

國立臺北科技大學 112 學年度碩士班招生考試

系所組別：3510 化學工程與生物科技系化學工程碩士班甲組

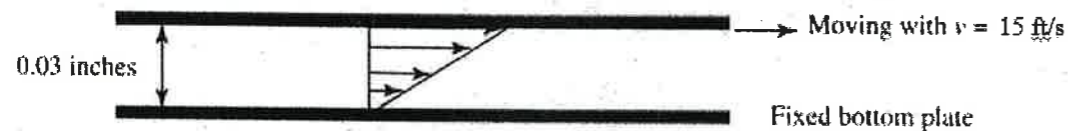
第一節 單元操作與輸送現象 試題

第 1 頁 共 1 頁

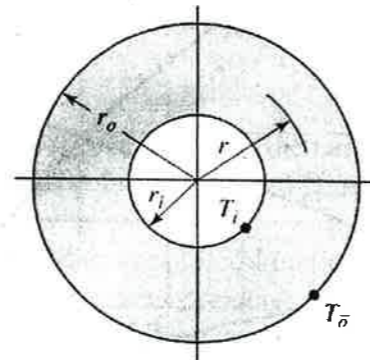
注意事項：

1. 本試題共 5 題，每題 20 分，共 100 分。
2. 不必抄題，作答時請將試題題號及答案依照順序寫在答案卷上。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. Describe and explain the following briefly
 - ① Write the driving forces of momentum transfer, heat transfer and mass transfer respectively. (4%)
 - ② Describe the newtonian and non-newtonian fluids? (4%)
 - ③ What is the "subcooled boiling" and "saturated boiling"; and to describe the difference between evaporation and boiling. (4%)
 - ④ Please interpret the Fourier's law of thermal heat transfer and Fick's first and second law of mass diffusion? (4%)
 - ⑤ Define the plate efficiency in distillation, and what are the types of plate efficiency are used? (4%)
2. A Newtonian oil undergoes steady shear between two horizontal plates. The lower plate is fixed, and the upper plate, weighing 0.5 lb_f, moves with a constant velocity of 15 ft/s. The distance between the plates is constant at 0.03 in and the area of the upper plate in contact with the fluid is 0.95 ft², what is the shear rate (8%) and the viscosity of this fluid (12%)?



3. A steel pipe having an inside diameter of 1.88 cm and a wall thickness of 0.391 cm is subjected to inside and outside surface temperature of 367 and 344 K, respectively. Find the heat flow rate per meter of pipe length (10%), and the also the heat flux based on the inside surface (10%).



4. A steady state Amold cell is used to determine the diffusivity of toluene in air at 298 K and 1 atm. The cell has a 0.8 cm² cross-sectional area and a constant diffusion path length of 10 cm, how much toluene in units of grams per hour must be supplied to the cell to maintain a constant liquid level? (20%) At 298 K the vapor pressure of toluene is 28.4 mm Hg and its specific gravity is 0.866, D_{AB} of toluene in air is $8.44 \times 10^{-6} \text{ m}^2/\text{s}$
5. A tank initially contains 1000 kg of brine containing 10% salt by mass. An inlet stream of brine containing 20% salt by mass flows into the tank at a rate of 20 kg/min. The mixture in the tank is kept uniform by stirring. Brine is removed from the tank via an outlet pipe at a rate of 10 kg/min. Find the amount of salt in the tank at any time t (10%), and the elapsed time when the amount of salt in the tank is 200 kg (10%)?

