Problem 1

The molar entropy of an ideal gas is given by

$$s = s_0 + cRln\frac{u}{u_0} + Rln\frac{v}{v_0}.$$

Calculate the entropy of mixing of a multi-component ideal gas.

Problem 2

A thermodynamic system obeys the following equations of state

$$U = \frac{1}{2}PV \quad \text{and} \quad T^2 = \frac{AU^{3/2}}{VN^{1/2}}.$$

Calculate the fundamental relation.

Problem 3

Calculate the fundamental relation for an empty vessel whose wall is maintained at a constant temperature T. [Hint: The empty vessel is not really empty, it contains electromagnetic radiation.]

Problem 4

(a) A small quantity of heat ΔQ is transferred from a large heat reservoir at temperature T_1 to another large heat reservoir at temperature T_2, with $T_1 > T_2$. The reservoirs are so large that there is no observable change in temperature. Show that the change of entropy for the entire system is positive. (b) An ideal gas of n kmol expands from volume V_A to volume $V_B > V_A$ with initial and final temperatures the same. Find the change of entropy of the gas. (c) A copper cylinder of negligible heat capacity contains 1 kg of water just above the freezing point. An identical cylinder contains same amount of water just below the boiling point. If the two cans are brought into thermal contact, find the change in entropy of the system.

Practice problems (below) will not be discussed in the tutorial

Problem 5

Solve problems 2.2-1 through 2.2-7, 2.8-1, 2.8-2 from the book by Callen (2nd edition).

Problem 6

Solve problems 3.3-2 through 3.3-4, 3.5-1, 3.9-1 through 3.9-6 from the book by Callen (2nd edition).