Colligative properties and determination of molar mass

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In other words, colligative properties are a set of property of the solution that can be reasonably approximate on the assumption that the solution is ideal. They are considered only properties resulting from non-volatile solute dissolution in a volatile liquid solvent are considered. [2] They are essentially solvent properties that have changed from the presence of the solute. Sulute particles move some solvent molecules into the liquid phase and thus reduce the solvent concentration, so that colligative properties are independent of the sulute nature. The word colligative comes from the meaning of the Latin Colligatus linked together. [3] This indicates that all colligative properties have a common feature, i.e. that they are related only to the number of sister molecules related to the number of solvent molecules and not to the nature of the solute. [4] Colligative properties include: relative lowering of steam pressure (Raoult law) Raoult point of boiling of freezing point depression Osmotic pressure for a given solvent solvent mass ratio, all properties in colligious are inversely proportional to the solute molar mass. The measurement of colligative properties for a diluted solution of a non-ionized solute as urea or glucose in water or another solvent can lead to relative molar mass determinations, both for small molecules and for polymers that cannot be studied by other means. Alternatively, ionized solute measurements can lead to an estimate of the percentage of dissociation taking place. Colligative properties are mainly designed for diluted solutions, whose behavior can be approximated as that of an ideal solution. In fact, all the properties listed above are coliganica only in the diluted limit: at higher concentrations, freezing point depression, elevation ofboiling, elevation of vapour pressure or depression and osmotic pressure depends on all chemical nature of the solvent and the solute. Relative lowering of the vapour pressure The vapour pressure of a liquid is the vapour pressure which is in equilibrium with that which The steam pressure of a solvent is lowered when a non-volatile solute is dissolved in it to form a solution. For an ideal solution, the pressure of the balance vapour is given by the law of Raoult as p = p A ▲ x A + p ▲ x B + ▸ , {\displaystyle p=p_{\rm {A}}^{\star }{A}}\rm {Arm} The pressure of the steam that lowers compared to the pure solvent is Δ p = p A ✖ (1 − x A) = p A ▲ x B {\displaystyle \Delta p=p_{\rm {A}}^{\star }-p=p_{\rm {A}}^{\star }(1-x_{\rm {A}})=p_{\rm {A}}{A}}^}{\rm}{\rm {A}} If the solute dissociates in solution, the number of solute molecules is increased by van 't Hoff factor i {\displaystyle i} , which represents the true number of solute particles for each formula unit. For example, the strong electrolyte MgCl2 dissociates in an ion Mg2+ and two ions Cl−, so that if the iionization is complete, i = 3 and Δ p = p A ✖ B {\displaystyle \Delta p=p_{\rm {A}}^{\star }x_{\rm {B}}} , where x B {\displaystyle x molesso The measured colligative properties show that they are a little less than 3 because of the ion association. boiling point and freezing point Solute Addition to form a solution stabilizes the solvent in the liquid phase, and lowers the chemical solvent potential so that solvent molecules have less tendency to move towards gas or solid phases. As a result, liquid solutions slightly higher than the solvent boiling point at a certain pressure become stable, which means that the boiling point increases. Similarly, liquid solutions slightly below the freezing point of the solvent become stable meaning that the freezing point decreases. Both the elevation of the boiling point and the freezing point depression are proportional to the lowering of the steam pressure in a diluted solution. These properties are collective in systems where the solute is essentially confined to the liquid phase. The elevation of the boiling point (as a lowering of the steam pressure) is striking for non-volatile soluts where the presence of the solute in the gas phase is negligible. The depression of the freezing point is colligating for most soluts since very few solutes are pleasantly dissolved in solid solvents. Extraction of the boiling point (ebullioscopy) Main article: Extraction of the boiling point The boiling point of a liquid at aexternal pressure is the temperature (T b {\displaystyle T_{\rm {b}}}) at which the vapour pressure of the liquid equals the external pressure. The The boiling point is the pressure boiling point equal to 1 atm. The boiling point of a pure solvent has increased with the addition of a non-volatile solute and the elevation can be measured by hebullioscopy. It is found that Î "t b = t b, solution â 't b, pure solvent = I â