HW 2. Due Tue 22 Jan at 4 p.m. in my mailbox

About Problem 3-8: the work done on gas in arbitrary process can be expressed as

$$\delta W \;=\; P\delta V \;=\; P\Big(\frac{dV}{dT}\Big)_P dT + P\Big(\frac{dV}{dP}\Big)_T dP \;=\; PV\beta dT - PV\kappa dP$$

Problem 1 (Problem 3-10)

a) Derive an equation similar to that in Problem 3-8 for the work δW when the temperature of a paramagnetic salt changes by dT and the applied magnetic intensity changes by δH.
b) Find the expression for the work when the temperature is changed and the magnetic intensity is held constant. What is the algebraic sign of W when the temperature rises? What is doing work in this process?
c) Find the expression for the work when the magnetic intensity is changed isothermally. is held constant. What is the algebraic sign of W when the intensity is decreased?
Hint: use Curie's law $M = C_c \frac{H}{T}$ (Eq. 2-13 from the textbook)

Problem 2 (Problem 3-16)

The temperature of an ideal gas at initial pressure P_1 and volume V_1 is increased at constant volume uniti the pressure is doubled. The gas is then expanded isothermally until the pressure drops to its original value, where it is compressed at constant pressure until the volume returns to its original value.
a) Sketch these processes in the $P - V$ plane and in n the $P - T$ plane.
b) Compute the work in each process and the net work done in the cycle if $n = 2$ kmol, $P_1 = 2$ atm, and $V_1 = 4$ m^3

Problem 3 (Problem 3-35)

Consider a system consisting of a cylinder containing 0.2 kmol of an ideal gas and fitted with a massless piston of area 0.5 m^2. The force of friction between the piston and the cylinder walls is 10N. The gas is initially at the pressure of 1 atm and the system is to be maintained at 300°K. the volume of the system is slowly decreased 10% by an external force.
a) Compute the work done on the system by the external force.
b) Compute the configurational work done on the system.
c) Compute the dissipative work done on the system.
c) How do the above answers change if the piston has a mass of 1 kg and the piston is displaced vertically.?