

ME 201

Thermodynamics

Transient System Practice Problems

1. A balloon initially contains 5 m^3 CO_2 at 100 kPa and 22°C . It is connected to a CO_2 gas line that provides CO_2 at 170 kPa and 30°C . The balloon is then filled to a pressure of 170 kPa. During this process the balloon is insulated and it is observed that the pressure and total volume are related by
$$PV^{-1} = \text{constant}$$
Determine the final temperature and volume of the balloon.
2. A pressure cooker used in cooking has a relief valve that normally opens at about 180 kPa and a volume of 3 liters. Initially, $2/3$ of the volume of the pressure cooker is filled with liquid. What is the highest heat transfer rate allowed for the pressure cooker not to run out of water in one hour of cooking?
3. A 5 m^3 tank contains saturated liquid R-134a at 1.0 MPa. A small leak occurs and the tank pressure falls to 0.32 MPa before it is sealed. It is determined that the refrigerant remaining in the tank has a quality of 0.3. Determine
 - a. the mass that is discharged
 - b. the heat transfer that occurs