**Problem 5.7**  
*Pressure drop in a reaction zone*

The sketch shows a liquid emulsion—a finely-divided mixture of two immiscible, incompressible liquids—with mean density $\rho_1$ entering a reaction zone of a constant-area reactor with speed $V_1$. The components of the emulsion react chemically in the reaction zone and leave at station 2 as one homogeneous phase with density $\rho_2$. Pitot tubes are installed upstream and downstream of the reaction zone. These measure the total (or stagnation) pressure $p_o = p + \frac{1}{2} \rho V^2$.

Assuming that the flow is inviscid, steady, and one-dimensional, obtain an expression for the change in total pressure from 1 to 2, expressed in the dimensionless form

$$\frac{p_{o1} - p_{o2}}{\frac{1}{2} \rho_1 V_1^2} ,$$

as a function of the density ratio $\rho_2 / \rho_1$.

**HINT**  
**ANSWER**