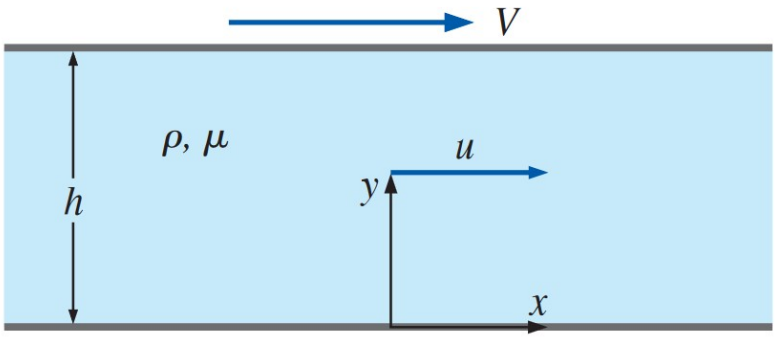
Fluid Mechanics Homework #10

繳交期限：2019/12/04(三) 09:10

共五題，題號為：7-52,54,67,73

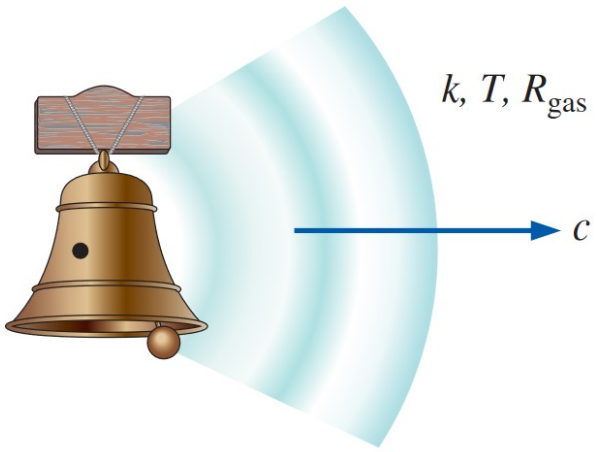
題號的對照書本是 Yunus A. Cengel and John M. Cimbala “Fluid Mechanics: Fundamentals and Applications 3/e (SI Units) ”

7-52 Consider fully developed **Couette flow**—flow between two infinite parallel plates separated by distance h, with the top plate moving and the bottom plate stationary as illustrated in Fig. P7–52. The flow is steady, incompressible, and two-dimensional in the xy-plane. Use the method of repeating variables to generate a dimensionless relationship for the x-component of fluid velocity u as a function of fluid viscosity μ, top plate speed V, distance h, fluid density ρ, and distance y. Show all your work.



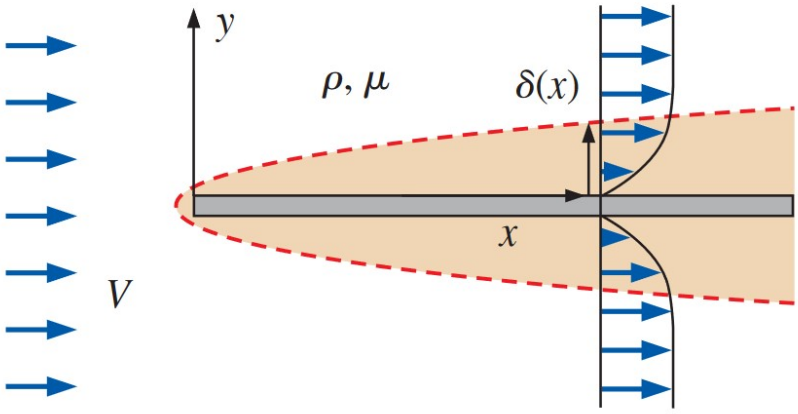
Assumptions: The given parameters are the only relevant ones in the problem.

7-54 The speed of sound c in an ideal gas is known to be a function of the ratio of specific heats k, absolute temperature T, and specific ideal gas constant R_{gas} (Fig. P7–54). Showing all your work, use dimensional analysis to find the functional relationship between these parameters.



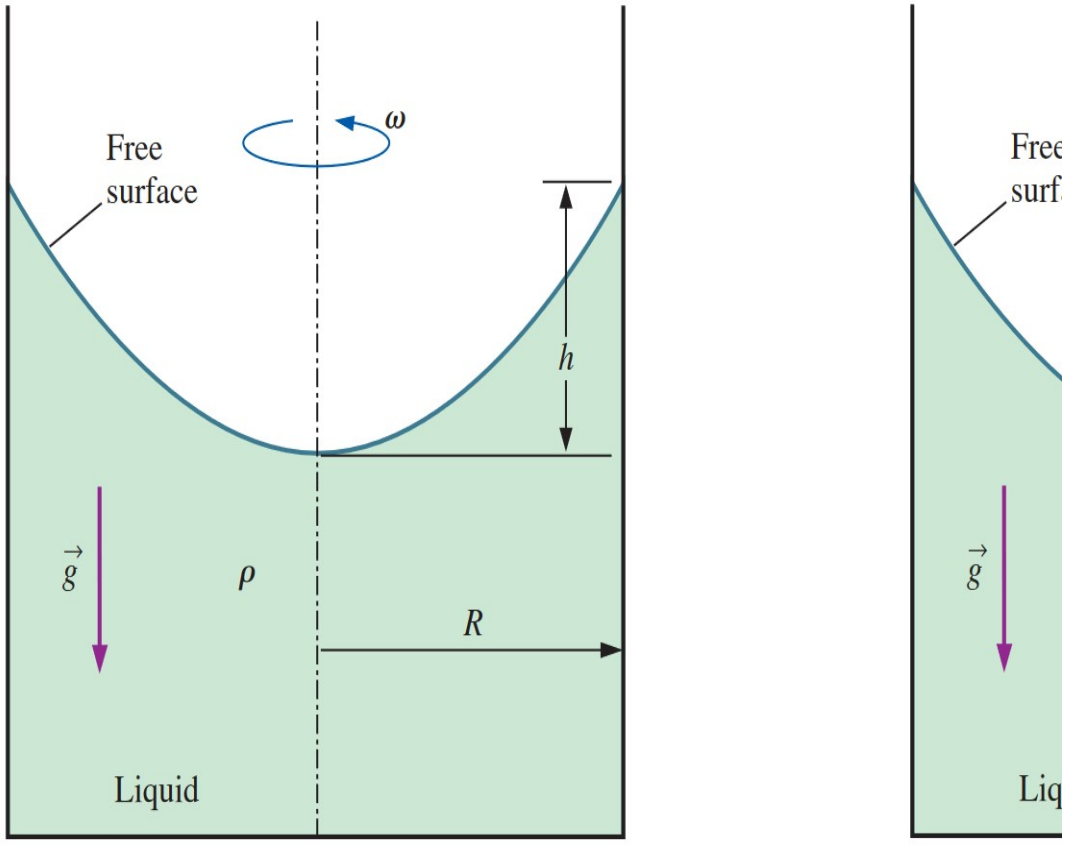
Assumptions: The given parameters are the only relevant ones in the problem.

7-67 A boundary layer is a thin region (usually along a wall) in which viscous forces are significant and within which the flow is rotational. Consider a boundary layer growing along a thin flat plate (Fig. P7–67). The flow is steady. The boundary layer thickness δ at any downstream distance x is a function of x, free-stream velocity V_∞, and fluid properties ρ (density)



Assumptions: The given parameters are the only relevant ones in the problem.

7-73 Consider a liquid in a cylindrical container in which both the container and the liquid are rotating as a rigid body (solid-body rotation). The elevation difference h between the center of the liquid surface and the rim of the liquid surface is a function of angular velocity ω, fluid density ρ, gravitational acceleration g, and radius R (Fig. P7–73). Use the method of repeating variables to find a dimensionless relationship between the parameters. Show all your work.



Assumptions: The given parameters are the only relevant ones in the problem.