Example
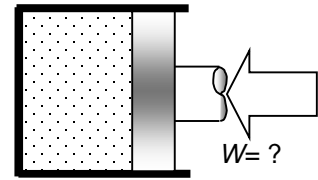
A gas contained in a piston-cylinder at an initial state of T_1 = 298 K, p_1 = 500 kPa and V_1 = 0.1 m³ is placed in a furnace with $T_{furnace}$ = 1500 K. This causes the gas to expand to a final state where p_2 = 100 kPa. During the expansion of the gas, the pressure and volume are related by $pV^{0.5}$ = constant.

$T_{furnace}$= 1500 K

W= ?

(a) Calculate the compression/expansion work into the gas.

(b) If the gas is air, calculate the initial and final temperatures. Assume air is an ideal gas with R_{air} = 0.287 kJ/kg-K

(c) Based on your answer to b), do you think there is heat transfer into or out of the system? Which way is it going?

(d) If the heat transfer into the system is 900 kJ, what is the change of energy of the system?

(e) Is there significant system kinetic energy in this system? Gravitational potential energy? So where is the energy?