Competition Corner: Evidence Is Not a Mechanism

Collision Theory and Rate Measurements | g10_u03_w09

Use only the supplied cards. Report average rates as positive quantities with units. Every conclusion must name the condition(s) it applies to and one limit on what rate data can establish.

1. At the same listed temperature and volume, Card A records [R] from 0.900 to 0.720 M in 30.0 s; Card B records [R] from 0.900 to 0.540 M in 30.0 s. Calculate both average disappearance rates and the rate factor. Give two non-mechanistic explanations that would need to be checked before attributing the difference to one named cause.

2. A matched temperature series gives 0.0060 $\mathrm{M\,s^{-1}}$ at 290 K, 0.0120 $\mathrm{M\,s^{-1}}$ at 310 K, and 0.0200 $\mathrm{M\,s^{-1}}$ at 330 K. Calculate both successive rate factors. Explain how the pattern supports a collision-energy interpretation without claiming that the factor per kelvin is constant.

3. Sketch a particle/energy evidence diagram for a faster trial. Your labels must distinguish (i) collision frequency, (ii) fraction with enough energy, (iii) suitable orientation, and (iv) observed average rate. Add an arrow that explicitly says which link is a model inference rather than a direct measurement.

4. A teammate concludes, "Trial B is faster, therefore its products are more stable and the reaction is more spontaneous." Write a two-sentence correction that separates rate evidence, energy barriers, and thermodynamic favorability.