Tracking Solute When Ice Forms in a Model

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

A class uses a model in which some water freezes out of a solution that contains a dissolved marker. The ice contains only water. All of the marker stays dissolved in the remaining liquid. The model uses the liquid volume when reporting concentration.

Stage	**Liquid volume (L)**	**Marker mass in liquid (g)**
Before freezing	0.40	2.0
After some ice forms	0.25	2.0

1 Calculate the marker concentration at both stages. Show how you used the liquid volumes. [1]

Answer and work

2 Which model change explains the concentration difference?

(1) The liquid gains marker as the ice forms.

(2) The liquid loses water to the ice and keeps the marker.

(3) The marker changes into pure water.

(4) The marker and water both leave the liquid in the same proportion.

The class saves all the ice and melts it back into the remaining liquid. The liquid volume returns to 0.40 L and no marker is lost.

3 Predict how the final concentration compares with the starting concentration. Explain. [1]

Answer and work

4 Suppose a small amount of marker actually enters the ice. Would using 2.0 g for the remaining liquid after freezing make its calculated concentration too high or too low? Explain. [1]

Answer and work