

Handin 6 Thermochemistry

1. For a pure substance the heat capacity can be expressed as $C_p = A + BT + CT^2$. Find the change in the enthalpy for a pure substance for a change in temperature from T_1 to T_2 at constant pressure from:

$$\left(\frac{\partial H}{\partial T}\right)_p = C_p$$

2. The enthalpy of combustion at 25°C for camphor, $C_{10}H_{16}O$, is -5904 kJ/mol. Calculate $\Delta_f H^\circ$ at this temperature.

3. The enthalpy of formation of pure $H_2SO_4(l)$ is -813.99 kJ mol⁻¹. The enthalpy of solution of $H_2SO_4(l)$ is -96.19 kJ mol⁻¹, to give an infinitely dilute solution. Calculate the enthalpy of formation of $SO_4^{2-}(aq)$.

4. The calculated equilibrium bond length for the C-H bond in ethane is $r_e = 1.0856$ Å. The potential energy for the C-H stretch is listed as a function of bond length in the following table. Calculate the stretching force constant and the cubic stretch constant. (Don't bother to calculate uncertainties, so Excel curve fitting is sufficient. Turn in a print out of your spreadsheet)

| r_{C-H} (Å) | ϵ_{str} (kJ mol ⁻¹) |
|---------------|--|
| 1 | 15.136 |
| 1.05 | 2.3630 |
| 1.075 | 0.1917 |
| 1.0856 | 0 |
| 1.1 | 0.3439 |
| 1.15 | 6.414 |