16.540 - Internal Flows **Spring 2006**

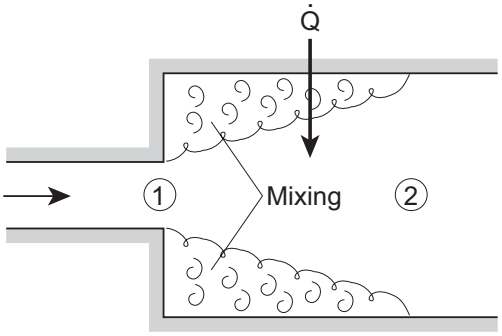
Practice Concept Quiz Questions

1. A perfect gas is passed through a sudden expansion in a duct. The expansion area ratio is three. Just downstream of the expansion an amount of heat, Q, per unit time, is added to the stream.. The flow at the exit of the smaller diameter duct and at a location several diameters downstream in the large pipe can be considered uniform across the duct. The Mach numbers everywhere are much less than one.

What is the change in static pressure from just upstream of the exit of the smaller diameter duct to the downstream station in the larger diameter duct?

a) The static pressure rises
b) The static pressure does not change
c) The static pressure decreases

Why? (Several clear sentences that explain the reason for the answer are needed. There is no credit without these explanations. Equations can be used if you think they are helpful in answering.)



2. What is the answer to the situation in which there is inflow to the bent tube shown in the lecture notes?

a) The rotation is the same as with outflow.
b) There is no rotation.
c) The rotation is opposite to that with outflow.

Why? (Several clear sentences that explain the reason for the answer are needed. There is no credit without these explanations. Equations can be used if you think they are helpful in answering.)

3. A compressible fluid is passed through a sudden expansion in a duct. The expansion area ratio is three. At the exit of the smaller diameter pipe, and several diameters downstream in the large pipe, the flow can be considered uniform across the duct, with the Mach number in the small pipe equal to 0.4. (Note these numbers are just to ensure that you work in the right regime, basically subsonic flow with a modest area increase.)

What are the directions of changes in the following quantities (increase, decrease or stay the same):

a) Stagnation temperature
b) Stagnation pressure
c) Static temperature
d) Static pressure
e) Momentum flux $\left(\rho u^2 A\right)$
f) Entropy