B. Tech Degree III Semester Examination, November 2009

SE 302 CHEMICAL ENGINEERING I

(2006 Scheme)

Time : 3 Hours | Maximum Marks : 100

PART – A
(Answer all questions)

(8 x 5=40)

I. a. State and explain Amagat's law and Dalton's law for gaseous mixtures.
b. Distinguish between recycle, byepass and purge operations.
c. State and explain Hess's law of heat summation.
d. Define first law of thermodynamics. What are it's significance and limitations?
e. Define enthalpy, latent heat of fusion and latent heat of vapourisation.
f. What is Gibb's free energy? State its significance.
g. State and explain the factors that control the rate of filtration.
h. What are the laws of crushing? Explain.

PART B

(4 x 15 = 60)

II. a. Define ppm, Molarity, Molality and Normality of a solution . (5)
b. An aquous solution of K_2CO_3 contains 50% salt and the specific gravity of the solution is 1.53. Determine the following:

(i) The mole percent of the salt in the solution.
(ii) The volume percent of water assuming density of water is 1000 Kg/m^3 and there is no volume change on mixing.
(iii) The Molality of the solution.
(iv) The Molarity of the solution.
(v) The Normality of the solution. (10)

OR

III. a. How many kilograms of carbon disulphide will contain 3.5 Kmol carbon? (3)
b. Cracked gas from a petroleum refinery has the following composition by volume: Methane 45%, Ethane 10%, Ethylene 25%, propane 7% , Propylene 8%, n-Butane 5%. Find (i) The average molecular weight of the gas mixture.
(ii) The composition by weight
(iii) Specific gravity of gas mixture (12)

IV. a. Define standard heat of formation and standard heat of combustion. (3)
b. The heat of combustion of methane, carbon and hydrogen are –890.4 KJ/mol, -393.51 KJ/mol and –285.84 KJ/mol respectively. Calculate the heat of formation of methane. (12)

OR

V. a. Calculate the number of kilo calories of heat given off when one cubic meter of air, at standard conditions, is cooled from 500°C to −100°C at constant pressure of 1 atm. Specific heat of air is given by the formula.

$C_p = a + bT + cT^2$.

Given that a = 6.386, b = 1.762, C = −0.2656 . T is in K. (10)

(Turn over)

b. Derive an expression for mean heat capacity and constant pressure at various temperatures. (5)

VI. Prove the following expressions:

(i) $$\left(\frac{\partial T}{\partial V}\right)_S = -\left(\frac{\partial P}{\partial S}\right)_V$$

(ii) $$\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial U}{\partial S}\right)_P$$

(iii) $$\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial S}{\partial P}\right)_T$$ (15)

OR

VII. a. State and explain the principle of corresponding states. (5)

b. Write notes on

(i) Entropy
(ii) Limitations of first law of thermodynamics. (10)

VIII. a. With the help of a neat sketch explain the working of a plate and frame filter press. (7)

b. Write notes on
(i) Filter aids
(ii) Filter media. (8)

OR

IX. a. Derive an expression to calculate the effectiveness of screens. (8)

b. Describe any ONE type of crushing equipment. (7)

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