For best results please view this as a slide show. You can hit the F5 key or go to the Slide Show tab on the menu bar and click on From Beginning. Page Down and Page Up will move you through the presentation.

If you have a Mac do whatever you have to do to play it as a slide show – I don’t know Macs well.

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Experiment #11 – Comparison of the Energy Content of Fuels by Combustion

Laboratory Overview

CHEM 1361

January 2013

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Experimental Background

A combustion process occurs when any substance is burned in the presence of oxygen. The products of a combustion reaction are the oxides of the reactants. In the case of combusting a compound containing carbon and oxygen, the products will include carbon dioxide and water. As an example,

$$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$$

The heat evolved in the burning process is called the heat (or enthalpy) of combustion. In this experiment you will determine the heat of combustion of fuels of two different types. One type – the hydrocarbons – contain only carbon and hydrogen. The other type – oxygenated compounds - contains carbon, hydrogen, and oxygen.
The fuels to be considered in this experiment are as follows:

<table>
<thead>
<tr>
<th>Hydrocarbons</th>
<th>Oxygenated Compounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name</td>
</tr>
<tr>
<td>Formula</td>
<td>Formula</td>
</tr>
<tr>
<td>hexane</td>
<td>methanol</td>
</tr>
<tr>
<td>C_6H_{14}</td>
<td>CH_3OH</td>
</tr>
<tr>
<td>kerosene</td>
<td>ethanol</td>
</tr>
<tr>
<td>C_{10}H_{22}</td>
<td>C_2H_5OH</td>
</tr>
<tr>
<td>lamp oil</td>
<td>n-propanol</td>
</tr>
<tr>
<td>C_{12}H_{26}</td>
<td>C_3H_7OH</td>
</tr>
<tr>
<td>candle wax</td>
<td>n-pentanol</td>
</tr>
<tr>
<td>C_{40}H_{82}</td>
<td>C_5H_{11}OH</td>
</tr>
</tbody>
</table>

You will not have enough time to determine the heats of combustion of all of these fuels, so you will work with one or two of the fuels. Your class data will be gathered for purposes of drawing some conclusions about heats of combustion of these materials.
Determining the Heat Evolved

A measured amount of the selected fuel will be burned with the heat being absorbed by an aluminum can containing water. The temperature rise of the water, assumed to be the same as that of the can, will be monitored by a thermometer.

The heat absorbed by the water and the can may be determined through the standard relationship

\[ \text{Heat} = \text{specific heat} \times \text{mass} \times \text{change in temperature} \]

or

\[ q = c \times m \times \Delta T \]

The sum of the heat absorbed by the water and that absorbed by the aluminum can provides the total heat absorbed. Knowing the mass of fuel consumed, the heat absorbed per gram (or per mol) of fuel may be determined.

Note the sophisticated way we keep the temperature probe cable from getting in the flame.