

CHEMICAL KINETICS

Pg-1

Rate of Reaction :

$$\text{Rate} = \frac{\text{Change in Conc or Pressure}}{\text{Time taken}}$$

$$\text{Unit} \rightarrow \text{mol L}^{-1} \text{T}^{-1} \text{ or atm T}^{-1}$$

* ROR can never be negative. (-ve)

Rate of Reaction. (A $\rightarrow$ B)

Average Rate

$$\text{Rate} = -\frac{\Delta(A)}{\Delta t} = \frac{\Delta(B)}{\Delta t}$$



$$R_{\text{avg}} = \left(\frac{A_1 - A_2}{t_2 - t_1} \right)$$

Instantaneous Rate

$$\text{Rate} = -\frac{d(A)}{dt} = \frac{d(B)}{dt}$$



$$\text{Rate} = \text{Slope} = \left| \frac{d(A)}{dt} \right|$$



$$\text{Rate (ROR)} = -\frac{d(\text{N}_2)}{dt} = -\frac{d(\text{H}_2)}{3dt} = \frac{1}{2} \frac{d(\text{NH}_3)}{dt}$$

$$\text{Rate of Disappearance} = -\frac{d(\text{N}_2)}{dt} = -\frac{d(\text{H}_2)}{dt}$$

$$\text{Rate of Appearance} = \frac{d(\text{NH}_3)}{dt} \text{ (Product)}$$

ROR & RODA does not include the St. Coeff.



$$\text{ROR} = -\frac{\text{RODA}}{a} = \frac{\text{RODB}}{b} = \frac{\text{RODC}}{c} = \frac{\text{RODD}}{d}$$

$$\text{ROR} = -\frac{1}{a} \frac{d(A)}{dt} = -\frac{1}{b} \frac{d(B)}{dt} = \frac{1}{c} \frac{d(C)}{dt} = \frac{1}{d} \frac{d(D)}{dt}$$

~ Differential Rate Law

Q. The rate of the reaction: $2\text{N}_2\text{O}_5 \rightarrow 4\text{NO}_2 + \text{O}_2$
Can be written in three ways $\rightarrow$

$$-\frac{d(\text{N}_2\text{O}_5)}{dt} = K [\text{N}_2\text{O}_5] ; \frac{d(\text{NO}_2)}{dt} = k' [\text{N}_2\text{O}_5]$$

$$\frac{d(\text{O}_2)}{dt} = K'' [\text{N}_2\text{O}_5]$$

$$\text{Soln. ROR} = -\frac{1}{2} \frac{d(\text{N}_2\text{O}_5)}{dt} = \frac{1}{4} \frac{d(\text{NO}_2)}{dt} = \frac{d(\text{O}_2)}{dt}$$

$$= -\frac{K [\text{N}_2\text{O}_5]}{2} = \frac{K' [\text{N}_2\text{O}_5]}{4} = \frac{K'' [\text{N}_2\text{O}_5]}{1}$$

$$\text{ROR} = K' = 2K \quad K'' = \frac{K}{2}$$

$$Q. -0.3 + \log \left(-\frac{d(A)}{dt} \right) = 0.18 + \log \left(\frac{d(B)}{dt} \right)$$

Write the reaction.

$$\log 8 + \log \left(-\frac{d(A)}{dt} \right) = \log 8 + \log \left(\frac{d(B)}{dt} \right)$$

$$\log \left(8 -\frac{d(A)}{dt} \right) = \log 8 \frac{d(B)}{dt}$$



Molecularity :

Δ Can be integer (1, 2 or 3) but it cannot be zero, negative or fractional.

Δ For elementary reaction: Molecularity is equal to its order

Δ Maximum value of molecularity is 3. (or order)

Δ For complex rxn molecularity of each step of mechanism is defined separately. $\therefore$ molecularity cannot be defined for whole complex reaction at once.

Δ Molecularity of a reaction may or may not be equal to order of reaction.

Δ Molecularity can not be determined by balanced chemical rxn and can only be determined from simple reaction

Manual Solution Of Chemical Kinetics

M Walker



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Gorban, Iliya V. Karlin, 2005-02-01 By bringing together various ideas and methods for extracting the slow manifolds the
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Table of Contents Manual Solution Of Chemical Kinetics

1. Understanding the eBook Manual Solution Of Chemical Kinetics
 - The Rise of Digital Reading Manual Solution Of Chemical Kinetics
 - Advantages of eBooks Over Traditional Books
2. Identifying Manual Solution Of Chemical Kinetics
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Manual Solution Of Chemical Kinetics
 - User-Friendly Interface
4. Exploring eBook Recommendations from Manual Solution Of Chemical Kinetics
 - Personalized Recommendations
 - Manual Solution Of Chemical Kinetics User Reviews and Ratings
 - Manual Solution Of Chemical Kinetics and Bestseller Lists
5. Accessing Manual Solution Of Chemical Kinetics Free and Paid eBooks
 - Manual Solution Of Chemical Kinetics Public Domain eBooks
 - Manual Solution Of Chemical Kinetics eBook Subscription Services
 - Manual Solution Of Chemical Kinetics Budget-Friendly Options
6. Navigating Manual Solution Of Chemical Kinetics eBook Formats

- ePub, PDF, MOBI, and More
- Manual Solution Of Chemical Kinetics Compatibility with Devices
- Manual Solution Of Chemical Kinetics Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Manual Solution Of Chemical Kinetics
 - Highlighting and Note-Taking Manual Solution Of Chemical Kinetics
 - Interactive Elements Manual Solution Of Chemical Kinetics
- 8. Staying Engaged with Manual Solution Of Chemical Kinetics
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Manual Solution Of Chemical Kinetics
- 9. Balancing eBooks and Physical Books Manual Solution Of Chemical Kinetics
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Manual Solution Of Chemical Kinetics
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Manual Solution Of Chemical Kinetics
 - Setting Reading Goals Manual Solution Of Chemical Kinetics
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Manual Solution Of Chemical Kinetics
 - Fact-Checking eBook Content of Manual Solution Of Chemical Kinetics
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
- 14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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