Freezing Point Depression Quiz Answer Key PDF

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What are the characteristics of an ideal solution in the context of freezing point depression? (Select all that apply)

A. No change in volume upon mixing ✓

B. No heat exchange upon mixing ✓

C. Follows Raoult's Law perfectly ✓

D. Has strong intermolecular forces

What is the primary factor that freezing point depression depends on?

A. Type of solute

B. Number of solute particles ✓

C. Temperature of the solvent

D. Volume of the solvent

What is the role of antifreeze in a car radiator?

A. To increase the boiling point

B. To lower the freezing point ✓

C. To increase the viscosity

D. To reduce the density

Which property of a solvent is used in the formula for freezing point depression?

A. Density

B. Viscosity

C. Freezing point depression constant (Kf) ✓

D. Boiling point

Explain the steps you would take to calculate the freezing point of a solution given the mass of solute, mass of solvent, and the Kf value.

1. Calculate the number of moles of solute by dividing the mass of the solute by its molar mass. 2. Calculate the mass of the solvent in kilograms. 3. Determine the molality (m) of the solution by dividing the moles of solute by the mass of solvent in kg. 4. Use the freezing point depression formula: ΔTf = Kf * m, where ΔTf is the change in freezing point. 5. Subtract ΔTf from the pure solvent's freezing point to find the new freezing point of the solution.

Which of the following are examples of colligative properties? (Select all that apply)

A. Freezing point depression ✓

B. Boiling point elevation ✓

C. Osmotic pressure ✓

D. Surface tension

Why is salt used on icy roads? (Select all that apply)

A. It raises the freezing point of water

B. It lowers the freezing point of water ✓

C. It prevents ice formation ✓

D. It increases the density of water

Describe how the van't Hoff factor (i) affects the freezing point depression of a solution.

The van't Hoff factor (i) affects the freezing point depression of a solution by determining the number of solute particles in the solution; specifically, the freezing point depression is proportional to the van't Hoff factor, meaning that as i increases, the freezing point depression also increases.

Which of the following is a colligative property?

A. Boiling point

B. Viscosity

C. Freezing point depression ✓

D. Density

Explain why the freezing point of a solution is lower than that of the pure solvent.

The freezing point of a solution is lower than that of the pure solvent because the solute particles interfere with the ability of the solvent molecules to form a solid lattice structure, thus lowering the temperature at which freezing occurs.

How would you experimentally determine the freezing point depression constant (Kf) for a new solvent?

1. Measure the freezing point of the pure solvent (Tf,solvent). 2. Prepare a solution with a known molality (m) of a non-volatile solute. 3. Measure the freezing point of the solution (Tf,solution). 4. Calculate the freezing point depression (ΔTf = Tf,solvent - Tf,solution). 5. Use the formula Kf = ΔTf / m to find the freezing point depression constant.

Which of the following solutions will have a higher freezing point depression? (Select all that apply)

A. 1 molal NaCl solution ✓

B. 1 molal glucose solution

C. 1 molal CaCl2 solution ✓

D. 1 molal urea solution

What is the effect of adding more solute to a solution on its freezing point?

A. Increases the freezing point

B. Decreases the freezing point ✓

C. No effect on the freezing point

D. Freezing point becomes zero

What is the unit of molality?

A. Moles per liter

B. Moles per kilogram ✓

C. Grams per liter

D. Grams per kilogram

What does the van't Hoff factor (i) represent?

A. The boiling point elevation

B. The number of particles a solute dissociates into ✓

C. The freezing point of the solvent

D. The molality of the solution

Which of the following substances would cause the greatest freezing point depression in water?

A. Glucose
B. Sodium chloride ✓
C. Urea
D. Ethanol

Discuss the importance of colligative properties in real-world applications, providing at least two examples.

Colligative properties are important in real-world applications such as: 1) The use of antifreeze in vehicles, where the addition of ethylene glycol lowers the freezing point of water, preventing engine freeze in cold temperatures. 2) The preservation of food, where salt or sugar is added to lower the freezing point of water in food, inhibiting microbial growth and extending shelf life.

Compare and contrast the effects of ionic and non-ionic solutes on freezing point depression.

Ionic solutes lead to a greater freezing point depression than non-ionic solutes because they dissociate into multiple ions, increasing the number of solute particles in solution.

Which factors influence the extent of freezing point depression? (Select all that apply)

A. Type of solvent ✓
B. Amount of solute ✓
C. Temperature of the environment
D. Identity of solute particles

In the formula ΔTf = i · Kf · m, what does Kf depend on? (Select all that apply)

A. Nature of the solvent ✓
B. Temperature
C. Type of solute
D. Pressure