

# Bomb Calorimetry

**Background Reading:** Class notes and “Bomb Calorimetry Addendum” from your class notes

**Goal of the Experiment:** To determine how resonance and ring strain can affect the stability of organic compounds by calculating the change in enthalpy of formation for the hydrocarbons in Figure 1 and by comparing these values to the literature values (if obtainable) and to the experimental enthalpy changes obtained for benzene, naphthalene, anthracene, and possibly rhodamine B through bomb calorimetry

Strategy: By burning compounds in a constant-volume calorimeter, we can determine the amount of heat released, and thus, the heat of formation of structural isomers and of a series of polyaromatic hydrocarbons.

**Assignment:** You will perform this lab with your lab group over a three week period during pchem lab. Each student will write a formal lab report due at the stipulated due date after the lab is performed. This report should adhere to the guidelines outlined in your lab syllabus addendum (handout and on class web page). One rewrite will be allowed. (The final grade will be the average of the first draft and the final draft.)

## Pre-laboratory Exercise

Include these answers in the formal lab report that you turn in. (Please include these as a separate section (an appendix) at the end of the formal lab report.

- (1) Determine what kind of data you will obtain from your observations. By “kind,” I mean the units and a rough idea of the order of magnitude of the numerical data.
- (2) Describe how you will use the data collected to calculate the enthalpy of combustion. This information will appear in the Data Analysis section of your paper.
- (3) Write balanced equations for all of the combustion reactions that take place: benzene, naphthalene, anthracene, and possibly rhodamine B. You can find these structures online, in a text, or in the Aldrich Chemical catalog.

## Procedure

Refer to the Parr 1241/1242 instruction manual (link on web page) for specifics on sample sizes, how to load the calorimeter, and how to run the calorimeter.

Over the three-week period, you will need to combust benzoic acid (calibration of the bomb) and naphthalene, anthracene, and rhodamine B. Run them once each. You should then go back and rerun them all a second time starting with the benzoic acid.

## Precautions and Safety

### **WEAR SAFETY GLASSES OR GOGGLES AT ALL TIMES WHILE IN THE LAB!**

- (1) Do not put more than 0.5 grams of sample in the bomb or any amount of sample that would release more than 33 kJ when burned in oxygen.
- (2) Do not put a sample that might react with *explosive violence* into the bomb.
- (3) Do not put more than 40 atm (590 psi) of pressure into the bomb.
- (4) Do not fire the bomb unless it is immersed in a coolant, such as water.
- (5) Do not fire the bomb if gas bubbles are released from any point on the bomb when it is submerged in water.
- (6) Stand away from the bomb when it is firing, and remain away from it from 30 seconds after firing.
- (7) If any part of the bomb is damaged, corroded, or in any way appears to be weakened, do not use the bomb. These parts must be replaced and the bomb must be in good working condition for safe usage.