Estimating Freezing in a Model Brine Bath

Base your answers on the information provided and your knowledge of chemistry. Use the 2025 Chemistry Reference Tables as needed.

A class models solutions used in a cold test bath. Each trial starts with the same mass of water. Salt A releases two dissolved ions per formula unit, and salt B releases three. The model assumes complete separation into ions. In this concentration range it treats the decrease in freezing temperature as proportional to the total number of dissolved particles per mass of water.

Bath	**Amount of salt added (mol)**	**Measured freezing temperature (°C)**
Pure water	0.00	0.0
Salt A	0.10	−2.0
Salt B	0.10	−3.0

1 Calculate the amount in moles of dissolved ions in each salt bath. Show how the formula unit information enters your calculation. [1]

Answer and work

2 Which explanation fits the greater decrease in the freezing temperature for salt B?

(1) Salt B is added in more moles of formula units.

(2) Salt B produces more dissolved particles for the same water mass.

(3) Salt B produces fewer dissolved particles for the same water mass.

(4) Salt B raises the freezing temperature.

Students add enough pure water to the salt B bath to double its water mass. The amount of dissolved salt stays the same.

3 Use the model to predict the freezing temperature of the diluted bath. Show how the added water changes the decrease in temperature. [1]

Answer and work

4 A student says the undiluted salt B bath and diluted salt B bath should have the same freezing temperature because both contain the same amount of salt. Explain why the model predicts different readings. [1]

Answer and work