What is a Rate Law and Reaction Order?

Worksheet

Rate law: rate = k[A]^m[B]^n, where k is the rate constant and m, n are the reaction orders. Orders are determined experimentally, not from stoichiometry.

$$\text{rate} = k[\text{A}]^m[\text{B}]^n$$

Questions

1. For rate = 0.1[A]^2[B], if [A] = 2 M and [B] = 1 M, rate?

A) 0.1
B) 0.2
C) 0.4
D) 0.8

2. Tripling [A] increases rate 9. Reaction order in A?

A) 0 (zero)
B) 1 (first)
C) 2 (second)
D) 3 (third)

3. Which is determined experimentally?

A) Rate constant k only
B) Reaction order only
C) Both k and order
D) Stoichiometry

4. For a zero-order reaction, doubling [A]

A) Doubles rate
B) Quadruples rate
C) No effect
D) Halves rate

5. For a reaction rate = k[A][B], with k = 0.5 M^-1s^-1, [A] = 2 M, [B] = 0.3 M, find the rate.

6. A decomposition follows rate = k[A]^2 with k = 0.02 M^-1s^-1 and [A] = 1.5 M. Rate?

7. If doubling [A] quadruples the rate, what is the reaction order with respect to A?

8. Define: What is a rate law?

9. Define: What is reaction order?

10. Define: What is the rate constant k?

Answer Key

1. C) 0.4 - rate = 0.1 (2)^2 1 = 0.1 4 = 0.4 mol/(Ls).
2. C) 2 (second) - 3^m = 9 m = 2 (second order).
3. C) Both k and order - Both k and orders come from experiment, not from the balanced equation.
4. C) No effect - rate = k[A]^0 = k (constant), independent of [A].
5. rate = k[A][B] rate = 0.5 2 0.3 rate = 0.3 mol/(Ls)
6. rate = k[A]^2 rate = 0.02 (1.5)^2 rate = 0.02 2.25 = 0.045 mol/(Ls)
7. If rate [A]^m, and 2[A] 4 rate Then 2^m = 4 2^m = 2^2, so m = 2 The reaction is second order in A.
8. A mathematical expression relating rate to concentrations: rate = k[A]^m[B]^n.
9. The exponent of concentration in the rate law; determined experimentally, not from stoichiometry.
10. A proportionality constant unique to a reaction at a given temperature; units depend on overall order.