}) = 320$  torr.

The solution is not ideal. There is negative deviation since the observed vapor pressure of the solution is less than the vapor pressure of the ideal solution.