Department of Materials and Metallurgical Engineering
Bangladesh University of Engineering and Technology, Dhaka

MME231 Materials Thermodynamics

Assignment 2
Please submit your answer on or before 25 January 2014

4.4 Derive expression for the heat absorbed by the system for each of the following classes of reversible processes for one mole of an ideal gas: (a) Isothermal change in pressure, (b) Isobaric change in volume, (c) Isochoric change in temperature.

4.8 Estimate the amount of heat in ergs per mole that must be supplied to an ideal gas in the isothermal, reversible compression from a pressure of 1 atm to 25 atm at 25 C.

4.15 One mole of N_2 gas is contained at 273 K and a pressure of 1 atm. The addition of 3000 joules of heat to the gas at constant pressure causes 832 joules of work to be done during the expansion. Calculate (a) the final state of the gas, (b) the values of ΔU and ΔH for the change of state, and (c) the values of c_P and c_V for N_2. Assume that nitrogen behaves ideally and the above change of state is conducted reversibly.

4.18 A quantity of air at 25 C is (a) compressed adiabatically and reversibly from a volume of 10 litres to 1 litre. Assuming ideal behaviour, and taking c_V for air as 5.0 cal/deg-mole, calculate the approximate final temperature of the air. If the same system is allowed to expand adiabatically and reversibly from 200 to 20 atm, what will be the new final temperature?

4.22 Calculate the enthalpy and entropy changes of iron in the fcc structure when it is brought, without phase transformation, from a temperature of 1250 K and a pressure of 1 atm to 1600 K and 1000 atm. Calculate also C_V at 1250 K and 1 atm. The data at 1250 K are: V = 7.31 cc/mol, $\alpha = 0.63 \times 10^{-4}$ K^{-1}, $\beta = 1.10 \times 10^{-6}$ atm^{-1}, $C_P = 5.80 + 1.98 \times 10^{-3}$ T cal/mol-K.