Answer to Question #62534, Chemistry / Physical Chemistry

When 5.15×10^{-2} kg of an organic compound was dissolved in 3.50 kg of chloroform, the boiling point of chloroform was raised by 0.320 K. calculate the molar mass of the organic compound. molar elevation constant for chloroform is 3.90 K kg mol.

Answer:
Increase of the boiling point of infinitely dilute solutions of non-volatile substances is not dependent on the nature of the solute and directly proportional to the molal concentration of the solution:

$$\Delta T = E_k m$$

$$m = \frac{n\ (mol)}{m_{solv}\ (kg)} = \frac{m}{M_r \times m_{solv}}$$

$$\Delta T = E_k \frac{m}{M_r \times m_{solv}}$$

$$M_r = \frac{E_k \times m}{\Delta T \times m_{solv}}$$

$$M_r = \frac{3.90\ K \times \frac{kg}{mol} \times 5.15 \times 10^{-2}\ kg}{0.32\ K \times 3.5\ kg} = 0.180\ \frac{kg}{mol} = \mathbf{180\ \frac{g}{mol}}$$