Equilibrium Calculations, ICE Tables, and Approximation Checks

g11_u04_w13

Purpose and boundary

Use supplied original fictional concentration data to model equilibrium. No materials, chemicals, or laboratory procedure are required.

Targets: I can distinguish Q from K, build an ICE table, solve an equilibrium model, and check an approximation. **Vocabulary:** equilibrium, reaction quotient, ICE table, approximation. **Prerequisites:** molarity, coefficients, quadratic formula. Suggested use: 70 minutes.

For fictional $A(aq) \rightleftharpoons B(aq)$, $K_c = [B]/[A] = 4.00$:

1. With $A = .80\,\mathrm{M}, B = .20\,\mathrm{M}$, calculate Q_c; predict direction.

2. At equilibrium $A = .30\,\mathrm{M}$. Find B.

3. At equilibrium $B = 1.20\,\mathrm{M}$. Find A.

4. Explain why $2A \rightleftharpoons 2B$ does not give $K_c = 2[B]/2[A]$.

5. If $A_0 = .500\,\mathrm{M}, B_0 = 0$, write the ICE expressions using x.

6. Solve $4 = x/(.500 - x)$.

7. State equilibrium A and B from item 6.

8. Explain why $K_c = 4$ is not a fixed mole amount.

9. For $P(aq) \rightleftharpoons 2Q(aq)$, write K_c.

10. If $P_0 = .100\,\mathrm{M}, Q_0 = 0$, write ICE expressions.

11. Given $K_c = .360$, substitute item 10 and write the equation in x.

12. Rearrange it as a quadratic.

13. Use the quadratic formula and select a physical root.

14. Find equilibrium P and Q.

15. Calculate Q_c from your values.

16. The shortcut $P_0 - x \approx P_0$ gives $x = .0949\,\mathrm{M}$. What percent of P changes? Is a 5% rule met?

17. Why cannot the size of K_c alone justify an approximation?

18. A fictional sensor reports $P = .061, Q = .078\,\mathrm{M}$. Find Q_c and direction.

19. Name one reason measured Q_c could differ slightly from tabulated K_c.

20. Write a bounded conclusion: composition, approximation decision, and one model limitation.