

Competition Corner: Fit the Pattern, Limit the Story

Introductory Rate Laws | g10_u03_w12

All values are supplied initial-rate data under a stated matched-condition model. Use proportional factors before fitting an expression. Every answer must name one reason a fitted rate law is not a detailed mechanism proof.

1. A data set holds $[Y]$ fixed. When $[X]$ changes from 0.150 to 0.300 M, the initial rate changes from 0.00500 to 0.0200 M s^{-1} . Determine the X exponent consistent with the factor pattern. Predict the rate at $[X] = 0.450$ M if the same model remains applicable.
2. A second comparison holds $[X]$ fixed. When $[Y]$ triples, rate triples. Combine this with item 1 to write a possible empirical rate model. If one trial has $[X] = 0.200$ M, $[Y] = 0.100$ M, and rate = 0.00800 M s^{-1} , calculate k and its units.
3. Draw two initial-rate graphs: rate versus X for the second-power pattern and rate versus Y for the first-power pattern. Label what shape/slope pattern is direct data evidence and what kinetic interpretation is a model inference.
4. Critique: “The reaction equation has coefficient 2 on X, so the rate law must have $[X]^2$.” Replace it with a defensible statement using the words ‘initial-rate data’, ‘conditions’, and ‘mechanism’.