

# KINETICS Practice Problems and Solutions

Name: \_\_\_\_\_  
 Period: \_\_\_\_\_ Date: \_\_\_\_\_

AP Chemistry  
 Dr. Mandes

The following questions represent potential types of quiz questions. Please answer each question completely and thoroughly. The solutions will be posted on-line on Monday.

5. Please do #18 in chapter 12 of your text.
- This increases the  $[H_2]$ , which will increase the rate, but has no effect on  $k$
  - Due to Arrhenius equation, changing temperature changes the value of  $k$ .
  - Catalyst function by lowering the activation energy, so due to Arrhenius equation, changing the activation energy changes the value of  $k$ .

6. Consider the reaction:  $P_4 + 6 H_2 \rightarrow 4 PH_3$ . A rate study of this reaction was conducted at 298 K. The data that were obtained are shown in the table.

$[P_4]$ , mol/L	$[H_2]$ , mol/L	Initial Rate, mol/L · s
0.0110	0.0075	$3.20 \times 10^{-4}$
0.0110	0.0150	$6.40 \times 10^{-4}$
0.0220	0.0150	$6.39 \times 10^{-4}$

- What is the order with respect to:  $P_4$  0  
 $H_2$  1
- Write the rate law for this reaction.  $rate = k[H_2]$
- Determine the value and units of the rate constant,  $k$ . **plug and chug using the rate law & data from exp't 1 and solving for  $k$ , we get  $k = 0.0427 s^{-1}$**

7. Consider the reaction:  $SO_2 + O_3 \rightarrow SO_3 + O_2$ . A rate study of this reaction was conducted at 298 K. The data that were obtained are shown in the table.

$[SO_2]$ , mol/L	$[O_3]$ , mol/L	Initial Rate, mol/L · s
0.25	0.40	0.118
0.25	0.20	0.118
0.75	0.20	1.062

- What is the order with respect to:  $SO_2$  2  
 $O_3$  0
- Write the rate law for this reaction.  $rate = k[SO_2]^2[O_3]^0$
- Determine the value and units of the rate constant,  $k$ . **plug and chug using the rate law & data from exp't 1 and solving for  $k$ , we get  $k = 2.36 molL^{-2} s^{-1}$**

8. Consider the following mechanism.
- $$A_2 + B_2 \rightarrow R + C \quad (\text{slow})$$
- $$A_2 + R \rightarrow C \quad (\text{fast})$$

- Write the overall balanced chemical equation.  $2 A_2 + B_2 \rightarrow 2 C$
- Identify any intermediates within the mechanism. **R**
- What is the order with respect to each reactant?  **$A_2$  1<sup>st</sup>;  $B_2$  1<sup>st</sup>**

# Kinetics Problems And Solutions

**G G Chernyi, Moscow State University  
S Macheret G Chernyi and S Losev**

## **Kinetics Problems And Solutions:**

**Kinetics of Metal Ion Adsorption from Aqueous Solutions** Sotira Yiacomou, Chi Tien, 2013-11-27 This monograph is intended to provide a systematic presentation of theories concerning the adsorption of metal ions from aqueous solutions onto surfaces of natural and synthetic substances and to outline methods and procedures to estimate the extent and progress of adsorption. As heavy metals and the problems associated with their transport and distribution are of serious concern to human health and the environment, the materials presented in this volume have both theoretical and practical significance. In writing this monograph, one of our goals was to prepare a book useful to environmental workers and practicing engineers. For this reason, our presentation relies heavily on concepts commonly used in the environmental engineering literature. In fact, the volume was prepared for readers with a basic understanding of environmental engineering principles and some knowledge of adsorption processes. No prior familiarity with the ionic solute adsorption at solid solution interfaces is assumed. Instead, introduction of the necessary background information was included. Generally speaking, metal ion adsorption may be studied in terms of three distinct but interrelated phenomena: surface ionization, complex formation, and the formation and presence of an electrostatic double layer adjacent to adsorbent surfaces. Analyses of these phenomena with various degrees of sophistication are presented, and their various combinations yield different models that describe metal ion adsorption. [Kinetics in Materials Science and Engineering](#)

Dennis W. Readey, 2017-01-27 A pedagogical gem. Professor Readey replaces black box explanations with detailed insightful derivations. A wealth of practical application examples and exercise problems complement the exhaustive coverage of kinetics for all material classes. Prof. Rainer Hebert, University of Connecticut. Prof. Readey gives a grand tour of the kinetics of materials suitable for experimentalists and modellers. In an easy-to-read and entertaining style, this book leads the reader to a fundamental model-based understanding of kinetic processes critical to development, fabrication, and application of commercially important soft polymers, biomaterials, hard ceramics, metals, and composite materials. It is a must-have for anyone who really wants to understand how to make materials and how they will behave in service. Prof. Bill Lee, Imperial College London, Fellow of the Royal Academy of Engineering. A much-needed text filling the gap between an introductory course in materials science and advanced materials-specific kinetics courses. Ideal for the undergraduate interested in an in-depth study of kinetics in materials. Prof. Mark E. Eberhart, Colorado School of Mines. This book provides an in-depth introduction to the most important kinetic concepts in materials science, engineering, and processing. All types of materials are addressed, including metals, ceramics, polymers, electronic materials, biomaterials, and composites. The expert author, with decades of teaching and practical experience, gives a lively and accessible overview explaining the principles that determine how long it takes to change material properties and make new and better materials. The chapters cover a broad range of topics, extending from the heat treatment of steels to the processing of silicon integrated microchips and the production of

cement to the movement of drugs through the human body The author explicitly avoids black box equations providing derivations with clear explanations Chemical Kinetics with Mathcad and Maple Viktor Korobov, Valery Ochkov, 2011-05-26 The authors explain at length the principles of chemical kinetics and approaches to computerized calculations in modern software suites mathcad and maple Mathematics is crucial in determining correlations in chemical processes and requires various numerical approaches Often significant issues with mathematical formalizations of chemical problems arise and many kinetic problems can't be solved without computers Numerous problems encountered in solving kinetics calculations with detailed descriptions of the numerical tools are given Special attention is given to electrochemical reactions which fills a gap in existing texts not covering this topic in detail The material demonstrates how these suites provide quick and precise behavior predictions for a system over time for postulated mechanisms Examples i e oscillating and non isothermal reactions help explain the use of mathcad more efficiently Also included are the results of authors own research toward effective computations **Problems in Chemical Kinetics** Nikolaï Markovich Ėmanuël', 1981 **The Kinetic Theory of Gases** Oskar Emil Meyer, 1899 Analytical Mechanics for Engineers Fred B. Seely, Newton Edward Ensign, 1921 **The Application of metabolic and excretion kinetics to problems of industrial toxicology** Jerzy Piotrowski, 1971 **Handbook of Heat and Mass Transfer: Catalysis, kinetics, and reactor engineering**, 1989 **Thermal, Power and Electrical Engineering** Charles C. Zhou, Guo Jun Ma, Ru Tang Liao, Jian Wen Wang, 2013-08-16 Selected peer reviewed papers from the 2013 2nd International Conference on Energy and Environmental Protection ICEEP 2013 April 19 21 2013 Guilin China **Solutions and Solubilities** Michael R. J. Dack, 1975 **Papers and Notes on the Genesis and Matrix of the Diamond** Henry Carvill Lewis, 1897 College of Engineering Catalogue Carnegie Institute of Technology. College of Engineering and Science, 1920 **Calculations in Hydraulic Engineering: Fluid pressure, and the calculations of its effects in engineering structures** Thomas Claxton Fidler, 1898 **Nuclear Science Abstracts**, 1971 NSA is a comprehensive collection of international nuclear science and technology literature for the period 1948 through 1976 pre dating the prestigious INIS database which began in 1970 NSA existed as a printed product Volumes 1 33 initially created by DOE s predecessor the U S Atomic Energy Commission AEC NSA includes citations to scientific and technical reports from the AEC the U S Energy Research and Development Administration and its contractors plus other agencies and international organizations universities and industrial and research organizations References to books conference proceedings papers patents dissertations engineering drawings and journal articles from worldwide sources are also included Abstracts and full text are provided if available **Assaying and Metallurgical Analysis** Ezra Lobb Rhead, Alexander Humboldt Sexton, 1902 The Analysis of Steel-works Materials Harry Brearley, Fred Ibbotson, 1902 A Manual of Machine Drawing and Design David Allan Low, Alfred William Bevis, 1898 Physical and Chemical Processes in Gas Dynamics G G Chernyi, Moscow State University S Macheret G Chernyi and S Losev, 2004 A decade ago Russian scientist Staly A Losev assembled top scientists

from various Russian institutions at Moscow State University and invited them to pool their knowledge about the changes gases undergo in a variety of aerospace settings from combustion of rocket fuels to hypersonic flow paths to the exteriors of atmospheric reentry vehicles The work grew into the AVAGADRO Laboratory of Moscow State Universitys Institute of Mechanics The models and formulas produced by the team of authors are contained in the second edition of the text book Physical and Chemical Processes in Gas Dynamics The text provides a valuable window into the design philosophies and models that govern former Soviet engineers and scientists Normally these things are not accessible to U S engineers said Paul Zarchan of MITs Lincoln Laboratory Editor in Chief of AIAAs Progress in Astronautics and Aeronautics Series that includes this text Accompanying the book is the Russian produced Chemical Workbench software which is a user friendly Windows based interface for performing calculations based on the models of gas dynamics contained in the book The book and software provide concise exhaustive and clear descriptions of terms notations concepts methods laws and techniques It is invaluable for students and engineers who are determined to more accurately predict the physical and chemical processes in gas and plasma dynamics Chemical and Engineering News ,1958 **Transactions of the American Nuclear Society** American Nuclear Society,1992

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