Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. Sem-II Examination May 2011

Subject code: 132102 Subject Name: Metallurgical Thermodynamics

Date:28/05/2011 **Time: 10.30 am – 01.00 pm**
Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Draw Ellingham diagram for some very common metal oxides and give its silent features. **07**

(b) Explain free-energy composition and temperature - composition diagram for Binary Alloy system. **07**

Q.2 **(a)** State Roult's law and Henry's law. Explain that in a binary dilute solution; if the solute obeys Henry's law, solvent obeys Roult's law. **07**

(b) Give Hess's law and Kirchhoff's law and discuss their silent features schematically. **07**

OR

(b) (i) Give the combined statement 1st and 2nd law of thermodynamics and give Maxwell's relation equation. **4**

(ii) Explain Quasistatic process. **3**

Q.3 **(a)** Derive Gibb's-Duhem equation in terms of partial molar quantities. **07**

(b) Calculate the standard heat of formation of $WO_{3(s)}$ from $W_{(s)}$ an $O_{2\,(g)}$ at 25 °C and 1 atm pressure from the following data. **07**

$<W> + \{O_2\} \rightarrow \{WO_2\}$…..(i)

$\Delta H°_{298}$ = -560.66 KJ/mole

$3<WO_2> + \{O_2\} \rightarrow <W_3O_8>$….(ii)

$\Delta H°_{298}$ = -550.2 KJ/mole

$<W_3O_8> + 1/2\ \{O_2\} \rightarrow 3<WO_3>$….(iii)

$\Delta H°_{298}$ = -92.75 KJ/mole

OR

Q.3 **(a)** Derive the Clausius - Clapeyron equation. **5**

(b) (i) Calculate ΔG for the process: **5**

$Al_{(s)}$ --> $Al_{(l)}$ at 1000 °K. Given melting point of Al is 660 °C, heat of fusion (ΔH_f) = 10.9 KJ/mole, Cp $Al_{(l)}$ = 29.3 J/K/mole.

(ii) Copper melt at 1084 °C and heat fusion is 12.97 KJ/mole. Calculate the change of entropy at melting point of Copper. **4**

Q.4 **(a)** Define Thermodynamics. Discuss its application in Metallurgy. **5**

(b) (i) Write a note on Nernest Heat equation **5**

(ii) Explain following: **4**

(1)Heat of formation (2)Latent heat (3)Entropy (4)Enthalpy

OR

Q.4 **(a)** Calculate the entropy of Fe melting point 1808 °K and L_f=15.4 KJ/mole, S°298=27.2 J/K/mole, T2=Tm=1808 °K, $Cp_{(Fe)}$ =25.2 J/K/mole. **5**

	(b)	(i) Calculate the vapour pressure of pure lead at 1000 °C. Given boiling point of lead is 2017 °K and ΔHv=177000 KJ/mole. (Note: Take P_1 = 1atm = 101325 N/mm2).	**7**
		(ii) What is fugacity? Explain in brief.	**2**
Q.5	**(a)**	Differentiate the following: (1) Extensive and Intensive property (2)Exothermic and Endothermic reactions	**6**
	(b)	(i) Explain the concept of basicity of index for slag.	**6**
		(ii) What is phase diagram? Explain in brief with phase rule.	**2**
Q.5	**(a)**	Write the short hole on following: (1)Third law of Thermodynamics and its verifications (2)1 wt% standard state.	**10**
	(b)	Brass contains 70% Cu and rest is Zn. Calculate composition of brass in atom% and also calculate atom fraction of Cu=63.54 and Zn=65.34.	**4**

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