**Mass Transfer-1 Class Test**

**Time Duration: 30 minutes Date: 13th Feb 2023**

**Instructions:**

1.Assume atmospheric temperature and pressure, and required constants if not mentioned.

2. If constants are not provided then solve in terms of the missing constant.

Q.1. In a controlled pressure permeation test setup, hydrogen gas is made to flow through a tube of neoprene rubber having ID = 30 mm and OD = 55mm. The pressure of hydrogen inside this tube is at 3 X 105 pascals at standard conditions. If the solubility of hydrogen in rubber is s = 55 \* 10-3 m3/m3.atm and diffusivity of H2 through rubber is DAB = 1.8 X 10-10 m2/sec. Calculate the rate of H2 loss out of the tube per unit length of tube due to diffusion. Hint: Concentration can be equated using solubility for standard litre.

Or

Q.1. Calculate the rate of diffusion butanol at 20°C under unidirectional steady state conditions through a 0.1 cm thick film of water when the concentrations of butanol at opposite sides of the film are 10 and 4% butanol by weight respectively. The diffusivity of butanol in water solution is 5.9 X 10-6 cm2/sec. The densities of 10% and 4% butanol solutions at 20°C may be taken as 0.971 and 0.992 g/cc respectively. Butanol (C4H9OH) and water (H2O). (Assume conditions if not specified)

Q.2. Ammonia is absorbed by water in a wetted-wall column being operated at 20°C and 1 std. atm. The overall gas side coefficient is 0.5 mole NH3/m2. At a certain point in the column, the gas stream contains 10 mole % NH3 and the liquid stream contains 0.155 mole ammonia per m3 of the solution. 96% of the resistance to mass transfer is offered by the gas phase. Assume henry’s law constant at 293K = 4.247 X 10-3. Determine the following

1. Gas and liquid phase coefficients
2. Partial pressure pa\* in equilibrium with liquid
3. Molar flux NA
4. Partial pressure at the interface
5. Concentration in liquid phase