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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION - 2016

M.Tech I Semester

COURSE CODE: 14M31CE212   MAX. MARKS: 25

COURSE NAME: CONTAMINANT TRANSPORT

COURSE CREDITS: 03   MAX. TIME: 1.5 Hr

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.

Q1.a) Discuss the significance of Gibbs free energy in an environmental system
[2.5 Marks]

b) Consider the aqueous reaction between acetate ion and hydrogen ion:

$$CH_3COO^- + H^+ = CH_3COOH; \quad \log K = 4.8$$

What is the ratio of the acetate ion concentration to the acetic acid molecule in water if the pH is 8? [2.5 Marks]

Q2.a) Why rate of a reaction is more important in modeling the environmental fate processes of a chemical released to environment. Distinguish between a "First order" and "Second order" rate of a chemical reaction [03 Marks]

b) How does a catalyst influence the rate of a reaction? Write a note on metal containing catalysts. [02 Marks]

Q3.a) Define "Vapour Pressure". How do you convert vapour pressure of a chemical into concentration? Explain with an example [2.5 Marks]

b) Define "Henry's Law Constant (H)". What are the factors on which H depends? Deduce the relationship between H(dimensionless) with H(with units)
[2.5 Marks]

Q4.a) Distinguish between "Polar" and "Non-Polar" chemicals. Give at least two examples for each along with their chemical structure. [03 Marks]

b) What are the various mechanisms by which sorption can occur in the environment? List some of the most commonly used sorbents. [02 Marks]

Q5.a) Define "Fugacity". How fugacity is related to concentration of a chemical in a system. [02 Marks]

b) 15 kg of Dichloromethane are added to an artificial ecosystem consisting of 10^{10} m^3 of air, 7×10^6 m^3 of water, and 3.5 m^3 of fish. Using the fugacity concept, predict the equilibrium partitioning of Dichloromethane into each phase. Assume a BCF of 5.0 L/kg, a fish density of 1 g/cm^3, and a temperature of 20°C. (Data for Dichloromethane: Vapour Pressure = 0.46atm; H = 3 $\times$ 10^{-3}atm.m^3/mol and molecular weight = 85g/mol) [03 Marks]