1. (Due on Monday) A fuel–lean mixture of propane and air enter a torch at 298 K. Determine the percent theoretical air needed to provide an adiabatic flame temperature of 1400 K, using
   (a) enthalpy values as a function of temperature (use the property data sheet), and
   (b) a constant specific heat assumption with a lower heating value of the fuel. Make a reasonable assumption for the specific heat.

The following problems are due Wednesday

2. A mixture of octane vapor and 150 % theoretical air is initially at 298 K, 1 atm pressure. The mixture is enclosed in a rigid container of volume $V = 2$ L. The mixture is ignited, and the system is cooled to a final temperature of 400 K. Calculate the heat transfer from the system and the final system pressure.

3. Methane enters a heater at 298 K, 1 atm pressure with a volumetric flow rate of $\dot{V} = 50$ cc/s. The fuel is mixed with air at the same temperature and pressure, and the mixture has an equivalence ratio of $\Phi = 0.9$. Using a constant specific heat for the products of $c_p = 1.05$ kJ/kg K, calculate and plot the rate of heat transfer from the heater as a function of product exhaust temperature, for $T_P = 298$ K to 400 K. Be sure to include the effect of water condensation in your result. The MATLAB steam functions will be useful in this assignment.