

South Dakota School of Mines and Technology
Department of Materials Metallurgical Engineering

Met 422
 MI 222

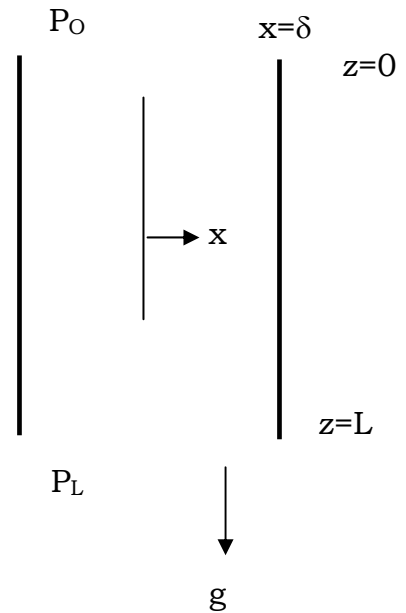
HQ 1
 (closed book)

October 5, 2002
 11:00 AM

1. Find the drag force on a sphere 1 m in diameter tethered in a 40 m/sec wind.

2. a) Derive an equation showing the laminar velocity distribution between two vertical flat plates both fixed. Assume the z direction is positive downward. Gravity acts on the fluid in the z direction. There is a pressure gradient.

b) Show how to find the pressure gradient required to keep the net cup mixing flow at zero. That is, there is a pressure up that should counteract the gravity down. Show how to find it.



3. A study is to be done to determine the mixing occurring as a stream of molten slag is poured from a distance into a ladle as shown. Discuss the pertinent factors needed to model the slag system with water. Address the relative sizes of the systems, the dimensionless variables Involved, the relationship between times in the two systems, etc. The goal is to find the optimal location of the stream relative to the centerline and the optimal height. Ask yourself, “How could I get meaningful results for the slag system using a water model”? What are the important variables?

- Use:
- D = diameter of the vessel
 - η = viscosity
 - ρ = fluid density
 - h = Height of stream

Add more, if needed
 Would you keep some dimensions in the same ratio?
 What is geometric similarity?
 Use the next page.

