QP Code:536801

[3 Hours] [Total Marks: 80]

(1) Q.1 is compulsory.
(2) Attempt any 3 from the remaining 5 questions.
(3) Use graph paper, if required.
(4) Assume suitable data if required and justify the same

Q1:A: What you mean by excess and limiting reactant in a reaction [5]

B. An aqueous solution contains 20 percent ammonia, 60 percent ammonium nitrate and 5 percent urea by weight. Find available nitrogen content of the solution. [5]

C. Ethanol and water forms azeotrope at 96 percent by weight ethanol Find the composition of azeotrope by mole percent. [5]

D.Explain the concept of adiabatic flame temperature. [5]

Q2A. The feed water to a reverse osmosis plant contains 5000 ppm dissolved solids. The feed to product ratio is 4:3 on weight basis. The treated water(product) leaving thc plant contains 600 ppm solids. Find dissolved solids content of the concentrated stream(rejected stream). [10]

B.A dye house effluent is found to contain sodium(as Na) and calcium(as Ca) to the extent of 245.7 mg/l and 37.6 mg/l respectively. This effluent is to be discharged on the land used for irrigation. The tolerance limit for Na(%) of total cations (on equivalent basis) is 60. In order to bring the sodium level down to 60 percent, gypsum(CaSO4) is to be dissolved in effluent. Calculate percentage of Na in effluent and dosage of $CaSO_4$ required. [10]

Q3:1000 kg of an impure lime stone which analyzes 96 percent $CaCO_3$ and 4 percent inerts is reacted with a sulphuric acid solution containing 70 percent H_2SO_4 and 30 percent water. The reaction mass is heated and all the CO_2 generated is driven off together with some of the water. The analysis of final solid cake in percent is: $CaSO_4$-86.54, $CaCO_3$-3.11, H_2SO_4-1.35, H_2O-6.23, Inerts-2.77

Calculate: a.The degree of completion of reaction. [5]

b. Mass of acid solution fed [5]

c. Mass of gas driven off [5]

d. Composition of gases driven off. [5]

Q4:A. A gas mixture entering an ammonia converter contains H_2 and N_2 in mole ratio 4:1. The mole ratio of these gases in the exit stream is found to be 4.2:1. What volume of entering gases measured at 500^0C and 1.013 bar must be fed to the converter to produce 100 tons of ammonia per day.? [10]

B. Explain the need to have recycle in the processes. [5]

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C. Explain the relation between C_p and C_v for an ideal gas. [5]

Q5: Explain the concept of heat of formation and heat of combustion. How would you calculate heat of reaction from heat of combustion of product and reactants? [10]

B. Methane gas is heated from 303 K TO 523 k at atmospheric pressure. Calculate the heat added per kmol methane using Cp^0 data given below. [10]

$Cp= a+ bT+dT^2+dT^3$, kj/kmol.k

Gas	a	$bx10^3$	$C x10^6$	$dx10^9$
methane	19.2494	52.1135	11.973	-11.3173

Q6:A.What you mean by standard heat of formation. [4]

B. What you mean by percentage saturation and percentage relative humidity of air water mixture.[4]

C.Differentiate between proximate and ultimate analysis of fuel. [4]

D.Explain Hess's law of constant heat summation. [4]

E.Explain effect of pressure on heat of reaction. [4]