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53 (FPT 403) TPEN

2016

TRANSFER PROCESS ENGG.

Paper : FPT 403 (Back)

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer **any five** questions.

1. (i) What is fluid viscosity ?
- (ii) Write Newton's Law of viscosity and define all terms.
- (iii) Why viscosity of gas and liquid change with pressure and temperature ?
- (iv) Write Fourier's Law of heat conduction. 4+6+7+3=20
2. (i) A molecule being transported by diffusion through a fluid at steady state. At a given point 1, concentration is $1.37 \times 10^{-2} \text{ g/m}^3$ and $0.72 \times 10^{-2} \text{ g/m}^3$ at

Contd.

point 2. Distance between the points is $0.4m$. Diffusivity $0.013 m^2/s$ and cross sectional area is constant. Calculate Flux and concentration at the middle point of the distance.

(ii) What is conduction and convection in heat transfer? 12+8= 20

3. (i) Calculate heat loss per m^2 of surface area for an insulating wall composed of $25.4mm$ thick fiber insulating board, where the inside temperature is $352.7K$ and outside temperature is $297.1K$. Thermal conductivity of insulating board is $0.048 W/mK$. 10

(ii) Write Fick's 1st law of diffusion and 2nd law of diffusion. Define all terms. 10

4. Water in the bottom of a narrow metal tube is held at a constant temperature of $293K$. The total pressure is $1.01325 \times 10^5 Pa$. Water evaporates and diffuses through the air in the tube and the diffusion path is $0.1524m$ long. Calculate the rate of evaporation at steady state.

The diffusivity of water vapor at $293K$ and $1atm$. is $0.250 \times 10^{-4} m^2/s$. Assume the system is isothermal. Use SI units.

Water vapor pressure at $293K = 17.54 mmHg$. 20