

系別：航空太空工程學系

科目：流體力學

准帶項目請打「V」	
✓	計算機

本試題共 2 頁，8 大題

本試題雙面印製

- 何謂牛頓流體(Newtonian fluids)? 何謂非牛頓流體(Non-Newtonian fluids)? 10%
- 水流過一塊平板時，開始時為層流(Laminar flow)隨著流過的距離增加變成過渡流(Transition flow)然後變成紊流(Turbulent flow)，這三種流況的特性有何不同？並請畫出在這三種流況下流體在平板表面之速度分布圖。 10%
- 請寫下雷諾數的定義(定義中之各參數需說明)，並解釋雷諾數之物理意義。 10%
- 請解釋天燈及載人熱汽球加熱後為什麼可以飛起來？ 10%
- 因次分析(Dimensional analysis)是在做什麼，有什麼重要性？ 10%
- 圖一為流體流過一個圓柱體及圓球時，圓柱與球上所量得之阻力係數與雷諾數(Re)之關係圖。阻力係數隨著 Re 增加而穩定下降，但在 $Re \approx 2 \times 10^5$ 時阻力係數會快速下降，在 $Re \approx 5 \times 10^5$ 達到最低點然後再回升，請解釋其背後之物理原因。 10%
- A U-tube acts as a water siphon (虹吸管) (圖二). The bend in the tube is 1 meter above the water surface; the tube outlet is 7 meters below the water surface. The fluid issues (流出) from the bottom of the siphon as a free jet at atmospheric pressure (大氣壓力 $= 1.01 \times 10^5 \text{ N/m}^2$). If the flow is frictionless (無摩擦) as a first approximation, determine the speed of the free jet and the absolute pressure of the fluid in the bend (point A). The density of water is 999 kg/m^3 . 20%
- The sketch below (圖三) shows a vane with a turning angle of 60° . The vane moves at constant speed, $U=10\text{m/sec}$, and receives a jet of water that leaves a stationary nozzle with speed, $V=30\text{m/sec}$. The nozzle has an exit area of 0.003 m^2 . Determine the force of the water on the moving vane (both horizontal and vertical forces are required, 水平和垂直力都須計算). 20%

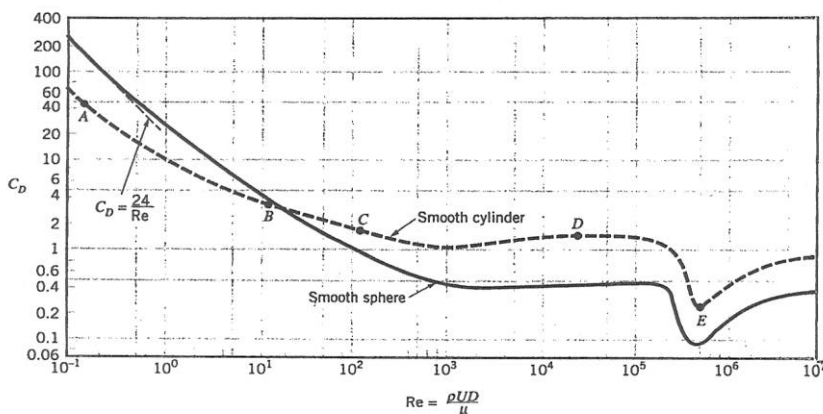


FIGURE 1 (a) Drag coefficient as a function of Reynolds number for a smooth circular cylinder and a smooth sphere.

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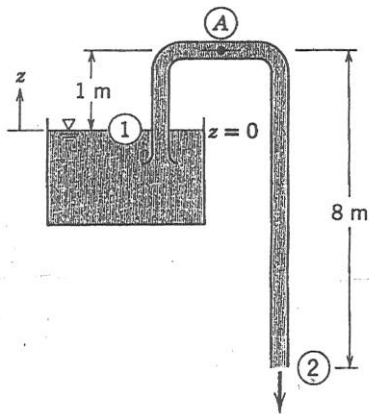


Fig. 2

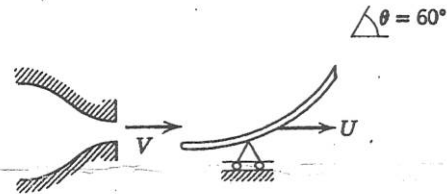


Fig. 3