Code No: R09221804 | R09 | SET-1

B.Tech II Year - II Semester Examinations, April-May, 2012
METALLURGICAL THERMODYNAMICS AND KINETICS
(Metallurgy and Material Technology)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) How can you define enthalpy? Derive the relation between C_p and C_v for reversible adiabatic process.

b) Two moles of monoatomic ideal gas at 1 atm and 300K. 53KJ of heat is transferred to gas as a result of which the gas expands and does 1.3 KJ of work against surroundings. Calculate the final temperature of gas if process is reversible. [15]

2.a) What is meant by Reversible heat and how it is related to entropy? Explain.

b) A monoatomic ideal gas of one mole is at 15 bar and 350 K is undergoing a constant volume process while pressure dropping to 5 bar. Calculate the entropy change and heat involved. [15]

3.a) Obtain relation between Helmholtz function and Gibbs Function.

b) Show that $\left(\frac{\partial T}{\partial P}\right)_S = \frac{T\alpha V}{C_p}$. [15]

4.a) Explain the Duhriges rule for estimation of the vapour pressure of an element in detail.

b) Can we apply the Clausis – Clapeyron equation for only single substance or even more? Explain in detail. [15]

5.a) Explain the Fick's law of diffusion with the help of diffusion dependence on concentration profile.

b) Explain what is meant by diffusion coefficient and what are the parameters that will affect its value? Write the details. [15]

6.a) Explain the composistion of solutions in terms of partial molal quantities.

b) Compare and contrast ideal and non ideal solutions and their field of applications. [15]

7.a) What is meant by kinetics of chemical process and how it is useful in the analysis of metallurgical applications? Explain in detail.

b) What is meant by zero order and first order reactions? How they are different from second order reaction and how to determine the order of reaction? [15]

8. Write short notes on the following:
a) Ellingham Diagrams.
b) Maxwell's Relations.
c) Method to calculate Δs^o for a reaction. [15]

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Code No: R09221804 | R09 | SET-2

B.Tech II Year - II Semester Examinations, April-May, 2012
METALLURGICAL THERMODYNAMICS AND KINETICS
(Metallurgy and Material Technology)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Derive the equation for workdone in reversible adiabatic process.
b) An ideal gas at 300K has a volume of 15 Litres at 15 atm. Process is reversible isothermal expansion to 10 atm. Calculate the final volume, workdone, heat involved, change in enthalpy and internal energy. (Assume if missing any). [15]

2.a) Illustrate the Reversible and Irreversible process.
b) An ideal gas of monoatomic and one mole is at 12 bar and 320K is expanding to 5 bar in a reversible adiabatic process. Calculate entropy change, heat and work involved. [15]

3.a) Derive the equation for $C_p - C_v = \frac{VT\alpha^2}{\beta}$.

b) Show that $\left(\frac{\partial H}{\partial S}\right)_V = T\left(1+\frac{V\alpha}{C_v\beta}\right)$. [15]

4.a) With the help of H-T diagram, explain the effect of phase changes on ΔH for a chemical reaction.
b) Write the Clapeyron equation for single substance and explain Duhriges rule. [15]

5.a) Explain the method of self diffusion in pure metals with help of governing law.
b) Explain the diffusion of the pure metals and also diffusion through a stagnant gas. Also explain what is meant by equimolar counter diffusion. [15]

6.a) What is meant by ideal solutions? What is the need of solutions in terms of Thermodynamic aspects?
b) Derive Gibbs – Duhem equation and explain its significance in the light of solutions. [15]

7.a) Explain what is meant by kinetics of chemical process and what are the outcomes of the same.
b) Describe the method to determine the order of reation in detail. [15]

8. Write short notes on the following:
a) Fick's law of diffusion.
b) Fugacity and its significance
c) Nomographic scale in Richardsons diagram. [15]

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Code No: R09221804 | R09 | SET-3

B.Tech II Year - II Semester Examinations, April-May, 2012
METALLURGICAL THERMODYNAMICS AND KINETICS
(Metallurgy and Material Technology)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Write the Kirchoff's equation and explain it in detail.
b) An ideal gas at 290K has a volume of 16 litres at 16 atm. Process is a reversible adibatic expansion to 12 atm. Calculate the final volume, workdone, heat transfer, internal energy and change in entralpy. If any data is missing, assume. [15]

2.a) Explain the efficiency of heat engine in the light of II law of thermodynamics.
b) One mole of monoatomic gas is at 16 bar and 360 K. It expands freely into a vaccum to triple its volume. Explain the process and calculate different values which can be measured/calculated. [15]

3.a) Derive Maxwell's relations.
b) Show that $\left(\frac{\partial A}{\partial P}\right)_V = -\frac{S\beta}{\alpha}$. [15]

4.a) Define the third law of Thermodynamics and obtain the relation involved in it.
b) Explain the need and importance of the integration of Clausis-Clapeyron equation and its significance. [15]

5.a) Explain Kirkendal effect and significance of it.
b) How can you explain the diffusion along the grain boundaries and surfaces with the help of required diagrams? [15]

6.a) Explain both Raoults law and Sieverts law and their applications.
b) What is meant by excess thermodynamic quantities? Why they are called like that and explain their significance. [15]

7.a) Explain Collision theory and explain the theory of absolute reaction rates in detail.
b) What is meant by order of reaction? Classify that and explain in detail. [15]

8. Write short notes on the following:
a) Carnot cycle and Carnot theorem.
b) Helmholtz and Gibbs free energy change equations.
c) Catalysis in chemical reactions. [15]

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Code No: R09221804 | R09 | SET-4

B.Tech II Year - II Semester Examinations, April-May, 2012
METALLURGICAL THERMODYNAMICS AND KINETICS
(Metallurgy and Material Technology)

Time: 3 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks

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1.a) Derive the equation for workdone in a reversible isothermal process.
b) Two moles of an ideal gas at 10 atm, 5L are taken reversibly around a circular path by $(V-10)^2+(P-10)^2 = 25$. Calculate the amount of workdone by the gas as a result of the process and calculate maximum and minimum temperatures attained by the gas during the cycle. [15]

2.a) Define entropy and quantify it for irreversibility.
b) The initial state of one mole of monoatomic ideal gas is 10 atm and T = 300 K. If an isothermal decrease in pressure to 5 atm, calculate the change in entropy. [15]

3.a) Show that $\left(\frac{\partial S}{\partial V}\right)_p = \frac{C_p}{TV\alpha}$.

b) Show that $\left(\frac{\partial H}{\partial V}\right)_s = -\frac{C_p}{C_v\beta}$. [15]

4.a) What is the significance of Clausis Clapeyron equation and how it is useful in thermodynamic analysis?
b) If there is any deviation, explain it in terms of thermodynamic properties in case of Clausis – Clapeyron equation. [15]

5.a) In detail, explain the Ficks law of diffusion and its application.
b) Explain the temperature dependance of the diffusion coefficient and its implications. [15]

6.a) Explain the enthalpy and Temperature analysis of solutions.
b) Indicate the steps involved in the integration of Gibbs – Duhem equation. [15]

7.a) Explain the theory of absolute reaction rates and the application of its usage.
b) What is meant by Catalysis and its role in chemical reactions? Explain in detail. [15]

8. Write short notes on the following:
a) Kirchoff's equation
b) Third law of Thermodynamics.
c) Richardson's diagrams. [15]

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