Homework #7  ME/CH EN 2300
Due Wednesday February 28, 2007


1.  (4-49) Is the relation $\Delta u = mc_{v,avg} \Delta T$ restricted to constant volume processes only,
or ca it be used for any kind of process of an ideal gas?

2.  (4-54) A fixed mass of an ideal gas is heat heated from 50 to 80 C at a constant
pressure of a) 1 atm and b) 3 atm.  For which case do you think the energy will be
greater? Why?

3. (4-61) Neon is compressed from 100 kPa and 20 C to 500 kPa in an isothermal
compressor.  Determine the change in the specific volume and specific enthalpy of neon
caused by this compression.

4. (5-66) A 4-m x 5-m x 6-m room is to be heated by a baseboard resistance heater.  It is
desired to be able to raise the temperature in the room from 7 to 23 C within 15 minutes.
Assuming no heat losses from the room and an atmospheric pressure of 100kPa,
determine the required power of the resistance heater.  Assume constant specific heats at
room temperature.

5. (4-78)  A piston-cylinder device whose piston is resting on top of a set of stops initially
contains 0.5 kg of helium gas at 100 kPa and 25 C.  The mass of the piston is such that
5000 kPa of pressure is required to raise it.  How much heat must be transferred to the
helium before the piston starts rising? (A: 1857 kJ)


6. (4-90)  Stainless steel ball bearings (density = 8085 kg/m$^3$ and $c_p$ = 0.480 kJ/kG C)
having a diameter of 1.2 cm are to be quenched in water at a rate of 800 per minute. The
balls leave the oven at a uniform temperature of 900 C and are exposed to air at 25 C for
a while before they are dropped into the water.  If the temperature of the balls drops to a
uniform temperature of 850 C prior to quenching, determine  the rate of heat transfer
from the balls to the air.