NAME:
ME 327
Examination 2
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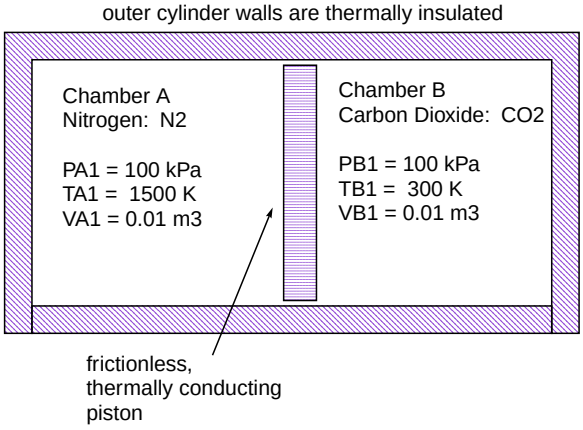
1. Closed System (50)

A cylinder, sketched in the figure below contains two chambers. The chambers are separated by a frictionless, thermally conducting piston. Initially, Chamber A contains N_2 at $P_{A1} = 100\ kPa$, $T_{A1} = 1500\ K$, $V_{A1} = 0.01\ m^3$. Initailly Chamber B contains CO_2 at $P_{B1} = 100\ kPa$, $T_{B1} = 300\ K$, $V_{B1} = 0.01\ m^3$. The cylinder itself is thermally isolated from the surroundings; within the cylinder, heat is transferred from one chamber to the other.



a) Assuming ideal gas behavior for both gases, what is the mass of N_2 and CO_2?

b) Assuming *constant specific heats* N_2: $c_v = 0.7448\ \frac{kJ}{kg\ K}$, CO_2: $c_v = 0.6529\ \frac{kJ}{kg\ K}$, determine the temperature and pressure after the system has come to thermal and mechanical equilibrium.

2. Open System (50)

In the cogeneration turbine system sketched in the figure below, a fraction of the input steam is extracted at high pressure; the remainder expands to low pressure. The system loses heat to the surroundings at a rate of 1.3 kW.

a) Calculate the total work output in kW for this configuration.

b) If *none* of the steam was extracted at high pressure so that *all* the steam expanded to low pressure *and* the system were adiabatic, what would the work output be?