1. **(a) 0.05 wt% silicon in iron is in equilibrium with pure silica (solid) and dissolved oxygen at 1950K. What is the dissolved oxygen content ? Assume Henry’s law followed by solutes. 2 marks**

ANSWER:

Si(l) + O2(g) = SiO2(s) ; ΔGo = -952500 +202.80T, J/mol

Si(l) = Si (% in Fe, Henrian); ΔGo = -131500 - 17.24T, J/mol

½ O2(g) = O (% in Fe, Henrian); ΔGo = -117150 − 2.89T, J/mol

Si (% in Fe, Henrian) + 2O (% in Fe, Henrian) = SiO2(s) ; ΔGo = -586700 +225.78T, J/mol

ΔGo1950 = -146429; K = 8366 = aSiO2/(%Si . %O2); **%O = 0.0488.** (Note Henry’s law followed, hi =%i)

1. **Now the melt is cooled to 1800K without any additional oxygen being available. What is now the oxygen and silicon contents ? ( Equilibrium shifts, but Si and O removed have to be in stoichiometric proportions). Mol. Wt: Si :28, O2 : 32 3 marks**

Now at 1800K, the equilibrium has shifted. K = 170704 = 1/(%Sinew . %O2new). **Eqn. V**

New SiO2 has been formed, But decrease in Si and decrease in oxygen should be in stoichimetric proportions.

(0.05 - %Sinew)/28 = (0.0488 -%Onew)/32; (0.05 - %Sinew) = 0.875 (0.0488 -%Onew);

%Sinew = 0.05 – 0.875 (0.0488 -%Onew);

Substitute in eqn.V:

%O2new x (0.05 – 0.875 (0.0488 -%Onew)) = 5.858 x 10-6;

This is a cubic equation; solve to get positive root as : 0.01643

**%Onew  =**  **0.01643; % Sinew = 0.0217**

Verify the answers: 1/(%O2.%Si) = 170712; OK.