Homework

1) Two moles of ideal gas are at 20^0C and a pressure of 200 kPa. If the gas is heated to 40^0C, and its pressure is reduced by 38%, what is the new volume? (R = 8.31 J mol^{-1} K^{-1})

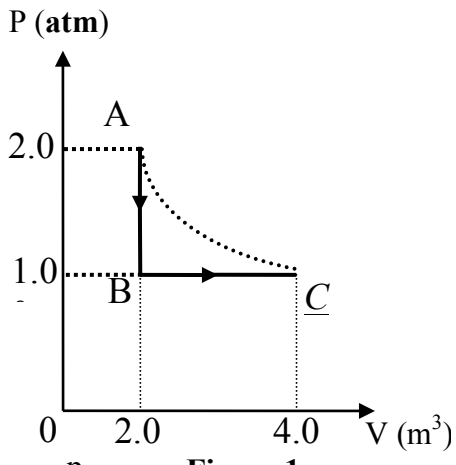

Figure 1

2) A sample of an ideal gas is taken along process ABC (see Figure 1). Heat is allowed to flow out from the gas at constant volume so that its pressure drops from 2 atm to 1 atm. Then the gas expands at constant pressure, from a volume of 2 m^3 to 4 m^3, where the temperature reaches its initial value. Calculate:
(a) the total work done by the gas in the process.
(b) the change in internal energy of the gas in the process.
(c) the total heat flow into or out of the gas.

3) One mole of an ideal monatomic gas is initially at a temperature of 300 K, and has a volume of 1.0 L. It is compressed adiabatically to a volume of 0.0667 L. Calculate the magnitude of the work done during the process.

4) An ideal gas does 12 J of work when taken along the isothermal process from a to b and 7 J of work when taken along the adiabatic process from b to c (see Figure 2). What is the change in internal energy of the gas when it is taken along the straight path from a to c?

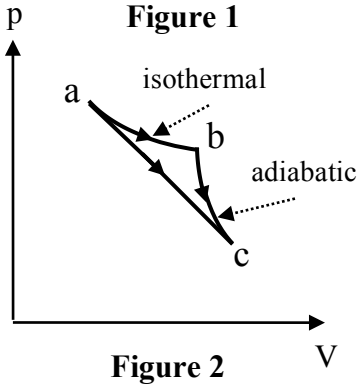

Figure 2

5) One mole of an ideal gas is first compressed isothermally at 380 K to half of its initial volume. Then, 450 J of heat is added to it at constant volume:
(a) Calculate the net work and the total change in the internal energy after the gas has passed through the above two processes; **(b)** Sketch the p-V diagram for the two processes.

6) Under constant pressure p = 1 atm, the temperature of 1 mol of an ideal monatomic gas decreases from 400 K to 300 K. What are:

(a) the energy transferred as heat Q; and
(b) the internal energy change ΔE_{int} of the gas?

7) An ideal monatomic gas in confined to a cylinder by a piston. The piston is slowly pushed in so that the gas temperature remains at 30^0C. During the compression, 650 J of work is done on the gas. What is the entropy change of the gas?

8) Calculate the change in entropy of 1.0 kg of ice at 0.0°C when its temperature is increased to 20.0 °C ($L_{fusion\text{-}ice}$= 333 $kJ.kg^{-1}$; c_{water}= 4190 $J.kg^{-1}.K^{-1}$).

9) You mix two samples of water, A and B. Sample A is 100 g at 10^0C and sample B is also 100 g but at 90^0C. Calculate the change in entropy of sample B.
(c_{water} = 4190 $J.kg^{-1}.K^{-1}$)

10) A 100-g of ice at -10^0C is placed in a lake whose temperature is 25^0C. Calculate the change in entropy of the lake if we assume that the temperature of the lake does not change.
(c_{water} = 4190 J $kg^{-1}K^{-1}$, c_{ice} = 2220 J kg^{-1} K^{-1}; L_F = 333 kJ kg^{-1})