

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION - 2018

M.Tech II 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) Distinguish between 'Volatile', 'Semi-Volatile' and 'Non-Volatile' chemical. Give Examples [03 Marks]
- b) A fuel tank in an automobile has a filler pipe of 607 mm in length with a diameter of 38.1 mm. Estimate the amount of fuel lost by molecular diffusion (if the gas cap is let off for a day). Assume the fuel is octane (C_8H_{18}) with a vapor pressure of 0.015atm. at the ambient temperature of 21°C. The 70-liter tank is $\frac{1}{2}$ full. Use an approximate diffusion coefficient of $0.1\text{cm}^2/\text{sec}$. [04 Marks]
- Q2.a) Define "Henry's Law Constant (H)". What are the factors on which H depends? Deduce the relationship between H(dimensionless) with H(with units) [03 Marks]
- b) In an unsaturated soil, the dissolved oxygen concentration in soil water at equilibrium with soil air is 1.6mg/L. Given the dimensionless Henry's law constant of 26 for oxygen at 20°C, what is the corresponding oxygen concentration in soil air? What is the Henry's law constant in units of (atm. m^3/mol) at 20°C. [02 Marks]
- Q3.a) How does a catalyst influence the rate of a reaction? Write a note on metal containing catalysts. [02 Marks]
- b) Distinguish between "Polar" and "Non-Polar" chemicals. Give at least two examples for each along with their chemical structure. [03 Marks]
- c) What are the various mechanisms by which sorption can occur in the environment? List some of the most commonly used sorbents. [02 Marks]
- Q4.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, $7 \times 10^6\text{m}^3$ of water, and 3.5m^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 $1\text{g}/\text{cm}^3$, and a temperature of 20°C. (Data for Dichloromethane: Vapour Pressure = 0.46atm; $H = 3 \times 10^{-3}\text{atm}\cdot\text{m}^3/\text{mol}$ and molecular weight = 85g/mol) [04 Marks]