**INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY**

**Department of Metallurgical Engineering and Materials Science**

**MM 202: THERMODYNAMICS : 2019-20: Fall**

**Tutorial No. 6: Date: Sept 13, 2019**

1. (a) A 50:50 mixture of gas of H2 and H2O at2 atm. pressure and 1000 K is allowed to come to equilibrium. It is hypothesized that a very small amount of oxygen will form after equilibrium is reached. Is it true? If so what is the pO2 ? Do not use equilibrium constant concept. Instead use the concept that GO2, P – GO2, 1 atm = = .

H2(g) + ½ O2(g) = H2O(g); ΔG0T = -247300 + 50.9T J/mol H2O

Assume here that the partial pressures of H2 and H2O remain at more or less at 1 atm. each. Further GH2 and G­H2O remain that for pure gases even though they are in mixture: that is

GH2 pure, 1 atm = GoH2, mixture, pH2: 1atm.­

GH2O pure, 1 atm = GoH2O, mixture, pH2O: 1atm.

(b) Will this gas (50:50 mixture of H2 and H2O), oxidize iron( pure solid) to wustite (pure solid) at 1000K ?

Fe(s) + ½ O2(g) = FexO(s); ΔG0T = -263700 +64.3T J/mol

Neglect the change in G of condensed phases.

1. What is the free energy change for the oxidation of pure iron to pure wustite at 1000K if the pressure is raised from 1 atm. pressure to (i) 100 atm. (ii) 10-9 atm. Density of iron and wustite are respectively 7800 and 4000 kg/m3. In this pressure range, these solids may be considered incompressible as an approximation.