

THE UNIVERSITY OF RHODE ISLAND

# Practice Problems Chemical Kinetics: Rates and Mechanisms of Chemical Reactions

1. State two quantities that must be measured to establish the rate of a chemical reaction and cite several factors that affect the rate of a chemical reaction.

### Answer

The rate of a reaction is defined as the change in concentration as a function of time. Thus, the two quantities that must be measured are the molarity of either a reactant or product and the time.

The factors that affect a reaction rate include the temperature, the concentration of reactants, the surface area (if solids are involved in the reaction), and the presence or absence of a catalyst.

2. Explain why the rate of disappearance of NO and the rate of formation of  $N_2$  are not the same in the reaction,  $2CO(g) + 2NO(g) \rightarrow 2CO_2(g) + N_2(g)$ .

### Answer

Because of the 2:1 stoichiometric ratio between NO and  $N_2$ , the NO must use 2 moles for each mole of  $N_2$  produced. This means the rate of consumption of NO is twice as fast as the rate of production of  $N_2$ .

3. What plot of experimental data can be used to evaluate the activation energy,  $E_a$ , of a reaction? How is  $E_a$  related to this plot?

### Answer

The experimental data required to evaluate the activation energy are rate constants as a function of absolute temperature. If  $\ln k$  is plotted against  $1/T$ , a straight line should result and the slope of the line is equal to  $-E_a/R$ , where  $R$  is the ideal gas constant in energy units.

4. What are the chief requirements that must be met by a plausible reaction mechanism? Why do we say "plausible" mechanism rather than "correct" mechanism?

### Answer

A reaction mechanism must meet two criteria. 1) The sum of all of the steps in the mechanism must match the observed reaction, stoichiometry of the reaction must be satisfied. 2) The reaction mechanism must account for the experimentally observed rate law.

Reaction mechanisms are considered "plausible" rather than "correct" because different sequences of elementary reactions may meet the two requirements.

5. In a reaction mechanism, (a) what is the difference between an activated complex and an intermediate? (b) What is meant by the rate-determining step? Which elementary reaction in a reaction mechanism is often the rate-determining step?

### Answer

(a) An activated complex is the structure along the reaction pathway of the highest energy, which determines the activation energy of the reaction. An intermediate can be any structure found in the reaction path.

(b) The rate-determining step is the elementary reaction that controls the mathematical form of the overall rate law. The rate-determining step is usually the slowest elementary reaction.

6. In the reaction  $H_2O_2(aq) \rightarrow H_2O(l) + \frac{1}{2} O_2(g)$ , the initial concentration of  $H_2O_2$  is 0.2546 M, and the initial rate of reaction is  $9.32 \times 10^{-4} M s^{-1}$ . What will be  $[H_2O_2]$  at  $t = 35$  s?

### Answer

Use the definition of rate (change in concentration over change in time), recognizing that the initial rate for the loss of hydrogen peroxide is negative and at  $t = 0$  s,  $[H_2O_2] = 0.2546$  M.

# Chemical Kinetics Practice Problems And Answers

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## **Chemical Kinetics Practice Problems And Answers:**

*Calculations in Chemical Kinetics for Undergraduates* Eli Usheunepa Yunana,2022-06-14 *Calculations in Chemical Kinetics for Undergraduates* aims to restore passion for problem solving and applied quantitative skills in undergraduate chemistry students Avoiding complicated chemistry jargon and providing hints and step wise explanations in every calculation problem students are able to overcome their fear of handling mathematically applied problems in physical chemistry This solid foundation in their early studies will enable them to connect fundamental theoretical chemistry to real experimental applications as graduates Additional Features Include Contains quantitative problems from popular physical chemistry references Provides step by step explanations are given in every calculation problem Offers hints to certain problems as points to note to enable student comprehension Includes solutions for all questions and exercises This book is a great resource for undergraduate chemistry students however the contents are rich and useful to even the graduate chemist that has passion for applied problems in physical chemistry of reaction Kinetics (Free Sample) *GO TO Objective NEET Chemistry Guide with DPP & CPP Sheets 9th Edition* Disha Experts,2021-10-07 The thoroughly revised updated 9th Edition of *Go To Objective NEET Chemistry* is developed on the objective pattern following the chapter plan as per the NCERT books of class 11 and 12 The book has been rebranded as *GO TO* keeping the spirit with which this edition has been designed The complete book has contains 31 Chapters In the new structure the book is completely revamped with every chapter divided into 2 4 Topics Each Topic contains Study Notes along with a DPP Daily Practice Problem of 15 20 MCQs This is followed by a Revision Concept Map at the end of each chapter The theory is followed by a set of 2 Exercises for practice The first exercise is based on Concepts Application It also covers NCERT based questions This is followed by Exemplar past 8 year NEET 2013 2021 questions In the end of the chapter a CPP Chapter Practice Problem Sheet of 45 Quality MCQs is provided The solutions to all the questions have been provided immediately at the end of each chapter **Cracking the GRE Chemistry Subject Test** Princeton Review (Firm),2005 The GRE subject tests are among the most difficult standardized exams Rather than testing general problem solving skills they require highly specialized knowledge The experts at The Princeton Review have thoroughly research each subject test to provide students with the most thorough up to date information available Students don t need to relearn the entire histories of their fields just what they need to know to earn high scores on the exams Each guide includes one full length practice exam complete with comprehensive explanations for every solution *GO TO Objective NEET 2021 Chemistry Guide 8th Edition* Disha Experts, *Survival Guide to General Chemistry* Patrick E. McMahon,Rosemary McMahon,Bohdan Khomtchouk,2019-02-13 This work evolved over thirty combined years of teaching general chemistry to a variety of student demographics The focus is not to recap or review the theoretical concepts well described in the available texts Instead the topics and descriptions in this book make available specific detailed step by step methods and procedures for solving the major types of problems in general chemistry

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