

General Chemistry Lab Experiment 4

Limiting Reactant

INTRODUCTION

Two factors affect the yield of products in a chemical reaction: (1) the amounts of starting materials (reactants) and (2) the percent yield of the reaction. Many experimental conditions, for example, temperature and pressure, can be adjusted to increase yield of a desired product in a chemical reaction. The reactant determining the amount of product generated in a chemical reaction is called the limiting reactant. Sometimes only a limited amount of the one of the reactants needed for the reaction is available, or perhaps it is easier to carry out a reaction by adding an excess of one of the reactants. The maximum amount of product that can be formed is determined by the amount of reactant that is used up first.

Chemicals react according to fixed mole ratios (stoichiometrically), so only a limited amount of product can form from given amounts of starting materials. To better understand the concept of the limiting reactant, let us look at the situation where a toy store is trying to assemble bicycles. Suppose that each bicycle requires six nuts, six bolts, and six washers. If the shipment of parts includes 60 nuts, 60 washers and only 59 bolts, then the bolts become the limiting factor and only 59 bicycles can be assembled.

In his experiment, the reaction of sodium phosphate dodecahydrate, $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$, and barium chloride dihydrate, $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, in an aqueous system produces solid barium phosphate, $\text{Ba}_3(\text{PO}_4)_2$. The molecular form of the equation for the reaction in aqueous solution is



The two reactant salts and sodium chloride are soluble in water but barium phosphate is insoluble. The ionic equation for the reaction is



Presenting only the ions that show evidence of a chemical reaction occurring, i.e., the formation of a precipitate (and removing spectator ions from the equation), the net ionic equation for the observed reaction is



Spectator ions, cations or anions, do not participate in any observable or detectable chemical reaction.

Net ionic equation is an equation that includes only those ions that participate in the observed chemical reaction. From the balanced net ionic equation, 2 moles of phosphate ion (from the 2 mol of $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$, molar mass = 380.12 g/mol, or 760.24 g) react with 3 moles of barium

Experiment Four Limiting Reactant Lab Report

**United States. Energy Research and
Development Administration**



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Organic Experiments Walter W. Linstromberg, Henry E. Baumgarten, 1987 **Improving Student Comprehension in Chemistry Laboratories** Tracy Lynn Haroff, 2006 **Scientific and Technical Aerospace Reports**, 1988 **Chem 5e Irm** Steven S. Zumdahl, 2000-02 **Chemistry** Steven S. Zumdahl, 1996-12 Special Report, 1990 Experiments in General Chemistry R. A. D. Wentworth, Darrell D. Ebbing, 1993 Laboratory Manual for Principles of General Chemistry J. A. Beran, Mark Lassiter, 2022-08-16

Laboratory Manual for Principles of General Chemistry 11th Edition covers two semesters of a general chemistry laboratory program. The material focuses on the lab experiences that reinforce the concepts that not all experimental conclusions are the same and depend on identifying an appropriate experimental procedure, selecting the proper apparatus, employing the proper techniques, systematically analyzing and interpreting the data, and minimizing inherent variables. As a result of good data, a scientific and analytical conclusion is made, which may or may not be right but is certainly consistent with the data. Experiments write textbooks; textbooks don't write experiments. A student's scientific literacy grows when experiences and observations associated with the scientific method are encountered. Further experimentation provides additional cause-effect observations, leading to an even better understanding of the experiment. The 11th edition's experiments are informative and challenging while offering a solid foundation for technique, safety, and experimental procedure. The reporting and analysis of the data and the pre and post lab questions focus on the intuitiveness of the experiment. The experiments may accompany any general chemistry textbook and are compiled at the beginning of each curricular unit. An Additional Notes column is included in each experiment's Report Sheet to provide a space for recording observations and data during the experiment. Continued emphasis on handling data is supported by the Data Analysis section.

NASA Scientific and Technical Reports United States. National Aeronautics and Space Administration Scientific and Technical Information Division, 1965 A Selected Listing of NASA Scientific and Technical Reports for ... United States. National Aeronautics and Space Administration. Scientific and Technical Information Division, 1964 **NASA Tech Briefs**, 1980 ERDA Energy Research Abstracts United States. Energy Research and Development Administration, 1977 Energy Research Abstracts, 1993 **The Electron Capture Detector and The Study of Reactions With Thermal Electrons** E. C. M. Chen, E. S. D. Chen, 2004-04-05

Broad in scope, this book describes the general theory and practice of using the Electron Capture Detector (ECD) to study reactions of thermal electrons with molecules. It reviews electron affinities and thermodynamic and kinetic parameters of atoms, small molecules, and large organic molecules obtained by using various methods. Summarizes other methods for studying reactions of thermal electrons with molecules. Discusses applications in analytical chemistry, physical chemistry, and biochemistry. Provides a data table of electron affinities.

ERDA Energy Research Abstracts United States. Energy Research and Development Administration. Technical Information Center, 1977 **Laboratory Manual for Principles of General Chemistry** Jo Allan Beran, 2010-11-01

This

new edition of the Beran lab manual emphasizes chemical principles as well as techniques The manual helps students understand the timing and situations for the various techniques The Beran lab manual has long been a market leading lab manual for general chemistry Each experiment is presented with concise objectives a comprehensive list of techniques and detailed lab intros and step by step procedures

Multiphase Catalytic Reactors Zeynep Ilsen Önsan,Ahmet Kerim Avci,2016-06-09 Provides a holistic approach to multiphase catalytic reactors from their modeling and design to their applications in industrial manufacturing of chemicals Covers theoretical aspects and examples of fixed bed fluidized bed trickle bed slurry monolith and microchannel reactors Includes chapters covering experimental techniques and practical guidelines for lab scale testing of multiphase reactors Includes mathematical content focused on design equations and empirical relationships characterizing different multiphase reactor types together with an assortment of computational tools Involves detailed coverage of multiphase reactor applications such as Fischer Tropsch synthesis fuel processing for fuel cells hydrotreating of oil fractions and biofuels processing

Technical Report - Jet Propulsion Laboratory, California Institute of Technology Jet Propulsion Laboratory (U.S.), **Nuclear Science Abstracts** ,1975-08 *Government Reports Announcements & Index* ,1994-02

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