

Chemical Kinetics - Formulas

All rates written as $\frac{\Delta \text{conc}}{\Delta \text{time}}$ or $\frac{\Delta [A]}{\Delta t}$. Instantaneous rate is the slope of a concentration vs time plot and is shown by the differential equation: $\frac{d[A]}{dt}$. Overall rates for forward reactions are shown as POSITIVE rates, therefore, all reactants (which have negative rate of change) must have their rates negated $-\frac{d[A]}{dt}$.

In general for the overall reaction:



Note that each individual rate is divided by it's coefficient in the balanced chemical equation.

Half-life ($t_{1/2}$): The time it takes for the concentration to drop to one half its current value during the course of the reaction. Note that the "current value" is typically the initial starting value - but not always.

Rate Laws for: $a A \rightarrow \text{products}$ (all the following equations assume that k is for the overall reaction)

Zero Order	First Order	Second Order
rate = ak	rate = $ak[A]$	rate = $ak[A]^2$
$[A]_0 - [A]_t = akt$	$\ln[A]_0 - \ln[A]_t = akt$ $\ln\left(\frac{[A]_0}{[A]_t}\right) = akt$	$\frac{1}{[A]_t} - \frac{1}{[A]_0} = akt$
$[A]_t = -akt + [A]_0$	$\ln[A]_t = -akt + \ln[A]_0$	$\frac{1}{[A]_t} = akt + \frac{1}{[A]_0}$
$t_{1/2} = \frac{[A]_0}{2ak}$	$t_{1/2} = \frac{\ln 2}{ak}$	$t_{1/2} = \frac{1}{ak[A]_0}$

Watch out for this! Make sure you know HOW k is defined for a reaction. It must be known WHICH component that the rate is being expressed. Is it A? B? C? D? Many times k is given for the *overall reaction*. If that is the case then you must remember to scale k by the coefficients (a , b , c , or d) given in order to get the right rates for each component. That is: $k = ak'$, etc... (this is discussed in section 15.2 in your textbook)

Temperature dependence of rate (Arrhenius Equation) $k = Ae^{-E_a/RT}$

Here's the straight line plot ($y = mx + b$) version:

$$\ln k = -\frac{E_a}{R} \left(\frac{1}{T} \right) + \ln A$$

When finding the new k at a new T ...

$$\ln \left(\frac{k_2}{k_1} \right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

Note this is the typical Arrhenius Equation where you have 2 specific rate constants at 2 specific temperatures. Remember they come in pairs. Also note how the Arrhenius factor A , has factored OUT of the equation.

Here is the version using half-lives instead of k 's

$$\ln \left(\frac{t_1}{t_2} \right) = \frac{E_a}{R} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

This is still the Arrhenius Equation, EXCEPT we now show TIME in place of rate constant. Time is inversely proportional to rate so the positions are switched. Any common timed event will work - half-life is the most common.

Chemistry Kinetics Cheat Sheet

M R Wright



Chemistry Kinetics Cheat Sheet:

Organic Chemistry I For Dummies Arthur Winter, PhD, 2005-07-08 A plain English guide to one of the toughest science courses around Organic chemistry is rated among the most difficult courses that students take and is frequently the cause of washout among pre med medical and nursing students This book is an easy to understand and fun reference to this challenging subject It explains the principles of organic chemistry in simple terms and includes worked out problems to help readers get up to speed on the basics **ACT** Lisa Zimmer Hatch, Scott A. Hatch, 2016-10-13 1 001 ACT questions with step by step solutions Ready to take the ACT No sweat With 1 001 ACT Practice Questions For Dummies you get 1 001 opportunities to prepare for the test Complete with detailed step by step solutions each practice ACT question gets you one step closer to a great score on the most popular college admissions test and getting into the school of your dreams Practice your way to ACT test taking perfection with the help of For Dummies Includes one year access to practice questions online Offers 1 001 practice questions from easy to hard Tracks your progress so you can see where you need more help and create your own question sets Provides detailed step by step answers and explanations for every question If you re a student with college in your sights 1 001 ACT Practice Questions For Dummies sets you up for success *American Book Publishing Record* R.R. Bowker Company, 1978 *Catalog of Copyright Entries. Third Series* Library of Congress. Copyright Office, 1967 Includes Part 1 Number 1 Books and Pamphlets Including Serials and Contributions to Periodicals January June

Chemical Kinetics Laidler, 1987-09 *Introduction to Chemical Kinetics* Gordon Skinner, 2012-12-02 Introduction to Chemical Kinetics is a compilation of lecture notes of the author about principles concepts and theories in chemical kinetics The book tackles the nature of chemical kinetics reaction rates and order and thermodynamic consistency of rate laws The effects of temperature on kinetics prediction of reaction rates gas phase reactions and controlled reactions are also discussed The text also explains the reactions catalyzed by enzymes reactions in solids and heterogenous systems oxidation of metals catalysis of reactions by solids and methods for different reaction rates The monograph is recommended as a textbook for undergraduate students in chemistry who are currently taking up kinetics as it is an easily understood and concise book that can also be used as reference **Books and Pamphlets, Including Serials and Contributions to Periodicals** Library of Congress. Copyright Office, 1964 *Catalog of Copyright Entries, Third Series* Library of Congress. Copyright Office, 1964 The record of each copyright registration listed in the Catalog includes a description of the work copyrighted and data relating to the copyright claim the name of the copyright claimant as given in the application for registration the copyright date the copyright registration number etc **Fundamental Chemical Kinetics** M R Wright, 1999-06-01 The unusual approach of this text gives final honours and post graduate students a clear and explanatory account of one of the harder areas of physical chemistry The author takes care to provide detailed verbal clarification of the concepts and their importance together with full explanations of the mathematical developments Her explanations are an essential and vital

feature of the text which is scholarly lucid and well written with a combination of depth of coverage and clarity which helps students to work through on their own A clear and explanatory account of one of the more difficult areas of physical chemistry Provides detailed verbal clarification of the concepts and their importance together with full explanations of the mathematical developments Discusses energy transfer molecular beam studies of reactive scattering and historical developments and modern kinetics among other topics Government Reports Announcements & Index ,1980-03

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