Accounting for Ions in a Model Water Softener

Scoring guide · one credit per question · review written work against each rubric

Accounting for Ions in a Model Water Softener

Question 1

Two Na^+ ions carry a total charge of +2, matching the charge on one Ca^{2+}. The charge balance requires two Na^+ ions to leave for each Ca^{2+} taken up.

Question 2

The cartridge holds 0.50 − 0.25 = 0.25 mmol Ca^{2+} from portion 2. Two Na^+ are released per Ca^{2+}, giving 0.50 mmol Na^+.

Question 3

Choice (3)

The amounts removed are 0.40, 0.25, and 0.00 mmol. The inlet and outlet match in the third portion.

Question 4

The exchange takes one Ca^{2+} out of the water but adds two Na^+ ions. Counting only these changes, the water gains one dissolved ion per exchange. An equivalent mole comparison using the first portion is valid.