What is Reaction Rate?

Worksheet

Reaction rate is the change in concentration of a reactant or product per unit time, often written as rate = k[A]^m[B]^n, where k is the rate constant and m, n are experimentally determined reaction orders.

r = k[A]^m[B]^n

Questions

1. The typical units of reaction rate are:

A) M/s
B) s/M
C) M
D) 1/s

2. Doubling [A] in a first-order reaction (rate = k[A]) will:

A) double the rate
B) quadruple the rate
C) have no effect
D) halve the rate

3. In rate = k[A]^2[B], the overall reaction order is:

A) 1
B) 2
C) 3
D) 4

4. Which factor speeds up a reaction by lowering activation energy?

A) Increasing volume
B) Adding a catalyst
C) Decreasing concentration
D) Cooling the system

5. For rate = k[A][B], k = 0.020 Ms, [A] = 0.50 M, [B] = 0.30 M. Find the rate.

6. A reactant's concentration drops from 0.80 M to 0.60 M in 50 s. Find the average rate.

7. A reaction's rate roughly doubles for every 10C rise. At 20C the rate is 0.010 M/s. Estimate the rate at 40C.

8. Define: What is reaction rate?

9. Define: What factors affect reaction rate?

10. Define: What is a rate law?

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Answer Key

1. A) M/s - Rate is a concentration change per unit time, so its units are mol/L per second, i.e. M/s.
2. A) double the rate - For first order in A, rate is directly proportional to [A], so doubling [A] doubles the rate.
3. C) 3 - Overall order is the sum of individual orders: 2 + 1 = 3.
4. B) Adding a catalyst - A catalyst provides an alternate pathway with lower activation energy, increasing rate.
5. rate = k[A][B] rate = 0.020 0.50 0.30 rate = 0.003 M/s
6. average rate = [A]/t average rate = (0.60 0.80) / 50 average rate = 0.20 / 50 = 0.004 M/s
7. Temperature rises by 20C = two 10C steps Each step doubles the rate: 2 2 = 4 rate at 40C 0.010 4 = 0.040 M/s
8. The change in concentration of a reactant or product per unit time.
9. Concentration, temperature, surface area, catalysts, and pressure (for gases).
10. An equation, rate = k[A]^m[B]^n, relating rate to reactant concentrations and the rate constant k.

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