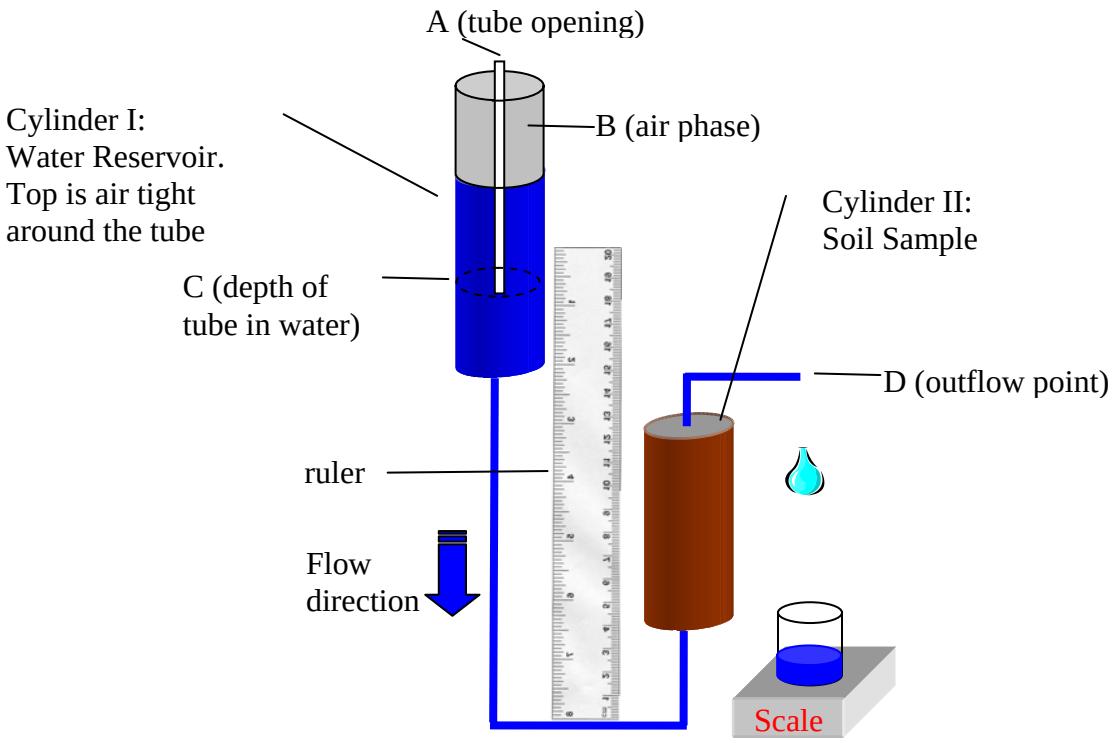
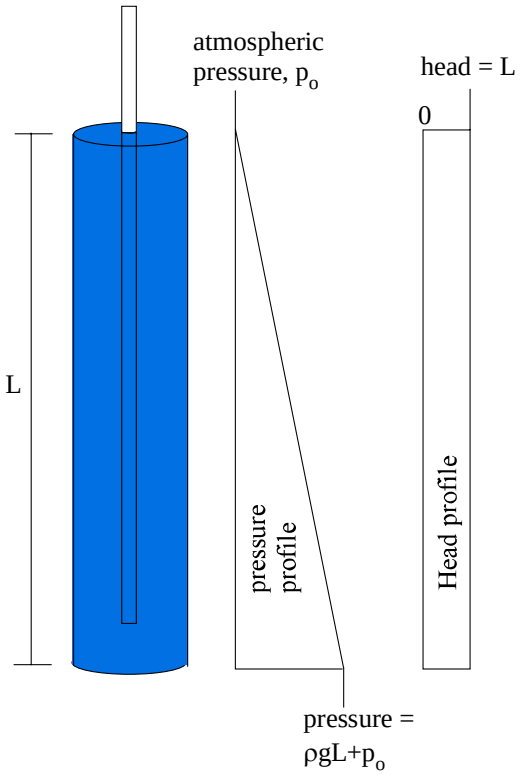
Hydraulic Conductivity: The Permeameter



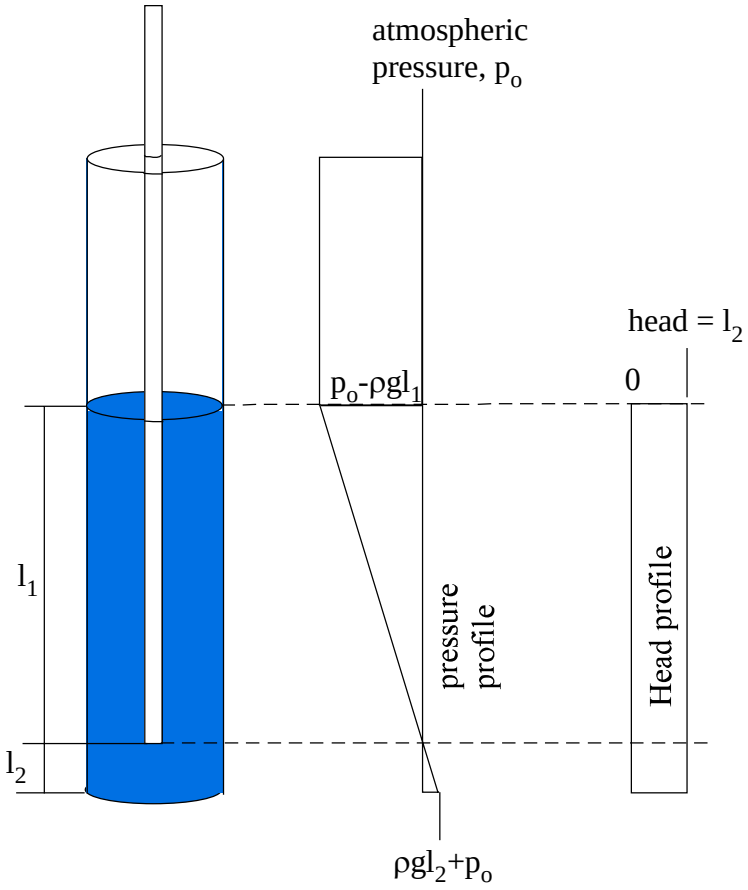
There has been a lot of confusion about how this system maintains a constant head without water flowing into Cylinder I. An explanation is presented below.

Lets focus on Cylinder I:

Initially, before there is any flow, Cylinder I acts like a system open to the atmosphere (like a cup with water in it), and has the following pressure and head profiles:



In order to have flow from any container, the leaving water must be replaced by air. This means that when flow begins in the permeameter, the water in the tube is evacuated first because the tube is the only opening to the atmosphere. Soon, all of the water in the tube is withdrawn and the air-water interface is at the bottom of the tube. At this point, air from the tube begins moves up into the top of the Cylinder to replace the flowing water. This means that the air-water interface remains at the bottom of the tube until the water in the Cylinder drops below the depth of the tube. Therefore, the water at the bottom of the tube experiences atmospheric pressure. The air that has moved up into the top of the Cylinder is at less than atmospheric pressure. The following figure shows the expected pressure and head profiles during flow:



While the water is above the bottom of the tube, the head in the Cylinder is constant (at a value of l_2) because the pressure at the bottom of the tube remains atmospheric.

[Remember, head = Z + $(p-p_o)/(\rho*g)$]