

III B.Tech I Semester Supplementary Examinations, November 2006
METALLURGICAL THERMO DYNAMICS
(Metallurgy & Material Technology)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) State and explain Fick's laws of diffusion.
(b) List out application of diffusion.
(c) Derive the relation between inter diffusion coefficient and intrinsic diffusivities. [5+5+6]
2. (a) Explain the significance of breaks in the plot of free energy of formation against temperature.
(b) Discuss the properties and useful information that can be obtained from the plot of standard free energy change of an oxide with temperature. [8+8]
3. (a) What are differences between Einstein and Debye's model of lattice specific heat. Explain its applicability.
(b) Explain anharmonicity and lattice thermal conductivity. [8+8]
4. (a) Explain the determination of partial molar quantities from quantities.
(b) Calculate the atom fractions of copper and zinc in a brass of 70 wt% copper and balance zinc, if atomic weights of copper and zinc are 63.54 and 65.38 respectively.
(c) What is a regular solution? Explain. [6+4+6]
5. (a) What is Gibbs's phase rule? Explain the importance of equilibrium diagram in the development of new alloys.
(b) A copper alloy with 15% silver is heated to 1100°C and then very slowly cooled to 781° . Describe the composition and amount of each phase. Draw the sketch of the structure. [8+8]
6. (a) What do you understand by thermodynamics of electro-chemical cells? Explain briefly.
(b) Determine the chemical reactions taking place in the following reversible cells
 - i. Pb, $\text{PbSO}_4(\text{s})$ and
 - ii. Hg, $\text{HgO}(\text{s})$ andwrite equations for the EMF's of the cells, ignoring liquid junction potential. [8+8]
7. (a) Explain Edge dislocation and screw dislocation with neat sketches.
(b) Discuss the stability of crystal disorder. [8+8]

8. Write short notes on:

- (a) Use of oxygen nomograms in Ellingham diagram.
- (b) Diffusion along grain boundaries
- (c) Galvanic cells.

[6+5+5]

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