



# CHEMISTRY

## CHEAT SHEET

# EQUILIBRIUM

## EQUILIBRIUM CHEAT SHEET

Chemical Equilibrium occurs when the concentrations of the chemical species remain the same with time having reached Equilibrium. Equilibrium reactions are represented by the symbol  $\rightleftharpoons$ .

<p><b>What is Equilibrium?</b></p> <p>Equilibrium is a state of balance between two or more opposing processes.</p> <p>In chemistry, it refers to a state where the concentrations of reactants and products remain constant over time.</p> <p>Equilibrium is reached when the rate of the forward reaction is equal to the rate of the reverse reaction.</p> <p>Equilibrium is a dynamic process, meaning that the reactions are still occurring, but the concentrations of the species remain constant.</p>	<p><b>Equilibrium Constant</b></p> <p>The equilibrium constant, <math>K</math>, is a measure of the extent to which a reaction proceeds. It is defined as the ratio of the concentrations of the products to the concentrations of the reactants, each raised to the power of its stoichiometric coefficient.</p> <p>For a general reaction:</p> $aA + bB \rightleftharpoons cC + dD$ <p>The equilibrium constant is given by:</p> $K = \frac{[C]^c [D]^d}{[A]^a [B]^b}$	<p>Graph showing concentration vs. time for a reaction at equilibrium. The concentration of reactants decreases over time, while the concentration of products increases, both reaching a constant value at equilibrium.</p>								
<p><b>Equilibrium Constant, <math>K_c</math></b></p> <p>The equilibrium constant, <math>K_c</math>, is defined as the ratio of the concentrations of the products to the concentrations of the reactants, each raised to the power of its stoichiometric coefficient.</p> <p>For a general reaction:</p> $aA + bB \rightleftharpoons cC + dD$ <p>The equilibrium constant is given by:</p> $K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$	<p><b>Equilibrium Constant, <math>K_p</math></b></p> <table><thead><tr><th>Equilibrium Constant, <math>K_p</math></th><th>Meaning</th></tr></thead><tbody><tr><td><math>K_p &gt; 1</math></td><td>Products are favored at equilibrium (reaction proceeds to the right)</td></tr><tr><td><math>K_p &lt; 1</math></td><td>Reactants are favored at equilibrium (reaction proceeds to the left)</td></tr><tr><td><math>K_p = 1</math></td><td>Reactants and products are at equal concentrations</td></tr></tbody></table>		Equilibrium Constant, $K_p$	Meaning	$K_p > 1$	Products are favored at equilibrium (reaction proceeds to the right)	$K_p < 1$	Reactants are favored at equilibrium (reaction proceeds to the left)	$K_p = 1$	Reactants and products are at equal concentrations
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<p><b>Le Chatelier's Principle: the effect of changing conditions on equilibrium</b></p>										
<p><b>Concentration</b></p>	<p><b>Effect on Equilibrium</b></p>	<p><b>Example</b></p>								
<p>Concentration</p>	<ul style="list-style-type: none"><li>Increasing the concentration of a reactant will shift the equilibrium to the right, favoring the products.</li><li>Increasing the concentration of a product will shift the equilibrium to the left, favoring the reactants.</li></ul>	<p>For the reaction:</p> $N_2 + 3H_2 \rightleftharpoons 2NH_3$ <p>Increasing the concentration of <math>N_2</math> will shift the equilibrium to the right, favoring the formation of <math>NH_3</math>.</p>								
<p>Pressure</p>	<ul style="list-style-type: none"><li>Increasing the pressure will shift the equilibrium to the side with the fewest moles of gas.</li><li>Decreasing the pressure will shift the equilibrium to the side with the most moles of gas.</li></ul>	<p>For the reaction:</p> $N_2 + 3H_2 \rightleftharpoons 2NH_3$ <p>Increasing the pressure will shift the equilibrium to the right, favoring the formation of <math>NH_3</math>.</p>								
<p>Temperature</p>	<ul style="list-style-type: none"><li>Increasing the temperature will shift the equilibrium to the side that is endothermic.</li><li>Decreasing the temperature will shift the equilibrium to the side that is exothermic.</li></ul>	<p>For the reaction:</p> $N_2 + 3H_2 \rightleftharpoons 2NH_3$ <p>Increasing the temperature will shift the equilibrium to the left, favoring the reactants.</p>								

# Chemistry Equilibrium Study Guide

**Daniel C. Pantaleo**



## Chemistry Equilibrium Study Guide:

Study Guide for Chemical Principles [by] Steven S. Zumdahl Steven S. Zumdahl, Paul B. Kelter, 1995 The Study Guide reflects the unique problem solving approach taken by the Chemical Principles text The new edition of the Study Guide includes many new worked out examples *Basic Concepts of Chemistry, 9e Study Guide and Solutions Manual* Leo J. Malone, Theodore O. Dolter, 2012-01-03 The 9th edition of Malone's Basic Concepts of Chemistry provides many new and advanced features that continue to address general chemistry topics with an emphasis on outcomes assessment New and advanced features include an objectives grid at the end of each chapter which ties the objectives to examples within the sections assessment exercises at the end each section and relevant chapter problems at the end of each chapter A new Math Check allows quick access to the needed basic skill The first chapter now includes brief introductions to several fundamental chemical concepts and Chapter Synthesis Problems have been added to the end of each chapter to bring key concepts into one encompassing problem Every concept in the text is clearly illustrated with one or more step by step examples Making it Real essays have been updated to present timely and engaging real world applications emphasizing the relevance of the material they are learning This edition continues the end of chapter Student Workshop activities to cater to the many different learning styles and to engage users in the practical aspect of the material discussed in the chapter **Study Guide and Solutions Manual for Seager/Slabaugh's Chemistry for Today** Seager/Slabaugh, 2004 The fifth edition of the Study Guide and Student Solutions Manual has been updated to reflect all of the changes to the text This ancillary tests the student on the learning objectives in each chapter and provides answers to all of the even numbered end of chapter exercises New additional activities have been added to include a review of each section of the chapter and a section entitled Tying It All Together with a Laboratory Application *Fundamentals of Chemistry, Study Guide* James E. Brady, John R. Holum, 1988-04-20 This Third Edition of the widely used fundamentals textbook for science majors maintains the conversational writing style that made the previous editions so popular while including up to date treatments of important and current topics Emphasizes descriptive chemistry chemical reactions and properties while maintaining a solid treatment of chemical principles Common chemicals are used whenever possible as examples in both theoretical discussions and in problems and exercises Incorporates many pedagogical aids each chapter begins with a brief table of contents and each section begins with a preview of topics covered Chapters include frequent margin comments figures and photographs

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