# ME 105 Midterm #1

Problem 1

A 25-kg piston is required to travel a specific distance within the piston-cylinder arrangement shown in the figure below. The piston, whose area is 0.0050 m^2, is initially at rest at the lower stops. Air within the cylinder is heated until the piston touches the upper stops. The initial pressure and temperature of the air are 101 kPa and 20°C, g= 9.80 m/s^2, and P_{atm} = 101 kPa. Determine the work done and the heat transfer during this process. The air may be considered as an ideal gas with constant specific heat, c_v = 0.72 kJ/kg·K.
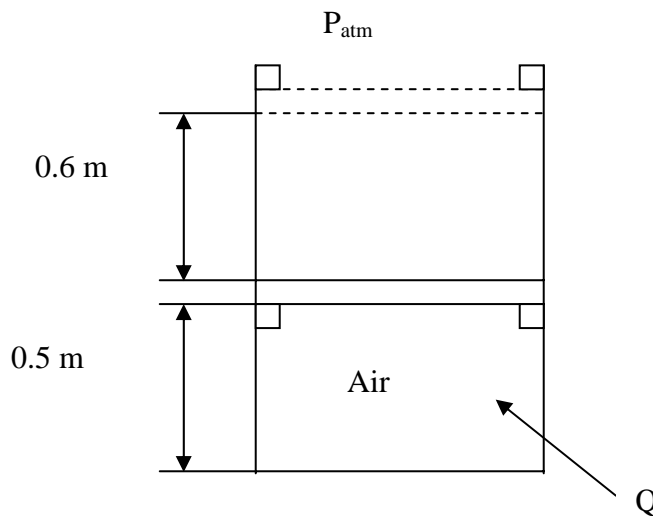
Problem 2

A tank with a volume of 0.5m^3 contains saturated water at 300°C. The vessel initially contains 50% (by volume) of liquid. Liquid is slowly withdrawn from the bottom of the tank, so that the contents are kept at constant temperature. Find how much heat must be added till the removal of half of the initial mass.

Problem 3

At steady state, a well-insulated steam turbine develops 10,000 kW of power for a steamflow rate of 10 kg/s. The steam enters at 5 MPa and leaves at 5 kPa with a quality of 90%. Kinetic and potential energy contributions may be neglected. What is the inlet temperature of the steam in °C?