

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 the 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(CaSO_4) 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°C 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]

[Turn Over

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 C_p^0 data given below. [10]

$$C_p = a + bT + dT^2 + eT^3, \text{ kJ/kmol.k}$$

Gas	a	$b \times 10^3$	$C \times 10^6$	$d \times 10^9$
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]