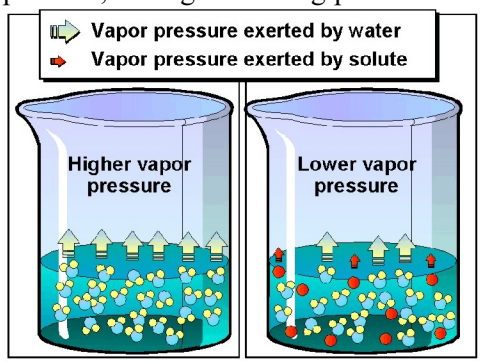
Understanding Colligative Properties

After a winter storm, people spread salt on the walks to help melt the ice. Salt reduces the freezing point of water. Actually, any soluble solute reduces the freezing point of water by interfering with crystallization. In this way, antifreeze keeps the water from freezing in an automobile radiator. This phenomenon is called **freezing point depression**. Antifreeze is left in the radiator during the summer. It also prevents the radiator from boiling over by raising the boiling point. Dissolved solute reduces the vapor pressure, raising the boiling point. This is called **boiling point elevation**.



The amount the freezing point is depressed or the boiling point is raised depends on the concentration of dissolved solute. The higher the concentration of dissolved solute is, the greater the effect on the boiling point or the freezing point is. Only the concentration of the particles of dissolved solute is important. The nature of the solute is not. A mole of dissolved sugar has exactly the same effect on the freezing point and boiling point of 1,000 g of water as a mole of antifreeze because it contains the same number of particles. Ionic compounds dissociate producing more particles per mole. One mole of dissolved sodium chloride, for example, produces one mole of aqueous sodium ions and one mole of aqueous chloride ions for a total of two moles [$NaCl(s) \rightarrow Na^+(aq) + Cl^-(aq)$]. One mole of dissolved sodium chloride, therefore, has twice the effect on the boiling and freezing points of 1,000 g of water as one mole of dissolved sugar. It is not the nature of the solute that matters, but only the concentration of dissolved particles that determines how large the change in freezing point or boiling point will be. Properties of a solution, such as this, which are dependent only on the number of particles in solution, and not on their nature are called **colligative properties.**

Dad misinterprets freezing point depression.

Answer the questions below based on your reading and on your knowledge of chemistry.

1. Why are boiling point elevation and freezing point depression considered colligative properties? _____

2. Why is salt put on icy roads and sidewalks in the winter? _____

3. How will the boiling points of pure water and sea water compare? Why? _____

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