

Experiment 25

Calorimetry

Andy Warhol



A set of nested coffee cups is a good constant pressure calorimeter.

- To determine the specific heat of a metal
- To determine the enthalpy of neutralization for a strong acid–strong base reaction
- To determine the enthalpy of solution for the dissolution of a salt

OBJECTIVES

The following techniques are used in the Experimental Procedure:

TECHNIQUES



Accompanying all chemical and physical changes is a transfer of heat (energy); heat may be either evolved (exothermic) or absorbed (endothermic). A **calorimeter** is the laboratory apparatus that is used to measure the quantity and direction of heat flow accompanying a chemical or physical change. The heat change in chemical reactions is quantitatively expressed as the **enthalpy (or heat) of reaction**, ΔH , at constant pressure. ΔH values are negative for exothermic reactions and positive for endothermic reactions.

INTRODUCTION

Three quantitative measurements of heat are detailed in this experiment: measurements of the specific heat of a metal, the heat change accompanying an acid–base reaction, and the heat change associated with the dissolution of a salt in water.

ΔH values are often expressed as J/mol or kJ/mol

The energy (heat, expressed in joules, J) required to change the temperature of one gram of a substance by 1°C is the **specific heat**¹ of that substance:

Specific Heat of a Metal

$$\text{specific heat} \left(\frac{J}{g \cdot ^\circ C} \right) = \frac{\text{energy } (J)}{\text{mass } (g) \times \Delta T (^\circ C)} \quad (25.1)$$

or, rearranging for energy,

$$\text{energy } (J) = \text{specific heat} \left(\frac{J}{g \cdot ^\circ C} \right) \times \text{mass } (g) \times \Delta T (^\circ C) \quad (25.2)$$

ΔT is the temperature change of the substance. Although the specific heat of a substance changes slightly with temperature, for our purposes, we assume it is constant over the temperature changes of this experiment.

The specific heat of a metal that does not react with water is determined by (1) heating a measured mass of the metal, M , to a known (higher) temperature; (2) placing it into a measured amount of water at a known (lower) temperature; and (3) measuring the final equilibrium temperature of the system after the two are combined.

¹The specific heat of a substance is an intensive property [independent of sample size], as are its melting point, boiling point, density, and so on.

Chemistry Lab Manual Beran Experiment 25 Answers

Clemens Wendtner



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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

Laboratory Manual Jo A. Beran, 1990 Teachers Manual to Accompany Laboratory for General Chemistry Beran, 1986-05 *Laboratory Manual for Fundamentals of Chemistry 3/E* Jo A. Beran, 1988

Chemistry in the Laboratory Jo A. Beran, 1996 This updated and revised chemistry manual provides a well rounded understanding of concepts in the general chemistry laboratory Utilising visual aids experiments and equipment are explained and results and their pertinence discussed

American Book Publishing Record, 1995 **Paperbound Books in Print**, 1984 *Paperbound Books in Print* 1995 Reed Reference Publishing, Reference Reed, 1995-12

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Table of Contents Chemistry Lab Manual Beran Experiment 25 Answers

1. Understanding the eBook Chemistry Lab Manual Beran Experiment 25 Answers
 - The Rise of Digital Reading Chemistry Lab Manual Beran Experiment 25 Answers
 - Advantages of eBooks Over Traditional Books
2. Identifying Chemistry Lab Manual Beran Experiment 25 Answers
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Chemistry Lab Manual Beran Experiment 25 Answers
 - User-Friendly Interface
4. Exploring eBook Recommendations from Chemistry Lab Manual Beran Experiment 25 Answers
 - Personalized Recommendations
 - Chemistry Lab Manual Beran Experiment 25 Answers User Reviews and Ratings
 - Chemistry Lab Manual Beran Experiment 25 Answers and Bestseller Lists
5. Accessing Chemistry Lab Manual Beran Experiment 25 Answers Free and Paid eBooks
 - Chemistry Lab Manual Beran Experiment 25 Answers Public Domain eBooks
 - Chemistry Lab Manual Beran Experiment 25 Answers eBook Subscription Services
 - Chemistry Lab Manual Beran Experiment 25 Answers Budget-Friendly Options
6. Navigating Chemistry Lab Manual Beran Experiment 25 Answers eBook Formats
 - ePub, PDF, MOBI, and More
 - Chemistry Lab Manual Beran Experiment 25 Answers Compatibility with Devices
 - Chemistry Lab Manual Beran Experiment 25 Answers Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Chemistry Lab Manual Beran Experiment 25 Answers
 - Highlighting and Note-Taking Chemistry Lab Manual Beran Experiment 25 Answers
 - Interactive Elements Chemistry Lab Manual Beran Experiment 25 Answers

8. Staying Engaged with Chemistry Lab Manual Beran Experiment 25 Answers
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Chemistry Lab Manual Beran Experiment 25 Answers
9. Balancing eBooks and Physical Books Chemistry Lab Manual Beran Experiment 25 Answers
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Chemistry Lab Manual Beran Experiment 25 Answers
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Chemistry Lab Manual Beran Experiment 25 Answers
 - Setting Reading Goals Chemistry Lab Manual Beran Experiment 25 Answers
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Chemistry Lab Manual Beran Experiment 25 Answers
 - Fact-Checking eBook Content of Chemistry Lab Manual Beran Experiment 25 Answers
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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