

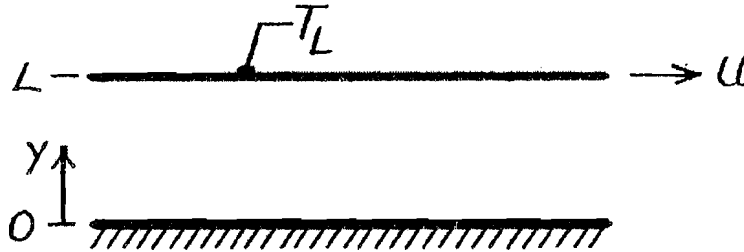
系列：化學工程與材料工程學系

科目：輸送現象與單元操作

准帶項目請打「V」	
V	簡單型計算機

本試題共 / 頁

- [20 pts] A 3' diameter, 25-tray distillation column has been designed to separate n-hexane and n-heptane under atmospheric pressure. Upon installation, the column is run at total reflux until steady state is reached. Analysis of the distillate and bottoms gives mole fractions (in terms of n-hexane) as $x_D = 0.98$ and $x_B = 0.03$. Feed $x_F = 0.45$ (at 10 °F below its boiling point) is put into the column. Estimate the effect on the product composition of each of the following actions, considered separately:
 - reducing the reflux ratio from infinity to 1,
 - increasing the steam pressure in the partial reboiler.
- [20 pts] A solid B contains a soluble component A (mass fraction $x_A = 0.3$ and $x_B = 0.7$) and is to be treated to recover A by solvent extraction with C . Solid B and solvent C are mutually and totally insoluble. The extracted solid is to be screw pressed to a 1 pound solution/pound B in the underflow. The entrainment of B in the overflow can be ignored.
 - Calculate the pounds of solvent C (A -free basis) that must be fed, per pound of $A+B$ feed solid, to obtain 90% of the A in the extract overflow.
 - Calculate the concentration of A in the extract overflow solution.
- [20 pts] Consider Couette flow for which the moving plate is maintained at a uniform temperature and the stationary plate is insulated. Determine the temperature of the insulated plate, expressing your result in terms of fluid properties and the temperature and speed of the moving plate. Obtain an expression for the heat flux at the moving plate.



- [20 pts] The equation for the velocity of a fluid stream measured with a Pitot tube is

$$v = \sqrt{\frac{2\Delta P}{\rho}}$$

where v = velocity; ΔP = pressure drop; ρ = density of fluid

If the pressure drop is 0.02 atm and the specific gravity of the fluid is 1.20, calculate the velocity in m/s.

- [20 pts] Answer the following questions: (5 pts for each question)
 - What is the effectiveness of a heat exchanger? Explain what factors will affect the effectiveness of a heat exchanger.
 - Briefly describe how to calculate the total heat transfer rate for a shell-and-tube heat exchanger while the inlet and outlet temperatures of two involved fluids and UA value of the exchanger are known.
 - State the relationships between the shear stresses (τ), the forces (F), and the momentum that act on a moving fluid.
 - Give the physical significance of the three derivatives $\partial T/\partial t$, dT/dt , and DT/Dt , in which T is the local fluid temperature.