

## Answer on the question #47843, Chemistry, Physical Chemistry

### Question:

Three moles of an ideal gas (closed system) initially at at 56 °C and 8.00 bar undergoes an irreversible, adiabatic process until the final pressure is 3.00 bar. The work done during the process is -615 J. Calculate  $\Delta S_{sys}$  and  $\Delta S_{surr}$  for the process.  $C_p = 32.5 \text{ J/(K mol)}$

### Solution

By definition in adiabatic process  $Q=0$ , so

$$\Delta S_{surr} = 0$$

For the irreversible process:

$$\Delta S_{sys} \neq 0$$

$$\Delta S_{sys} = \frac{Q}{T_1}$$

$$Q = \Delta U + A$$

$$\begin{aligned}\Delta U &= C * n * (T_2 - T_1) = C * 3 * \left( \frac{p_2 T_1}{p_1} - T_1 \right) = 32.5 * 3 * \left( \frac{3.00}{8.00} - 1 \right) (56 + 273) \\ &= -20048.4 \text{ J}\end{aligned}$$

$$Q = -20048.4 - 615 = -20663.4 \text{ J}$$

$$\Delta S_{sys} = \frac{Q}{T_1} = \frac{-20663.4}{56 + 273} = -62.8 \text{ J/K}$$

**Answer:**  $\Delta S_{surr} = 0$ ,  $\Delta S_{sys} = -62.8 \text{ J/K}$ .