Department of Chemical Engineering

Minor 1 Examination. CLL252. Mass Transfer I

Time: 1 Hour Max. Marks: 20

Q. I. In a gas-liquid contactor, a pure gas is absorbed in a solvent, and the penetration theory provides a reasonable model by which to describe the transfer mechanism. As fresh solvent is exposed to the gas, the transfer rate is initially limited by the rate at which the gas molecules can reach the surface. If at 20 ºC and a pressure of 1 bar the maximum possible rate of transfer of gas is 50 $m^3/m^2.s$, express this as an equivalent resistance, when the gas solubility is 0.04 $kmol/m^3$. If the diffusivity in the liquid phase is 1.8×10^{-9} m^2/s, at what time after the initial exposure will the resistance attributable to access of gas be equal to about 10 per cent of the total resistance to transfer? (15 marks)

Q.II.1. Mass transfer is characterised by

a. Convection
b. Diffusion
c. Neither convection nor diffusion
d. Either by convection or by diffusion

Q. II.2. In a pipe flow, the largest eddies contribute

a. 80% of the total turbulent kinetic energy
b. 50% of the total turbulent kinetic energy
c. 20% of the total turbulent kinetic energy
d. none of the above.

Q. II.3. Product cost depends upon

a. Concentration of a species to be separated in raw material
b. Concentration of a species to be separated in final product
c. Ratio of concentration of a species to be separated in raw material to the concentration of a species to be separated in final product
d. Ratio of concentration of a species to be separated in final product to the concentration of a species to be separated in raw material

Q. II.4. There are … major ways of classification of mass transfer operations

a. 6
b. 4
c. 2
d. 3

Q. II.5. In mass transfer operations, miscible phases are (c)

a. never contacted directly
b. always contacted directly
c. rarely contacted directly
d. none of the above

Q. II.6. In mass transfer operations, immiscible phases are (d)

a. never contacted directly
b. always contacted directly
c. rarely contacted directly
d. none of the above

Q. II.7. In separation operations, mechanical operations are
a. never an alternative to chemical reactions
b. always an alternative to chemical reactions
c. sometimes an alternative to chemical reactions
d. none of the above

Q. II.8. Foam fractionation is
a. a mechanical operation
b. a mass transfer operation
c. either a mechanical operation or a mass transfer operation, depending on the size scale of the substance being separated
d. none of the above

Q. II.9. Froth flotation is
a. a mechanical operation
b. a mass transfer operation
c. either a mechanical operation or a mass transfer operation
d. none of the above

Q. II.10. Adsorption is
a. a mass transfer operation
b. a mechanical operation
c. neither a mass transfer operation nor a mechanical operation
d. none of the above

(Q.II. 1-10: 0.5 mark each)