

Thermochemistry

Date Planned : __ / __ / __	Daily Tutorial Sheet	Expected Duration : 90 Min
Actual Date of Attempt : __ / __ / __	Level-0	Exact Duration : _____

Very Short Answer Type (1 Mark)

- The heat of combustion of benzene in a bomb calorimeter (i.e., constant volume) was found to be $3263.9 \text{ kJ mol}^{-1}$ at 25°C . Calculate the heat of combustion of benzene at constant pressure.
- The molar heat of formation of $\text{NH}_4\text{NO}_3(\text{s})$ is -367.54 kJ and those of $\text{N}_2\text{O}(\text{g})$ and $\text{H}_2\text{O}(\text{l})$ are $+81.46$ and -285.78 kJ respectively at 25°C and 1.0 atmospheric pressure. Calculate ΔH and ΔU for the reaction.
- 1 g of graphite is burnt in a bomb calorimeter in excess of oxygen at 298 K and 1 atmospheric pressure according to the equation $\text{C}(\text{graphite}) + \text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g})$. During the reaction, temperature rises from 298 K to 299 K. If the heat capacity of the bomb calorimeter is 20.7 kJ/K , what is the enthalpy change for the above reaction at 298 K and 1 atm?
- Calculate the enthalpy of hydration of anhydrous copper sulphate (CuSO_4) into hydrated copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$). Given that the enthalpies of solution of anhydrous copper sulphate and hydrated copper sulphate are -66.5 and $+11.7 \text{ kJ mol}^{-1}$ respectively.
- Calculate the standard enthalpy of formation of SO_3 at 298 K using the following reactions and enthalpies.
 $\text{S}_8(\text{s}) + 8\text{O}_2(\text{g}) \longrightarrow 8\text{SO}_2(\text{g}), \Delta H^\circ = -2775 \text{ kJ mol}^{-1}$;
 $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \longrightarrow 2\text{SO}_3(\text{g}), \Delta H^\circ = -198 \text{ kJ mol}^{-1}$
- From the following data at 25°C , calculate the bond energy of O - H bond:
 (i) $\text{H}_2(\text{g}) \longrightarrow 2\text{H}(\text{g}), \Delta H_1 = 104.2 \text{ kcal}$ (ii) $\text{O}_2(\text{g}) \longrightarrow 2\text{O}(\text{g}), \Delta H_2 = 118.4 \text{ kcal}$
 (iii) $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \longrightarrow \text{H}_2\text{O}(\text{g}), \Delta H_3 = -57.8 \text{ kcal}$

Short Answer Type-I (2 Marks)

- A 1.250 g sample of Octane (C_8H_{18}) is burned in excess of oxygen in a bomb calorimeter. The temperature of the calorimeter rises from 294.05 K to 300.78 K. If heat capacity of the calorimeter is 8.93 kJ/K , find the heat transferred to the calorimeter. Also calculate the enthalpy combustion of the sample of octane.
- 0.16 g of methane was subjected to combustion at 27°C in a bomb calorimeter system. The temperature of the calorimeter system (including water) was found to rise by 0.5°C . Calculate the heat of combustion of methane at (i) constant volume, and (ii) constant pressure. The thermal capacity of the calorimeter system is 17.7 kJ K^{-1} ($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

Thermochemistry Packet Types Of Energy

Marcel A. Müller



Thermochemistry Packet Types Of Energy:

Springer Handbook of Electrochemical Energy Cornelia Breitung, Karen Swider-Lyons, 2016-12-05 This comprehensive handbook covers all fundamentals of electrochemistry for contemporary applications. It provides a rich presentation of related topics of electrochemistry with a clear focus on energy technologies. It covers all aspects of electrochemistry starting with theoretical concepts and basic laws of thermodynamics, non-equilibrium thermodynamics, and multiscale modeling. It further gathers the basic experimental methods such as potentiometry, reference electrodes, ion-sensitive electrodes, voltammetry, and amperometry. The contents cover subjects related to mass transport, the electric double layer, ohmic losses, and experimentation affecting electrochemical reactions. These aspects of electrochemistry are especially examined in view of specific energy technologies including batteries, polymer electrolyte, and biological fuel cells, electrochemical capacitors, electrochemical hydrogen production, and photoelectrochemistry. Organized in six parts, the overall complexity of electrochemistry is presented and makes this handbook an authoritative reference and definitive source for advanced students, professionals, and scientists particularly interested in industrial and energy applications. **Energy Research Abstracts**, 1989

Publications of the National Institute of Standards and Technology ... Catalog National Institute of Standards and Technology (U.S.), 1987 **Handbook of Nanoscience, Engineering, and Technology** William A. Goddard III, Donald Brenner, Sergey Edward Lyshevski, Gerald J. Iafrate, 2018-09-03 In his 1959 address "There is Plenty of Room at the Bottom," Richard P. Feynman speculated about manipulating materials atom by atom and challenged the technical community to find ways of manipulating and controlling things on a small scale. This visionary challenge has now become a reality with recent advances enabling atomistic level tailoring and control of materials. Exemplifying Feynman's vision, *Handbook of Nanoscience, Engineering, and Technology*, Third Edition, continues to explore innovative nanoscience, engineering, and technology areas. Along with updating all chapters, this third edition extends the coverage of emerging nano areas even further. Two entirely new sections on energy and biology cover nanomaterials for energy storage devices, photovoltaics, DNA devices, and assembly; digital microfluidic lab on a chip; and much more. This edition also includes new chapters on nanomagnet logic, quantum transport at the nanoscale, terahertz emission from Bloch oscillator systems, molecular logic, electronic optics in graphene, and electromagnetic metamaterials. With contributions from top scientists and researchers from around the globe, this color handbook presents a unified, up-to-date account of the most promising technologies and developments in the nano field. It sets the stage for the next revolution of nanoscale manufacturing where scalable technologies are used to manufacture large numbers of devices with complex functionalities.

Publications of the National Bureau of Standards ... Catalog United States. National Bureau of Standards, 1983

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unique problem solving approach taken by the Chemical Principles text The new edition of the Study Guide includes many new worked out examples *Publications* United States. National Bureau of Standards,1987 **Scientific and Technical Aerospace Reports** ,1994 **A New-Generation Density Functional** Igor Ying Zhang,Xin Xu,2013-11-19 A New Generation Density Functional Towards Chemical Accuracy for Chemistry of Main Group Elements covers the most recent progress in the development of a new generation of density functional theory DFT for accurate descriptions of thermochemistry thermochemical kinetics and nonbonded interactions of main group molecules In this book the authors present the doubly hybrid density functionals DHDFs which dramatically improve the accuracy for predictions of critical properties by including the role of the virtual unoccupied orbitals The authors not only discuss the theoretical bases of three classes of DHDFs but also demonstrate their performance using some well established benchmarking data sets

Publications of the National Bureau of Standards United States. National Bureau of Standards,1983 NBS Special Publication ,1968 *The Encyclopedia of Mass Spectrometry* Michael L. Gross,P.B. Armentrout,R. M. Caprioli,2003-07-25 This multi volume work provides comprehensive coverage of the full range of topics and techniques in mass spectrometry Techniques methods and applications are described in detail including limitations current problems and areas in which the method does not succeed well Technical Abstract Bulletin ,1981 Reviews in Computational Chemistry, Volume 29 Abby L. Parrill,Kenny B. Lipkowitz,2016-04-11 The Reviews in Computational Chemistry series brings together leading authorities in the field to teach the newcomer and update the expert on topics centered on molecular modeling such as computer assisted molecular design CAMD quantum chemistry molecular mechanics and dynamics and quantitative structure activity relationships QSAR This volume like those prior to it features chapters by experts in various fields of computational chemistry Topics in Volume 29 include Noncovalent Interactions in Density Functional Theory Long Range Inter Particle Interactions Insights from Molecular Quantum Electrodynamics QED Theory Efficient Transition State Modeling using Molecular Mechanics Force Fields for the Everyday Chemist Machine Learning in Materials Science Recent Progress and Emerging Applications Discovering New Materials via a priori Crystal Structure Prediction Introduction to Maximally Localized Wannier Functions Methods for a Rapid and Automated Description of Proteins Protein Structure Protein Similarity and Protein Folding **Chemistry** Steven S. Zumdahl,1989 Science Abstracts ,1965 **Soviet Progress in Chemistry** ,1990 **Femtosecond Reaction Dynamics** Douwe A. Wiersma,1994 Presents the state of the art both from a theoretical and experimental point of view in the field of femtochemistry The book contains in depth coverage of femtosecond gasphase reaction dynamics coherent and coherence effects in solution and coherent control of chemical reactions

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