INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY

**Department of Metallurgical Engineering and Materials Science**

**MM 209: THERMODYNAMICS : 2019-20: Fall**

**Tutorial No. 5 \_\_\_\_\_\_\_\_\_\_\_\_ Date: Sep 5, 2019**

1. One mole of solid silver at 950oC is added into one mole of liquid silver at 1450oC in an adiabatic container at constant pressure of 1 atm. When the system has attained equilibrium and there is only liquid silver.

(a)What is the final temperature?

(b) What is the entropy change?

Data: Given: M.P. of silver = 961oC.

Heat of fusion of silver at the melting point = 11250 J/mol.

Cp(Ag,s)  =21.3 + 8.54\*10-3T J/ mol.K; Cp(Ag,l) = 30.54 J/mol.K.

1. (CaCO3(s), CaO(s) and CO2(g) are found to be at equilibrium with each other at 1183K and 1atm. pressure. That is to say, the reaction

CaO(s) + CO2(g) = CaCO3 (s) , all pure compounds

is reversible at 1183K and 1atm. pressure. (If you increase the pressure infinitesimally, the reaction will go forward, *and vice versa.* Similar is the case if you change the temperature infinitesimally)

Calculate ΔHo and ΔSo for the reaction at 298K and 1 atm. pressure.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Ho298, J/mol | Cp = a +bT + cT-2, J/mol/K | | |
| a | b x 103 ## | c x 10-5 |
| CaO(s) | -635000±2000 | 49.57 | 4.51 | -6.94 |
| CO2(g) | -394000±150 | 44.10 | 9.03 | -8.53 |
| CaCO3(s) | -1208000±3000 | 104.42 | 21.90 | -25.92 |

## When b x 103 = 4.51 in a table, b = 4.51 x 10-3.

Please note

1. For a reaction aA + bB = cC; ΔHo = HCo - HAo– HBo; similarly for ΔSo..
2. ΔH determination just needs a heat balance on any path which is isobaric. ΔS needs to be determined as δq/T only along reversible path.
3. o as a superscript usually indicates compounds which are pure and at 1 atm. (not always, though, as we will discuss later in the course).