**TUTORIAL SHEET**

**Year: B. Tech. I Year I Semester**

**Subject: Engineering Chemistry**

**CO1: Explain the impurities of water (mainly hardness) and boiler troubles.**

**#Sheet-1**

Q1. 1 g of CaCO3 was dissolved in dilute HCl and the solution diluted to one liter. 100 ml of this solution required 90 ml of EDTA solution , while 100 ml of the sample water required 40 ml of EDTA. On the other hand, 100 ml of boiled sample water when titrated against EDTA consumed 20 ml of solution. Calculate each type of hardness in ppm.

Q.2/CO1 (B) 1 g of CaCO3 was dissolved in dilute HCl and the solution diluted to one litre . 100 ml of this solution required 100 ml of EDTA solution, while 100 ml of the sample water required 50 ml of EDTA. On the other hand, 100 ml of boiled sample water when titrated against EDTA consumed 25 ml of solution. Calculate each type of hardness in ppm.

**#Sheet-2**

Q.1 Calculate the quantity of hydrated lime and sodium carbonate required to soften 20,000 liters of water containing the following salts: CaCO­­3 = 100 mg/L , MgCO3  = 84 mg/L ,CaCl2 = 111 mg/L , MgSO4  = 60 mgLt , Nacl = 1.2 mg/L.

Q.2. Calculate the quantity of hydrated lime and sodium carbonate required to soften 20,000 liters of water containing the following salts: CaCO­­3 = 10.0 mg/L , MgCO3  = 8.4 mg/L ,CaCl2 = 11.1 mg/L , MgSO4  = 6.0 mg/L , SiO2  = 1.2 mg/L assuming the purity of lime as 90 percent and that of sodium carbonate 95 percent .

**#Sheet-3**

Q1. Standard hard water contains 1g of CaCO3 per litre. 100 ml of this solution required 50 ml of EDTA solution while 100 ml of sample water required 18 ml of EDTA solution. The sample water after boiling required 12 ml of EDTA solution. Calculate temporary, permanent and total hardness of sample water.

Q2. Standard hard water contains 15g of CaCO3 per litre. 100 ml of this solution required 50 ml of EDTA solution while 100 ml of sample water required 40 ml of EDTA solution. The sample water after boiling required 20 ml of EDTA solution. Calculate temporary, permanent and total hardness of sample water.

**#Sheet-4**

Q1. A sample of water on analysis has been found to contain the following impurities in ppm Ca(HCO3)2 = 48.6 , Mg(HCO3)2 = 29.2 , MgCl2 = 95.0 , MgSO4 = 48.0 , CaCl2 = 33.3 . Calculate the quantity of lime and soda required for softening of one million litres of water.

Q2. A sample of water on analysis has been found to contain the following impurities in ppm Ca(HCO3)2 = 4.86 , Mg(HCO3)2 = 2.92 , MgCl2 = 9.50 , MgSO4 = 4.80 , CaCl2 = 3.33 . Calculate the quantity of lime and soda required for softening of 6 million litres of water if the purity % of lime is 90% and that of soda is 85%.

**#Sheet-5**

Q1. Calculate the total, permanent and temporary hardness of water sample which contain the following impurities: CaCO­­3 = 100 mg/L, MgCO3  = 84 mg/L ,CaCl2 = 111 mg/L , MgSO4  = 60 mg/L, Nacl = 1.2 mg/L.

Q2. Find out the total, permanent and temporary hardness of water sample which contain the following impurities: Ca(HCO­­3)2 = 162 mg/L, Mg(HCO­­3)2=146 mg/L, MgCO3  = 84 mg/L ,CaCl2 = 111 mg/L , CaSO4 =136 mg/L, MgSO4  = 60 mg/L, NaCl = 1.2 mg/L.

**#Sheet-6**

Q1. Calculate the amount of lime and soda required for softening the water sample which analysed as follows: Ca(HCO­­3)2 = 162 mg/L, Mg(HCO­­3)2=146 mg/L, MgCO3  = 84 mg/L ,CaCl2 = 111 mg/L , CaSO4 =136 mg/L, MgSO4  = 60 mg/L, NaCl = 1.2 mg/L.

Q2. Calculate the quantity of lime and soda required for softening the water sample which analysed as follows: Ca(HCO­­3)2 = 162 mg/L, Mg(HCO­­3)2=146 mg/L, MgCO3  = 84 mg/L ,CaCl2 = 111 mg/L , CaSO4 =136 mg/L, MgSO4  = 60 mg/L, NaCl = 1.2 mg/L. if the purity % of lime is 95 and that of soda

is 80.

**CO2: Describe processing technologies of fuel with numerical aspects of combustion of fuel.**

**#Sheet-1**

Q1. A sample of coal was found to have the following % composition by weight C = 70%, O = 14%,H = 6% , H = 6% , N = 5% and rest = ash . Calculate the gross and net calorific value of coal sample using Dulong’s formula.

Q2. A sample of coal was found to contain the following: C = 80%, H = 5%, O = 1%, N = 2% remaining being ash . Calculate the amount of minimum air required for complete combustion of 1 Kg of coal sample.

**#Sheet-2**

Q1. A sample of coal was found to contain the following: C = 85%, H = 7%, O = 3%, N = 5% remaining being ash. Calculate the amount of minimum air required for complete combustion of 10 Kg of coal sample.

Q2. A sample of coal was found to have the following % composition by weight C = 75%, O = 15%,H = 10% , S = 6% , N = 5% . Calculate the GCV and NCV of coal sample using Dulong’s formula.

**#Sheet-3**

Q1. A sample of coal was found to contain the following: C = 85%, H = 7%, O = 3%, N = 5% remaining being ash. Calculate the amount of minimum air required for complete combustion of 1 Kg of coal sample also calculate the percentage composition of dry products of combustion.

Q2. A sample gaseous fuel was found to contain the following: C = 85%, H = 7%, O = 3%, N = 5% remaining being ash. Calculate the amount of minimum air required for complete combustion of 1 m3 of fuel sample also calculatethe percentage composition of dry products of combustion by volume.

**#Sheet-4**

Q.1 Calculate the amount of oxygen and air required for complete combustion of 2 Kg of Coke.

Q2. Find out the volume of oxygen and air required for complete combustion of 5 Kg of Coke.

**#Sheet-5**

Q1. A sample gaseous fuel was found to contain the following: CH4 = 45%, C2H2=25%, C2H4 =20, O = 3%, N =2% remaining being ash. Calculate the amount of minimum air required for complete combustion of 1 m3 of fuel sample also calculate the percentage composition of dry products of combustion by weight & by volume.

Q2. A sample of coal was found to contain the following: C = 85%, H =7 %, O = 3%, N = 2% remaining being ash. Calculate the amount of minimum air required for complete combustion of 1 Kg of coal sample by weight and by volume.

**#Sheet-6**

Q1. A sample of coal was found to contain the following: C =75%, H = 3%, O = 5%, N = 3% remaining being ash. Calculate the amount of minimum air required for complete combustion of 1 Kg of coal sample also calculate the percentage composition of dry products of combustion.

Q2. A sample of coal was found to contain the following: C = 85%, H = 7%, O = 3%, N = 5% remaining being ash. Calculate the amount of minimum air required for complete combustion of 1 Kg of coal sample also calculate the percentage composition of dry products of combustion by volume.