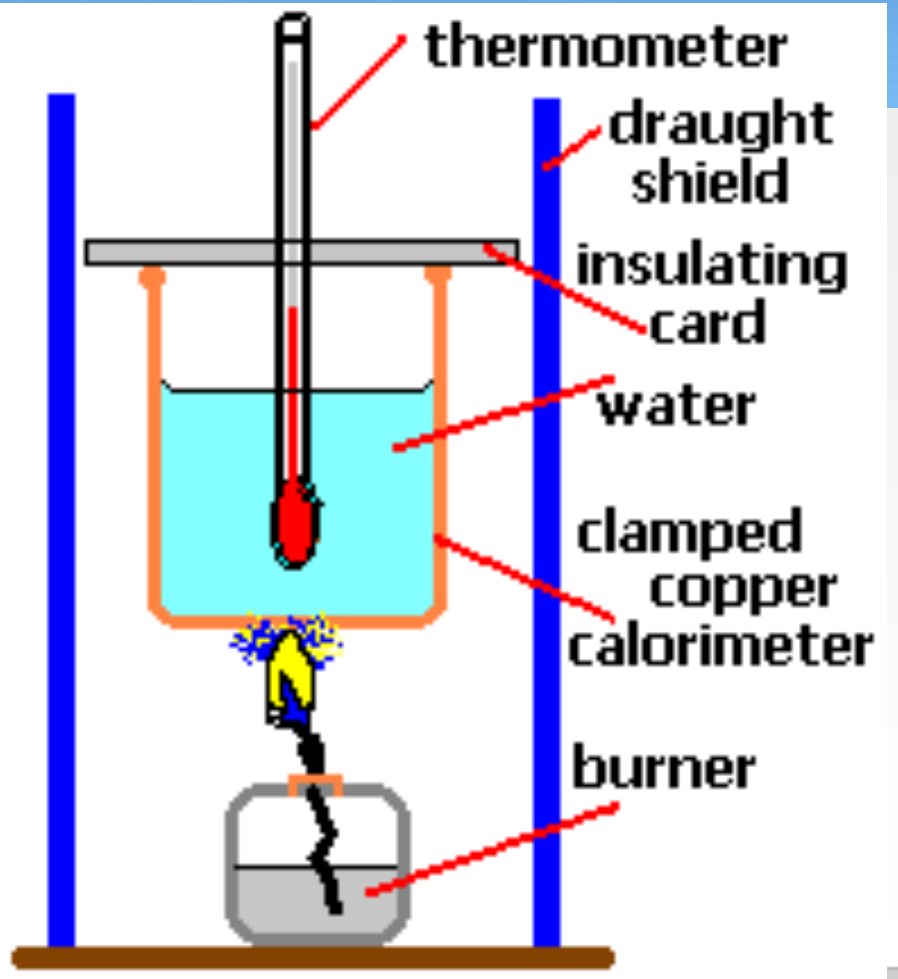
Everyday Calorimetry

- whenever we heat water, its like using a calorimeter
- calorimeters are used to compare quantities of different fuels that burn to boil water

Different Heat Capacities Effects the Calculations ☺

- in an Everyday Calorimeter, we have to take into account that different materials heat up at different rates
  - $nHm = -(mc\Delta t_{pot} + mc\Delta t_{water})$

Simple Calorimeter



Example:

- Calculate the enthalpy of combustion of 13g of butane C_4H_{10} on a campfire stove that is used to heat a copper pot (500g) filled with 1.5L of water from 17C to 98C?

- when we use calorimeters to determine enthalpies, they may not be 100% efficient
- an analysis of an experiment must take into account the varying amounts of heat energy that are lost to the immediate surroundings and not actually absorbed by water

- one way to determine the efficiency of a simple calorimeter is to calculate the energy released from fuel mass and its standard molar enthalpy of combustion

- alternatively the experimental molar enthalpy can be compared with the reference values

- remember:

$$\text{Efficiency} = \frac{\text{output}}{\text{input}} \times 100\%$$

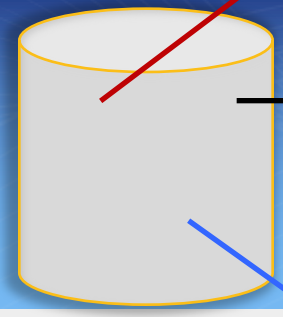
Example 1

- The following data were obtained from an experiment to measure the efficiency of a simple combustion calorimeter heated by a stearic acid candle

$$(\Delta H\ (C_{18}H_{36}O_2) = -1.13 \times 10^4\ kJ/mol)$$

What is the efficiency of the calorimeter?

Temperature Change = +25C



Aluminum Pot = 300g

Containing 150mL Water

50g Stearic Acid Candle Burns

Example 2

- A particular basement hot water heater is 70.0% efficient. What mass of natural gas (assume methane) must burn in order to heat 250kg of water from 5.0°C to 40.0°C?