

國立中正大學

112 學年度碩士班招生考試

試題

[第 2 節]

科目名稱	輸送現象與單元操作
系所組別	化學工程學系

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

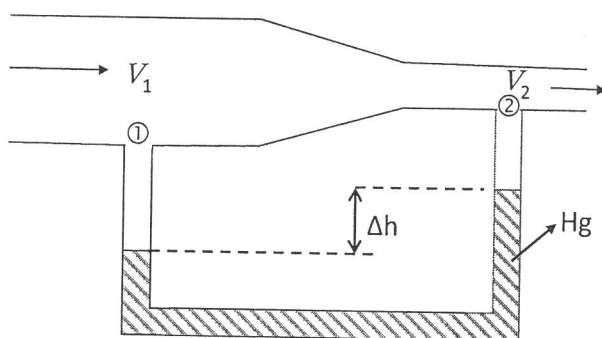
國立中正大學 112 學年度碩士班招生考試試題

科目名稱：輸送現象與單元操作

本科目共 1 頁 第 1 頁

系所組別：化學工程學系

1. A capillary flowmeter is mainly used to measure the pressure difference of pipes with different cross-sectional areas (as shown in the figure below). The cross-sectional areas at ① and ② are A_1 and A_2 respectively. The reading difference of the capillary flowmeter is Δh . Assume it is a horizontal frictionless, stable and equal-density fluid. Please use the Bernoulli equation to derive the velocities V_1 and V_2 (by using Δh , g , A_1 and A_2 to express)? (25%)



2. A heat exchanger is used to heat water ($C_{pw} = 3.0 \text{ KJ/kg}\cdot\text{K}$) from 40°C to 90°C . The mass flow rate of the water is 5.6 kg/s . The hot stream ($C_{pw} = 1.6 \text{ KJ/kg}\cdot\text{K}$) enters the heat exchanger at 210°C and leaves at 160°C . The overall heat transfer coefficient is $60 \text{ W/m}^2\cdot\text{K}$. Please determine:
- The mass flow rate of the heat stream. (10%)
 - The exchanger surface area for counterflow operation. (15%)
3. A liquid is flowing at a rate of $0.2 \text{ ft}^3/\text{sec}$ per feet of width of the plate between two flat parallel plates. The viscosity (μ) of the liquid is $6.98 \times 10^{-3} \text{ lbf} \cdot \text{sec}/\text{ft}^2$. Assume laminar flow. If the distance between the plates is 1 in, please calculate:
- The maximum velocity. (20%)
 - The shear stress at the plate wall. (5%)
4. A spherical ball of solid (nonporous naphthalene) is suspended in an infinite, still air. The naphthalene ball slowly sublimates, releasing the naphthalene vapor into the surrounding air by molecular diffusion-limited process. Estimate the time required to reduce the diameter from 1.0 cm to 0.25 cm when the surrounding air is at 347 K and 1.0 atm. Naphthalene has a molecular weight of 128 g/mol, a solid density of 1.145 g/cm^3 , and a diffusivity in air of $0.0819 \text{ cm}^2/\text{sec}$, and exerts a vapor pressure of 5.0 Torr (666 Pa) at 347 K. (25%)