CHEM355 Exam I (Nov 2 2009).
$33\frac{1}{3}$ points / problem with maximum of 100 points.

1. What is the change in entropy when 1 mol of water melts at 0 °C and 1 bar pressure. The enthalpy of fusion for water under standard conditions is 6007 J/mol. The given process is reversible.

2. What is the standard enthalpy of formation ($\Delta_f H^\circ$) for ethane (C_2H_6) at 25 °C? The following standard rection enthalpies at 25 °C are known:

$$(1)\ \mathrm{C}(s, \text{graphite}) + \mathrm{O_2}(g) \rightarrow \mathrm{CO_2}(g),\ \Delta_r H^\circ = -393.5\ \text{kJ mol}^{-1}$$

$$(2)\ \mathrm{H_2}(g) + \frac{1}{2}\mathrm{O_2}(g) \rightarrow \mathrm{H_2O}(l),\ \Delta_r H^\circ = -285.9\ \text{kJ mol}^{-1}$$

$$(3)\ \mathrm{C_2H_6}(g) + 3\frac{1}{2}\mathrm{O_2}(g) \rightarrow 2\mathrm{CO_2}(g) + 3\mathrm{H_2O}(l),\ \Delta_r H^\circ = -1560.1\ \text{kJ mol}^{-1}$$

The formation reaction of ethane corresponds to the reaction of graphite with hydrogen H_2 producing one mole of ethane.

3. One mole of monoatomic ideal gas initially at 298 K and 1.01 MPa expands adiabatically to the final external pressure of 101 kPa (reversible process). What is the final temperature of the gas, heat q, work w, change in internal energy ΔU and change in enthalpy ΔH?