Competition Corner: Quotient Boundaries

g10_u04_w14

Use only the supplied reaction forms and stated temperatures. A Q_c/K_c comparison predicts net direction in the model; it is not a speed or mechanism claim.

1. For $R + S \rightleftharpoons T$, $K_c = 4.00\ \text{M}^{-1}$. Snapshot A is $(0.200, 0.500, 0.200)$ M and snapshot B is $(0.100, 0.400, 0.200)$ M for (R, S, T). Calculate each Q_c, predict each net direction, and explain why identical $[T]$ values do not imply identical predictions.

2. For $2U \rightleftharpoons V$, a snapshot gives $[U] = 0.150$ M and $[V] = 0.0900$ M; $K_c = 3.00\ \text{M}^{-1}$. A classmate uses $Q_c = [V]/(2[U])$. Compute the correct Q_c, diagnose the expression error, and predict the net direction.

3. A laboratory note lists concentrations that give $Q_c = K_c$ for a reaction form but does not state temperature. Identify which conclusion is defensible and which two conclusions remain unsupported.

4. For $M + N \rightleftharpoons P$, choose any positive values for $[M]$ and $[N]$ and calculate an $[P]$ that makes $Q_c = 5.00\ \text{M}^{-1}$. Then explain why your arithmetic construction is not a claim about an actual experiment's final composition.

5. Critique: "$Q_c > K_c$ proves the reverse elementary step has a lower activation energy." Replace it with an evidence-bounded statement.