Code No: 07A30602 **R07** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain what do you mean by thermodynamic equillibrium.
   (b) Discuss the importance of functions of state in thermodynamics.
   (c) Prove that $(C_P - C_V) = \left[V - \left(\frac{H}{P}\right)_T\right]\left(\frac{P}{T}\right)_V$. [5+5+6]
2. (a) Explain about the vapour pressure of an element.
   (b) Derive the expression $\frac{d\ln P}{d\left(\frac{1}{T}\right)} = -\frac{\Delta H_s}{R}$. [7+9]
3. (a) Draw the concentration-distance profile under steady state flow and explain?
   (b) In a steel, during carburization at 937 ^{0}C, 0.6% carbon is found at a depth of 0.2 mm after 1hr. Find the time required to achieve the same concentration at the same depth of carburization is done at 1047 ^{0}C? [8+8]
4. (a) Draw neatly the free energy V_s temperature diagrams for both sulphides and oxide reactions?
   (b) What are the advantages and disadvantages of Ellingham diagrams? [8+8]
5. (a) What is a reversible process? A reversible process should not leave any evidence to show that the process had ever occured. Explain.
   (b) Explain the differences between reversible and irreversible processes. [8+8]
6. (a) According to the ionic theory, a basic slag of the following composition
   CaO = 48.9%, Mg = 6.7% , Mn = 1.6%
   FeO = 9.0%, Fe_2O_3 = 3.3%, SiO_2 = 14.4%
   P_2O_5 = 13.3% and Al_2O_3 = 4.1%
   consists of Ca^{2+}, Mg^{2+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, SiO_4^{-2}, PO_4^{-3}, AlO_3^{-3} and free O^{-2} ions. Calculate the ion fraction of each ion present in the slag. Molecular weights are CaO = 56.1, MgO = 40.3, MnO = 70.9, FeO = 71.8, Fe_2O_3 = 159.7, SiO_2 = 60, P_2O_5 = 142.0, and Al_2O_3 = 101.9
   (b) Explain about the excess thermodynamic functions for the solution? [8+8]
7. (a) Derive the following expression: $\frac{\Delta\left(\frac{G}{T}\right)}{\Delta T} = \frac{-H}{T^2}$ and explain the expression.
   (b) Give the expression to show the temperature dependance of fugacity and explain. [10+6]
8. (a) Explain the common characteristics of catalysis?
   (b) Differentiate between adsorption theory and collision theory? [8+8]

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Code No: 07A30602 **R07** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is a reversible process? A reversible process should not leave any evidence to show that the process had ever occured. Explain.
   (b) Explain the differences between reversible and irreversible processes. [8+8]

2. (a) According to the ionic theory, a basic slag of the following composition
   CaO = 48.9%, Mg = 6.7% , Mn = 1.6%
   FeO = 9.0%, Fe_2O_3 = 3.3%, SiO_2 = 14.4%
   P_2O_5 = 13.3% and Al_2O_3 = 4.1%
   consists of Ca^{2+}, Mg^{2+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, SiO_4^{-2}, PO_4^{-3}, AlO_3^{-3} and free O^{-2} ions. Calculate the ion fraction of each ion present in the slag. Molecular weights are CaO = 56.1, MgO = 40.3, MnO = 70.9, FeO = 71.8, Fe_2O_3 = 159.7, SiO_2 = 60, P_2O_5 = 142.0, and Al_2O_3 = 101.9
   (b) Explain about the excess thermodynamic functions for the solution? [8+8]

3. (a) Draw the concentration-distance profile under steady state flow and explain?
   (b) In a steel, during carburization at 937 ^{0}C, 0.6% carbon is found at a depth of 0.2 mm after 1hr. Find the time required to achieve the same concentration at the same depth of carburization is done at 1047 ^{0}C? [8+8]

4. (a) Explain about the vapour pressure of an element.
   (b) Derive the expression $\frac{d\ln P}{d\left(\frac{1}{T}\right)} = -\frac{\Delta H_s}{R}$. [7+9]

5. (a) Draw neatly the free energy V_s temperature diagrams for both sulphides and oxide reactions?
   (b) What are the advantages and disadvantages of Ellingham diagrams? [8+8]

6. (a) Explain what do you mean by thermodynamic equillibrium.
   (b) Discuss the importance of functions of state in thermodynamics.
   (c) Prove that $(C_P - C_V) = \left[V - \left(\frac{H}{P}\right)_T\right]\left(\frac{P}{T}\right)_V$. [5+5+6]

7. (a) Derive the following expression: $\frac{\Delta\left(\frac{G}{T}\right)}{\Delta T} = \frac{-H}{T^2}$ and explain the expression.
   (b) Give the expression to show the temperature dependance of fugacity and explain. [10+6]

8. (a) Explain the common characteristics of catalysis?
   (b) Differentiate between adsorption theory and collision theory? [8+8]

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Code No: 07A30602 **R07** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the following expression: $\frac{\Delta\left(\frac{G}{T}\right)}{\Delta T} = \frac{-H}{T^2}$ and explain the expression.
   (b) Give the expression to show the temperature dependance of fugacity and explain. [10+6]
2. (a) Draw the concentration-distance profile under steady state flow and explain?
   (b) In a steel, during carburization at 937 ^{0}C, 0.6% carbon is found at a depth of 0.2 mm after 1hr. Find the time required to achieve the same concentration at the same depth of carburization is done at 1047 ^{0}C? [8+8]
3. (a) Explain what do you mean by thermodynamic equillibrium.
   (b) Discuss the importance of functions of state in thermodynamics.
   (c) Prove that $(C_P - C_V) = \left[V - \left(\frac{H}{P}\right)_T\right]\left(\frac{P}{T}\right)_V$. [5+5+6]
4. (a) According to the ionic theory, a basic slag of the following composition
   CaO = 48.9%, Mg = 6.7% , Mn = 1.6%
   FeO = 9.0%, Fe_2O_3 = 3.3%, SiO_2 = 14.4%
   P_2O_5 = 13.3% and Al_2O_3 = 4.1%
   consists of Ca^{2+}, Mg^{2+}, Mn^{2+}, Fe^{2+}, Fe^{3+}, SiO_4^{-2}, PO_4^{-3}, AlO_3^{-3} and free O^{-2} ions. Calculate the ion fraction of each ion present in the slag. Molecular weights are CaO = 56.1, MgO = 40.3, MnO = 70.9, FeO = 71.8, Fe_2O_3 = 159.7, SiO_2 = 60, P_2O_5 = 142.0, and Al_2O_3 = 101.9
   (b) Explain about the excess thermodynamic functions for the solution? [8+8]
5. (a) Explain the common characteristics of catalysis?
   (b) Differentiate between adsorption theory and collision theory? [8+8]
6. (a) What is a reversible process? A reversible process should not leave any evidence to show that the process had ever occured. Explain.
   (b) Explain the differences between reversible and irreversible processes. [8+8]
7. (a) Draw neatly the free energy V_s temperature diagrams for both sulphides and oxide reactions?
   (b) What are the advantages and disadvantages of Ellingham diagrams? [8+8]
8. (a) Explain about the vapour pressure of an element.
   (b) Derive the expression $\frac{d\ln P}{d\left(\frac{1}{T}\right)} = -\frac{\Delta H_s}{R}$. [7+9]

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Code No: 07A30602 **R07** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
METALLURGICAL THERMODYNAMICS AND KINETICS
Metallurgy And Material Technology

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain what do you mean by thermodynamic equillibrium.
   (b) Discuss the importance of functions of state in thermodynamics.
   (c) Prove that $(C_P - C_V) = \left[V - \left(\frac{H}{P}\right)_T\right]\left(\frac{P}{T}\right)_V$. [5+5+6]
2. (a) Derive the following expression: $\frac{\Delta\left(\frac{G}{T}\right)}{\Delta T} = \frac{-H}{T^2}$ and explain the expression.
   (b) Give the expression to show the temperature dependance of fugacity and explain. [10+6]
3. (a) Draw neatly the free energy V_s temperature diagrams for both sulphides and oxide reactions?
   (b) What are the advantages and disadvantages of Ellingham diagrams? [8+8]
4. (a) What is a reversible process? A reversible process should not leave any evidence to show that the process had ever occured. Explain.
   (b) Explain the differences between reversible and irreversible processes. [8+8]
5. (a) Explain about the vapour pressure of an element.
   (b) Derive the expression $\frac{d\ln P}{d\left(\frac{1}{T}\right)} = -\frac{\Delta H_s}{R}$. [7+9]
6. (a) According to the ionic theory, a basic slag of the following composition
   CaO = 48.9%, Mg = 6.7% , Mn = 1.6%
   FeO = 9.0%, Fe_2O_3 = 3.3%, SiO_2 = 14.4%
   P_2O_5 = 13.3% and Al_2O_3 = 4.1%
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   (b) Explain about the excess thermodynamic functions for the solution? [8+8]
7. (a) Explain the common characteristics of catalysis?
   (b) Differentiate between adsorption theory and collision theory? [8+8]
8. (a) Draw the concentration-distance profile under steady state flow and explain?
   (b) In a steel, during carburization at 937 ^{0}C, 0.6% carbon is found at a depth of 0.2 mm after 1hr. Find the time required to achieve the same concentration at the same depth of carburization is done at 1047 ^{0}C? [8+8]

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