BE Chemical MBA+FT 4th Semester

Chemical Engineering Thermodynamics

First periodicals

Time: 90 mins Max Marks: 25

Q1) A gas which occupies a volume of $0.2m^3$ at a pressure 1 bar is expended to a final pressure of 7 bar. The pressure of gas varies according to the relation P=1200V+b, where P is in kPa, V is in m^3 and b is a constant. Calculate the work done by the gas. (5)

Q2) A system consisting of a gas confined in a cylinder is undergoing the following series of processes before it is brought back to the initial conditions:

Step 1: A constant pressure process when it receives 50J of work and gives up 25J of heat.
Step 2: A constant volume process when it receives 75J of heat.
Step 3: A adiabatic process.

Determine the change in internal energy during each step and work done during the adiabatic process. (5)

Q3) Pure CO is mixed with 100 percent excess air and completely burned at constant pressure. The reactants are originally at 400K. Determine the heat added or removed if the products leave at 600K. The standard heat of reaction at 298K is 283.028kJ per mol CO burned. The mean specific heats applicable in the temperature range of this problem are 29.10, 29.70, 29.10 and 41.45J/mol K respectively for CO, O_2, N_2 and CO_2 respectively. (5)

Q4) One kilogram of superheated steam at 1.5MPa and 523K (H=2923.5kJ/kg, S=6.71kJ/kg K) is contained in a piston cylinder assembly. The unit is kept at ambient conditions of 300K and the steam condenses to saturated liquid (H= 845kJ/kg, S=2.32kJ/kg K) at constant pressure. Calculate the change in entropy and check whether the process is reversible or not. (5)

Q5) A $\longrightarrow$ 2B+C, ΔH= 30kJ/mol, ΔS= 60J/mol K, find the temperature above which this reaction is spontaneous. (5)