

### 32538, Chemistry, Inorganic Chemistry

five gram of formamide is dissolved in 100 gram of water in 30 centigrade of temperature. vapour pressure of this solution is 31.2 mmHg. if the vapour pressure of pure water in this temperature is 31.8 mmHg. find their molecular mass.

#### Solution:

Raoult's law states that when a solute is added to a solvent, the vapor pressure of the solvent decreases in proportion to the concentration of solute particles:

$$\frac{P_0 - P}{P_0} = \frac{\text{moles of solute}}{\text{moles of solute} + \text{moles of solvent}}$$

where  $P_0$  - the vapor pressure of solvent  $P_0 = 31.8$  mm Hg.,  $P$  - the vapor pressure of solution  $P = 31.2$  mm Hg.

The number of moles of solvent is found by first determining the weight of 1 mole of water.

1 mole of  $\text{H}_2\text{O} = 18$  grams.

Since we have 100 grams of  $\text{H}_2\text{O}$ , we use a conversion factor to find the number of moles of  $\text{H}_2\text{O}$ :

$$100 \frac{1}{18} = 5.55 \text{ grams.}$$

We can use the numbers of moles of solute:

$$\frac{31.8 - 31.2}{31.8} = \frac{\text{moles of solute}}{\text{moles of solute} + 5.55}$$

After calculation we obtain that the number of moles of solute is 0.106.

We can now use the molar mass of solute, since we know all the needed values:

The mass of solute = 5 grams;

The number of moles of solute = 0.106 moles

$$\text{Molar mass of solute} = \frac{5}{0.106} = 47.17 \text{ g/mole.}$$

The molecular mass of solute is 47.17 amu (atomic mass unit).

#### Answer:

The molecular mass of solute is 47.17 amu.