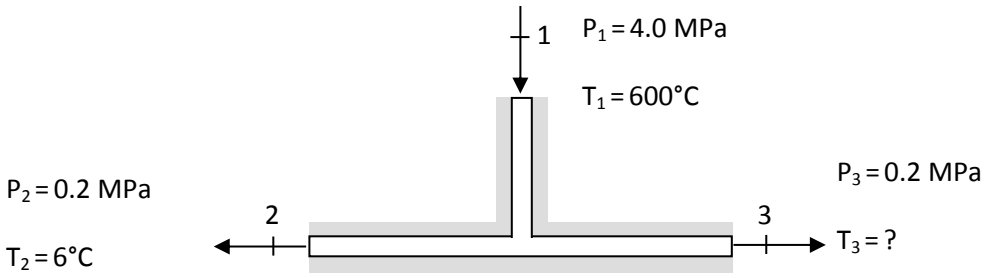
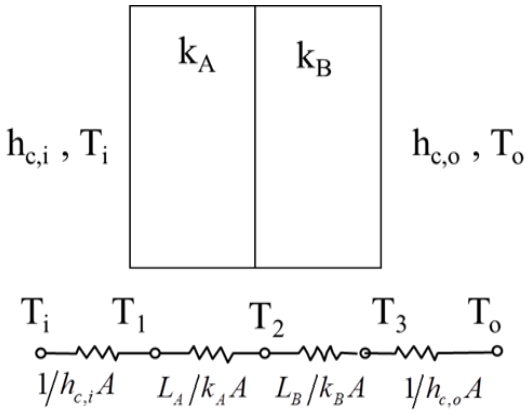
1. A closed rigid container has 6 kg of air at an initial pressure of 100 kPa and volume of 25 m^3. The air undergoes a process to a final pressure of 200 kPa. The pressure increase was a result of heat transfer. How much heat (energy) was transferred (kJ)?

2. An inventor has proposed the insulated device shown with air as the medium. Find T_3 (°C) if the mass flow rate in ports 2 and 3 are equal. How would you determine if this process is possible?



3. A sprinkler head fuse can be modeled as a cylinder of diameter 4 mm and length 12 mm. The density can be approximated as being 1000 kg/m^3. The specific heat capacity is approximately 1 kJ/kgK. The heat transfer coefficient of the smoke gases is 20 W/m2K. If the smoke gases are 200 C and the fuse is initially at 20 C, how long will it take for the fuse to open if the activation temperature is 80C?

4. A composite wall for a furnace is made of two materials, an insulating material with thermal conductivity k_A and an exterior skin with thermal conductivity k_B. Within the furnace there is an internal heat transfer coefficient $h_{c,i}$ and internal temperature Ti. Outside of this wall there is a heat transfer coefficient hc,o and external temperature To..



Analyze a case with T_i=1000 C, T_o=300 C,
h_{ci} =30 W/(m^2K), h_{co} = 10 W/(m^2K),
L_A= 2 cm, L_B= 0.2 cm,
k_A= 1 W/(mK), k_B=20 W/(mK),.

a) Find the equivalent resistance.
b) Find the heat flux through the wall.