

II B.Tech II Semester Supplementary Examinations, Apr/May 2006
THERMODYNAMICS AND KINETICS
(Metallurgy & Material Technology)

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

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Derive equations relating critical temperatures, critical pressure and critical volume with vanderwaal's constants.
(b) How is the most probable macrostate determined with in a given system?
[10+6]
2. (a) Show that internal energy is function of temperature only.
(b) The internal energy of a closed system is given by $U = 100 + 50T + 0.04T^2$ in Joules. The heat absorbed $Q = 4000 + 16T$ in joules.(T is in Kelvin). If the system changes from 500 K to 1000K, what is the work done.
(c) Calculate the work transfer and change in internal energy if the gas is changing it's state from 1 bar, $27^{\circ}C$ to 20 bar, $400^{\circ}C$ polytropically. [6+6+4]
3. (a) Explain how does second law of thermodynamics lead to concept of entropy.
(b) A lump of copper having a mass of 5 kg at a temperature of $540^{\circ}C$ is dropped into a well-insulated bucket containing 50 kg of water at a temperature of $20^{\circ}C$. If the specific heats of copper and water are $0.418 \text{ KJ/kg}^{\circ}C$ and $4.4 \text{ KJ/kg}^{\circ}C$ respectively, calculate the resulting change in entropy of the water and copper, and calculate the total entropy change resulting from the process. [6+10]
4. (a) What is Nernst heat theorem. Define and explain the theorem with the help of relevant equation.
(b) What is entropy generation? Can the entropy generation be negative? Explain. [10+6]
5. (a) Distinguish between Gibb's and Helmholtz free energies. What is their significance?
(b) From fundamentals, derive Maxwell's relations. [6+10]
6. (a) State the third law of thermodynamics and explain how it rationlises the thermochemical data
(b) What is the meaning of thermodynamically possible process?
(c) What are the important deductions of Third law of thermodynamics? [6+5+5]
7. (a) Explain the importance of different ways of integrating Classius-Clapeyron equation.

- (b) Suppose the saturation pressure of a liquid obeys the Classius-Clapeyron equation. What will be the slope of the line when $\log P$ is plotted against $\frac{1}{T}$? [8+8]
8. (a) Explain unimolecular reactions with examples.
- (b) Describe a few methods of determination of standard free energy changes of reactions. [6+10]
