ENSC 461
Assignment #1 (Review)

Problem 1: (the 1st law)

A tank with a volume of 1 m^3 is initially evacuated. Atmospheric air at 101.3 kPa leaks into the tank through a weld imperfection. The process is slow and heat transfer with the surroundings keeps the tank and its contents at the ambient temperature during the process. Calculate the amount and the direction of heat exchanged with the surroundings during the time it takes for the pressure in the tank to reach 1 atmosphere. (Ans. 101.3 kJ)

Problem 2: (entropy)

A tank contains 1 lbm of steam at 400 psia and 700 °F. It is connected through a valve to a vertical cylinder which contains a piston as shown below. Initially the piston rests at the bottom of the cylinder, and its mass is such that a pressure of 180 psia is required to lift it off the bottom of the cylinder. The valve is cracked open so as to allow steam to flow slowly into the cylinder until the pressure is uniform throughout the system. Assuming that no heat is transferred from the steam to the surroundings, and that no heat is exchanged between the two parts of the system, determine the final temperatures in the tank and the cylinder. Also assume that the steam in the tank (not the cylinder) has undergone a frictionless process. (Ans. $T_{tank} \approx 500$ °F, $T_{cylinder} \approx$ 600°F)