

## Answer Question #56768 - Chemistry - General Chemistry

### Question:

9. A 0.265 mg sample of an enzyme dissolved in 1.00 ml of an aqueous solution at 37°C has an osmotic pressure of  $2.26 \times 10^{-3}$  atm. What is the molar mass of the enzyme?

### Solution:

Van't Hoff law for the osmotic pressure establishes:

$$\pi = cRT,$$

where  $c$  is the molar concentration,  $R$  is the gas constant ( $0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$ ) and  $T$  is the temperature of the system.

Then, we can deduce the molar concentration of the enzyme from the given data (remember that 37 °C is  $(37+273.15)=310.15 \text{ K}$ ):

$$c = \frac{\pi}{RT} = \frac{2.26 \cdot 10^{-3}(\text{atm})}{0.08206 (\text{L atm mol}^{-1}\text{K}^{-1}) \cdot 310.15 (\text{K})} = 8.88 \cdot 10^{-5} \text{mol L}^{-1}$$

Then, molar mass of the enzyme can be deduced as:

$$c = \frac{n}{V} = \frac{m}{MV}, \quad M = \frac{m}{cV} = \frac{0.265 \cdot 10^{-3}(\text{g})}{8.88 \cdot 10^{-5}(\text{mol L}^{-1}) \cdot 10^{-3}(\text{L})} = 2984 \text{ g mol}^{-1}$$

**Answer:** 2984 g mol<sup>-1</sup>