

Experiment 25

Calorimetry

Andy Wislock



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

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

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.

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

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

or, rearranging for energy,

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

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 Principle Of Calorimetry Lab Manual

**Neena Sinha, R Rangarajan, R P
Manchanda, R K Gupta, Rajesh Kumar**



Chemistry Principle Of Calorimetry Lab Manual:

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

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Lab Manual for General, Organic, and Biochemistry Denise Guinn, Rebecca Brewer, 2009-08-21 Teaching all of the necessary concepts within the constraints of a one term chemistry course can be challenging Authors Denise Guinn and Rebecca Brewer have drawn on their 14 years of experience with the one term course to write a textbook that incorporates biochemistry and organic chemistry throughout each chapter emphasizes cases related to allied health and provides students with the practical quantitative skills they will need in their professional lives Essentials of General Organic and Biochemistry captures student interest from day one with a focus on attention getting applications relevant to health care professionals and as much pertinent chemistry as is reasonably possible in a one term course Students value their experience with chemistry getting a true sense of just how relevant it is to their chosen profession To browse a sample chapter view sample ChemCasts and more visit www.whfreeman.com/gob

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Chemistry Lab Manual Neena Sinha, R Rangarajan, R P Manchanda, R K Gupta, Rajesh Kumar, Lab Manual

Laboratory Manual Jo A. Beran, 1990

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Illustrated Guide to Home Chemistry Experiments Robert Bruce Thompson, 2012-02-17 For students DIY hobbyists and science buffs who can no longer get real chemistry sets this one of a kind guide explains how to set up and use a home chemistry lab with step by step instructions for conducting experiments in basic chemistry not just to make pretty colors and stinky smells but to learn how to do real lab work Purify alcohol by distillation Produce hydrogen and oxygen gas by electrolysis Smelt metallic copper from copper ore you make yourself Analyze the makeup of seawater bone and other common substances Synthesize oil of wintergreen from aspirin and rayon fiber from paper Perform forensics tests for fingerprints blood drugs and poisons and much more From the 1930s through the 1970s chemistry sets were among the most popular Christmas gifts selling in the millions But two decades ago real chemistry sets began to disappear as manufacturers and retailers became concerned about liability em The Illustrated Guide to Home Chemistry Experiments steps up to the plate with lessons on how to equip your home chemistry lab master laboratory skills and work safely in your lab The bulk of this book consists of 17 hands on chapters that include multiple laboratory sessions on the following topics Separating Mixtures Solubility and Solutions Colligative Properties of Solutions Introduction to Chemical Reactions Stoichiometry Reduction Oxidation Redox Reactions Acid Base Chemistry Chemical Kinetics Chemical Equilibrium and Le Chatelier's Principle Gas Chemistry Thermochemistry and Calorimetry Electrochemistry Photochemistry Colloids and Suspensions Qualitative Analysis Quantitative Analysis Synthesis of Useful Compounds Forensic Chemistry With plenty of full color illustrations and photos Illustrated Guide to Home Chemistry Experiments offers introductory level sessions suitable for a middle school or first year high school chemistry laboratory course and more advanced sessions suitable for students who intend to take the College Board Advanced Placement AP Chemistry exam A student who completes all of the laboratories in this book will have done the equivalent of two full years of high school chemistry lab work or a first year college general chemistry laboratory course This hands on introduction to real chemistry using real equipment real chemicals and real quantitative experiments is ideal for the many thousands of young people and adults who want to experience the magic of chemistry

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Table of Contents Chemistry Principle Of Calorimetry Lab Manual

1. Understanding the eBook Chemistry Principle Of Calorimetry Lab Manual
 - The Rise of Digital Reading Chemistry Principle Of Calorimetry Lab Manual
 - Advantages of eBooks Over Traditional Books
2. Identifying Chemistry Principle Of Calorimetry Lab Manual
 - 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 Principle Of Calorimetry Lab Manual
 - User-Friendly Interface
4. Exploring eBook Recommendations from Chemistry Principle Of Calorimetry Lab Manual
 - Personalized Recommendations
 - Chemistry Principle Of Calorimetry Lab Manual User Reviews and Ratings
 - Chemistry Principle Of Calorimetry Lab Manual and Bestseller Lists

5. Accessing Chemistry Principle Of Calorimetry Lab Manual Free and Paid eBooks
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 - Chemistry Principle Of Calorimetry Lab Manual eBook Subscription Services
 - Chemistry Principle Of Calorimetry Lab Manual Budget-Friendly Options
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 - ePub, PDF, MOBI, and More
 - Chemistry Principle Of Calorimetry Lab Manual Compatibility with Devices
 - Chemistry Principle Of Calorimetry Lab Manual Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Chemistry Principle Of Calorimetry Lab Manual
 - Highlighting and Note-Taking Chemistry Principle Of Calorimetry Lab Manual
 - Interactive Elements Chemistry Principle Of Calorimetry Lab Manual
8. Staying Engaged with Chemistry Principle Of Calorimetry Lab Manual
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Chemistry Principle Of Calorimetry Lab Manual
9. Balancing eBooks and Physical Books Chemistry Principle Of Calorimetry Lab Manual
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Chemistry Principle Of Calorimetry Lab Manual
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Chemistry Principle Of Calorimetry Lab Manual
 - Setting Reading Goals Chemistry Principle Of Calorimetry Lab Manual
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Chemistry Principle Of Calorimetry Lab Manual
 - Fact-Checking eBook Content of Chemistry Principle Of Calorimetry Lab Manual
 - 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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