**Energy Comparison of Fuels**

**Hands-On Labs, Inc. Version 42-0154-00-01**

**Lab RepoRt assistant**

This document is not meant to be a substitute for a formal laboratory report. The Lab Report Assistant is simply a summary of the experiment’s questions, diagrams if needed, and data tables that should be addressed in a formal lab report. The intent is to facilitate student’s writing of lab reports by providing this information in an editable file which can be sent to an instructor

**Exercise 1: Energy Content of Fuels**

**obseRvations**

|  |  |
| --- | --- |
| Data Table 1: Density of Water | |
| **Mass of 10 mL of distilled water (g)** | **Density of water (g/mL)** |
|  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data Table 2: Calorimetric Data | | | | |
| **Fuel:** | **Initial mass of fuel (g)** | **Final mass of**  **fuel (g)** | **Initial temperature (oC)** | **Final**  **temperature (oC)** |
| **Fuel canister:**  **(diethylene glycol)** |  |  |  |  |
| **Tea candle: (paraffin)** |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Data Table 3: Calories Released per Gram of Fuel | | | | |
| **Fuel type** | **ΔT (oC)** | **Calories absorbed by water (cal)** | **Grams of fuel**  **consumed (g)** | **calories/gram** |
| **Fuel canister:**  **(diethylene glycol)** |  |  |  |  |
| **Tea candle: (paraffin)** |  |  |  |  |

**Questions**

A. Which fuel was more efficient, i.e., produced more calories per gram? Explain your answer.

B. Explain the difference in the efficiencies of the fuels you tested based on the chemical structures of the fuels.

C. Conduct research on both diethylene glycol and paraffin wax; for each fuel, summarize in one or two sentences how these fuels are synthesized.

D. What are the possible sources of error in this experiment? How could the errors be reduced in future experiments?

E. A kilowatt hour (kWh) of energy (common measurement of electricity) is equivalent to 860,420.65 calories. The mass of one mole (6.022 x 1023 molecules) of diethylene glycol is

106.11 grams, the mass of one mole of a representative paraffin wax (C30H62) is 422.76 grams (we don’t know the actual composition of the wax, so we will use this as an estimate), and the mass of one mole of carbon dioxide is 44.00 g. If the fuel is completely combusted, one mole of diethylene glycol will produce four moles of CO2, because it has four atoms of carbon. In contrast, combusting one mole of the representative paraffin will produce 30 moles of carbon dioxide. Given this information, calculate the number of moles and the mass of carbon dioxide that would be produced by combusting enough of each of the fuels to release one kilowatt hour of energy. (HINT: you will need to calculate how many grams of the two fuels release 860,420.65 calories. Next, you will need to determine how many moles of the fuel that number of grams is equivalent

to. Then, this can be used to calculate the moles and the mass of CO2 that are produced).

F. Research how different fossil fuels compare in terms of the amount of carbon dioxide released per kWh of energy. How much carbon dioxide is produced by burning a gallon of gasoline? A gallon of diesel?

G. Compare the amount of carbon dioxide released in one year from burning coal to power ten, 65-watt incandescent bulbs with the amount released from powering ten, 13-watt compact fluorescent light (CFL) bulbs. Assume the bulbs are on four hours per day for 365 days. You will need to determine the kilowatt hours (kWh) used. First, multiply the wattage of the bulbs by the number of light bulbs to determine the total watts used in one hour. Then multiply the result by time in hours to obtain the watt hours. Next, divide the result by 1000 to obtain kilowatt hours. On average, 2.1 pounds of carbon dioxide are released for every kWh of electricity produced.