

Competition Corner: Equilibrium Evidence

g10_u04_w13

These are paper-model challenges. State assumptions, distinguish a rate claim from a concentration claim, and do not call a snapshot equilibrium unless the evidence supports it.

1. A reversible simulation reports 15 forward and 15 reverse events in one 10-s interval. A student concludes that every particle type must have the same count. Construct a counterexample particle inventory and explain why it is compatible with the event data.
2. For $P+Q \rightleftharpoons R$, two equilibrium cards at the same temperature list (0.120, 0.250, 0.0900) M and (0.300, 0.100, 0.0900) M for (P, Q, R) . Calculate each concentration ratio $[R]/([P][Q])$. What does agreement or disagreement imply about the cards?
3. For $2M \rightleftharpoons N$, an equilibrium card gives $[M] = 0.200$ M and $[N] = 0.0800$ M. A classmate writes $K_c = [N]/2[M]$. Diagnose the error, calculate the correct value, and explain why a coefficient is not a multiplier in the denominator.
4. A sealed-box model has equal forward and reverse event counts for three intervals, but the measured temperature rises between interval 2 and interval 3. Explain why the event evidence alone is insufficient to assert that the same equilibrium constant applies throughout.
5. Claim: “Because $[R] = [P]$ in one snapshot, the system is at equilibrium.” Write a compact rebuttal that identifies the missing evidence and gives a more useful test for a dynamic-equilibrium model.