Nathan Gillispie

The Calculation of Heat Capacity Ratios of Nitrogen and Argon Using Adiabatic Expansion

Lab Partners: Peyton Strickland, Kelsi Sogge

Introduction:

Experimental Methods:

A 5-gallon glass jug was used as a vessel. This was eventually closed by a three-holed rubber stopper with outlet tubes A, B and C. Before beginning the experiment, the vessel was filled with either argon or nitrogen. The procedure for both was identical: the vessel was lowered upside down into a water bath with a tube allowing air in the vessel to be displaced by the water. The same tube was plugged into a regulator on the gas cylinder and the gas was allowed to displace the water in vessel until gas flowed freely out the surface of the water. The vessel was quickly raised out of the water bath and capped with the rubber stopper. Tube A was attached to a digital pressure gauge to determine the difference between ambient atmospheric pressure and the pressure in the vessel. Tube B was attached to the gas canister and tube C was clamped closed. Temperature T1 was recorded.

The vessel was pressurized to around 1.6 psi above atmospheric and allowed to return to room temperature. The pressure was checked again to ensure 1.6 psi after thermal contraction and to ensure there were no leaks in the system. The pressure P1 was recorded. The gas was allowed to adiabatically expand by quickly removing the stopper and replacing it.

Results and Discussion:

Conclusions:

Safety: When working around high pressures

References:

The objective of the lab:

adiabatic def

heat capacity def

assume knowledge of ideal gasses

Chemistry 451 Lab Report Grading Sheet

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Lab Partners:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Experiment: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Introduction: 15 points

\_\_\_\_/3 Name, title, date, lab partners names, grading sheet are included and correct.

\_\_\_\_/2 Clear statement of the objective of the experiment is presented.

\_\_\_\_/10 most important ideas and equations (define all symbols!) for the lab are concisely summarized.

Methods: 10 points

\_\_\_\_/5 Instrumental apparatus is explained and diagramed as necessary.

\_\_\_\_/5 Experimental description allows another 451 student to reproduce your work.

Results and Discussion: 50 points

\_\_\_\_/15 All data is clearly presented in a table or graph that is referenced and described in the text.

\_\_\_\_/5 All data has units and experimental uncertainty clearly identified.

\_\_\_\_/10 Calculations and derived information are discussed briefly in narrative, and appendices referenced.

\_\_\_\_/10 Final results and all additional information requested in handout is presented clearly in narrative.

\_\_\_\_/5 Literature/ theoretical values are listed; appropriate comparisons are made, including error propagation.

\_\_\_\_/5 Major sources of error given (includes magnitude and direction that they would impact final result).

Conclusions: 10 points

\_\_\_\_/4 Quantitative summary of results (and uncertainty) reflects the objective statement from the introduction.

\_\_\_\_/4 Discussion of errors suggests ways to improve or fatal flaws (goes beyond what is in the discussion).

\_\_\_\_/2 Results are placed into the context of the broader scientific picture, with future applications noted.

Safety/References: 5 points

\_\_\_\_/3 Major safety issues are addressed, MSDS are cited.

\_\_\_\_/2 Citations for introduction, safety and literature or theoretical values are correct and complete.

General Writing: 10 points

\_\_\_\_/5 Scientific writing style is used, including proper tenses and voices.

\_\_\_\_/5 Organization, sentence structure, and flow make the report easy to follow and understand.

\_\_\_\_/100 Total Score