Question #78264, Engineering Chemical Engineering

Air (ideal gas) with mass of 12kg expands polytropically (n=1.11) in a closed system from 515 C to 10 C . Find the work and the heat exchanged with the surroundings.

Solution

The work is

$$W = \frac{mR(T_2 - T_1)}{1 - n}$$

$$W = \frac{(12)(287)(10 - 515)}{1 - 1.11} = 15.8\ MJ.$$

The heat exchanged with the surroundings:

$$Q = W + \Delta U = W + mc_V(T_2 - T_1) = 15.8 \cdot 10^6 + (12)(718)(10 - 515) = 11.4\ MJ.$$