1. A frictionless piston-cylinder device contains a constant mass of steam. Heat is added at constant pressure. Derive the equation for the work done by steam.

2. A mass of 2.4 kg of air at 150 kPa and 12 ^{o}C is contained in a gas-tight, frictionless piston-cylinder device. The air is now compressed to a final pressure of 600 kPa. During the process, heat is transferred from the air such that the temperature inside the cylinder remains constant. Calculate the work input during this process. Consider air as an ideal gas, where W = - mRT ln (V_2/V_1), and R = 0.287 kJ/kg.K.

3. Determine the enthalpy change Δh of nitrogen, in kJ/kg, as it is heated from 600 K to 1000 K, using:

    a. The empirical specific heat equation as a function of temperature, where a = 28.9 and b = -0.1571*10^{-2}.

    b. The C_p value at the average temperature, where C_p (800 K) = 1.121 kJ/kg.K.