Comparing One Large Wash With Two Small Washes

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

A display holds 12 mg of marker dissolved in a two-liter liquid layer. A wash liquid forms a separate layer. After each contact reaches equilibrium, the two layers have the same marker concentration in this model. All marker remains dissolved and the layer volumes stay fixed. The class removes the whole wash layer and keeps the original two-liter layer. Each fresh wash starts without marker.

Plan	First wash volume (L)	Second fresh wash volume (L)
P	2	0
Q	1	1

1 In P, what concentration is in each layer just before the wash layer is removed?

(1) 2 mg/L

(2) 3 mg/L

(3) 4 mg/L

(4) 6 mg/L

2 Find the marker mass removed in the first wash of each plan. [1]

Answer and work

3 Calculate how much marker Q removes in its second wash. Compare the total removed by the two plans. [1]

Answer and work

4 A student says Q is equivalent to P because both use two liters of wash liquid. Explain why removing the first wash changes what is available for the second. [1]

Answer and work

A separate plan uses one liter of the original wash and one liter of a stronger wash. When the stronger wash and the retained layer reach equilibrium, the wash concentration is twice the concentration in the retained layer. Each contact starts with fresh wash, and the wash is removed completely before the next contact.

5 Calculate the marker mass left when the stronger wash goes first and when it goes second. Compare the results. [1]

Answer and work