EXAMPLE 1
Verify the Reynolds number is dimensionless, using both the FLT system and MLT system for basic dimensions. Determine its value for ethyl-alcohol flowing at a velocity of 3m/s through a 5cm diameter pipe.

EXAMPLE 2
At a sudden contraction in a pipe the diameter changes from $D_1$ to $D_2$. The pressure drop, ΔP, which develops across the contraction, is a function of $D_1$ and $D_2$, as well as the velocity, $V$, in the larger pipe, and the fluid density, $\rho$, and viscosity, $\mu$. Use $D_1$, $V$ and $\mu$ as repeating variables to determine a suitable set of dimensionless parameters. Why it be incorrect to include the velocity in the smaller pipe as an additional variables.
EXAMPLE 3

Water sloshes back and forth in a tank as shown in Figure 1. The frequency of sloshing, $\omega$, is assumed to be a function of the acceleration of gravity, $g$, the average depth of the water, $h$, and the length of the tank, $l$. Develop a suitable set of dimensionless parameters for this problem using $g$ and $l$ as repeating variables.

EXAMPLE 4

Assume that the flowrate, $Q$, of a gas from a smokestack is a function of the density of ambient air, $\rho_a$, the density of the gas, $\rho_g$, within the stack, the acceleration of gravity, $g$, and the height and diameter of the stack, $h$ and $d$, respectively. Use $\rho_a$, $d$ and $g$ as repeating variables to develop a set of pi terms that could be used to describe this problem.
EXAMPLE 5

The water flowrate, \( Q \), in an open rectangular channel can be measured by placing a plate across the channel as shown in Figure 2. This type of a device is called a weir. The height of the water, \( H \), above the weir crest is referred to as the head and can be used to determine the flowrate through the channel. Assume that \( Q \) is a function of the head, \( H \), the channel width, \( b \), and the acceleration of gravity, \( g \). Determine a suitable set of dimensionless variables for this problem.

In some laboratory tests, it was determined that if \( b=0.9m \) and \( H=10cm \), then \( Q=0.07m^3/s \). Based on these limited data, determine a general equation for the flowrate over this type of weir.