

Homework #7

MEMS 0051 - Introduction to Thermodynamics

Assigned July 11th, 2018

Due July 16th, 2018

Problem #1

A high-temperature reservoir at 800 K dissipated 2,000 [kJ] of heat to a low-temperature thermal reservoir of a) 500 K and b) 750 K. Determine which of these two processes is the least reversible, i.e. which has the greatest change of entropy.

Problem #2

A rigid tank contains R-134a in the quantity of 5 [kg] initially at 293 K and 140 [kPa]. The refrigerant is cooled in a process until the pressure within the tank reaches 100 [kPa]. Determine the change of entropy during this process.

Problem #3

A mass-less piston-cylinder device contains 1.36 [kg] of water at 138 [kPa] and 21 °C. 3,700 [kJ] of thermal energy is supplied to the water. Determine the change of entropy of the water during this process.

Problem #4

Liquid methane is the main undergoes a process from 100 K and 1,000 [kPa] to 120 K and 5,000 [kPa]. Determine the change of entropy for this process using:

- a) tabulated values;
- b) TdS equations for incompressible substances.

Problem #5

Air at STSP conditions is compressed to 600 [kPa] and 300 K. Determine the change of entropy using:

- a) tabulated values;
- b) TdS equations for compressible substances.

Problem #5

Consider an automobile engine with a compression ratio of 8, i.e. $V_1/V_2=8$. If State 1 exists at STSP, determine the final temperature of the air.