Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-I Regular Examination January / February 2011

Subject code: 711702N

Subject Name: Environmental Chemistry

Date: 01 /02 /2011 **Time: 02.30 pm – 05.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Balance following Chemical equations **07**

(i) Manganese oxide reacts with Sodium chloride in sulphuric Acid Environment for producing chlorine and sulphates of sodium and Manganese

(ii) First step in reaction of Dissolved Oxygen determination using Modified Winkler's Method.

(b) Describe with the example Le Chaterlier Principle of Equilibrium and how is activity of species affect the equilibrium if they are present in the same solution . **07**

Q.2 **(a)** Describe ways of shifting Chemical equilibria and give example of each with environmental engineering application. **07**

(b) Solve any **TWO** of followings **07**

1.Calculate pH required to decrease the iron Concentration in a water supply to 0.03mg/L if Iron is in (a)Fe^{+2} and (b) Fe^{+3} form

2. Calculate the pH of the 0.30 *M* NH_3 & 0.36 *M* NH_4Cl buffer system. What is the pH after the addition of 20.0 mL of 0.050 *M* NaOH to 80.0 mL of the buffer solution?

3. Calculate the oxygen needed and carbon Dioxide and products produced in a combustion of the anesthetic cyclopropane, C3H6(*g*) of 420grams with sufficient oxygen in both mole/L and Volume in litre at normal temperature and pressure .

4. Draw log Concentration diagram phosphoric acid with pK_{a1}=2.12 pK_{a2}=7.21 and pKa3= 12.32 for adding it to water so that concentration of it is 0.1M.

OR

(b) Try any **Three** of followings **07**

(i)An effluent is consist of chlorides of Mg and Cu in concentration of f 0.20 M $MgCl_2$ and 0.10 M $CuCl_2$. Calculate the pH that would separate the metal ions as their hydroxides. K_{sp} of $Mg(OH)_2 = 6.3 \times 10^{-10}$; K_{sp} of $Cu(OH)_2 = 2.2 \times 10^{-20}$

(ii) Calculate the alkalinity of water if it contains 85mg/lL of bicarbonate ion, 120 mg/L carbonate ion and 1.5mg/L of hydroxide ion.

(iii) List reagents used and how is Chloride calculated from the Mohar method Solutions

(iv) Compute the relative proportion of free chlorine occurring as HOCl and OCl^- at ph 6.8 and a temperature of 20 ^oC pKa =7.54.

(v)Modifications in Winlker method of DO determination

(vi)Role of blanks in analysis of BOD, COD and Chloride

(a)Role of blank is BOD is provide DO utilization by Blank

Q.3 **(a)** Attempt any Three of followings **07**

(i) What is complex ions ? Write first four instability equations of any one of the metallic cations found in water containing chloride anion.

(ii) How one can find equilibrium constant using energy concept? Give one example of solubility product.

(iii) Explain in detail binary mixtures. Give in detail mode of obtaining each one in pure form

(iv) What is surface tension and how is it reduced? Describe in detail use of this property in nature.

(v) Describe chemical kinetics and its application in the field of Environmental engineering .

(b) Describe the basic concept of use of energy principles in Chemical Equilibria **07**

OR

Q.3 **(a)** Solve any One of the followings **07**

1. Calculate the activity coefficient and activity of each f the ion in solution containing 400mg/L of sodium nitrate and 200mg/L of Calcium Sulphate.
2. Calculate pH during titration of a solution containing250mg of Strong acid in one litre when it is titrated using 1N NaOH which is added at rate of 1,2,3,4,5ml.
3. What is pH of a buffer and buffering index of a solution (a) 0.005M HOCl & 0.005MNaOCl (b) 0.008M HOCl & 0.002NaOCl. Ans (a)7.5 and 5.8 $x10^{-3}$ (b) 6.9 ,1.26x 10^{-3}

(b) " Water from river at pH 7.5 contains both acidity and alkalinity". Explain in detail this statement. **07**

Q.4 **(a)** What is relationship between hardness and alkalinity under different theoretical condition. How is total hardness and Calcium hardness determined? **07**

(b) Describe gas laws and their applications in Environmental field. **07**

OR

Q.4 **(a)** Answer any TWO of followings **07**

1. Give properties and uses of detergents and problems of their presence in water.
2. Enlist at least of the pesticides of all generations and write their biological properties.
3. Describe fate of organics in Environment system.

(b) Describe in detail transformation reactions of organics **07**

Q.5 **(a)** Describe in detail the Chromatography principles and operation of GC and HPLC for use in Environmental Engineering . **07**

(b) Describe basic Principles of working of any TWO of the followings **07**

1. Types of Electro analytic methods
2. Atomic absorption Spectrophotometer
3. Polarography
4. Colourimetry
5. Spetrophotometry

OR

Q.5 **(a)** How is soil formed?. Describe important factors affecting the types and characteristics of soil. **07**

(b) TRY any ONE of followings **07**

1. What are important nutrients available for plant growth from soil? Where do plant nutrients come from?
2. Give few pollutant sources of soil pollution. How is a toxicant find its way to soil? What are mechanisms of its entry into the food chain?

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