9. Repeat steps 4 through 8 twice more, with different head differences, somewhere around 4 cm and 8 cm Δh. High heads may generate high flow-velocities that lead to nonlinear laminar flow or even turbulent flow.

10. Repeat procedures 1 through 9 for the second sample.

The remaining steps of this first procedure can be done after lab, although it is preferable to do them before leaving, in case there were procedural errors.

11. Write Darcy's equation.

12. Graph the results of your lab observations in Figure 7.2.

    Does Darcy's equation appear to be valid? That is, for a given sand, is the rate of flow of water directly proportional to $\Delta h/\Delta l$?

    If so, the slope of a regression line through the origin is the constant of proportionality, K, or hydraulic conductivity. Actually, it is K_T, the hydraulic conductivity at temperature T.

    Record K_T for each sample.

13. Hydraulic conductivity should be reported at a standard temperature, taken to be 15.5°C. The fluid properties that are temperature-sensitive are density and viscosity. By looking at the values in Table 7.2 on page 55, you can see that density variations are very small compared to changes in viscosity, and, in fact, density can be ignored.

    Thus, K_T can be corrected to K (15.5°C) by

    $$\frac{K_T}{K_{15.5°C}} = \frac{\mu_{15.5°C}}{\mu_T}$$

    Calculate and record $K_{15.5}$.

14. Permeability, k, can now be derived from K. The conversion from K to k is easier if you use the conversions you determined in Problem 3.

    Summary: At 15.5°C, 1μm² = darcies = m/day = gal/day/ft²
    Calculate and record permeability.

15. For each of the tests, calculate a Reynolds number from $N_R = \rho V d/\mu$, where V is specific discharge (not velocity) and the median grain diameter, d, is taken to be the median pore diameter.

    Does each test appear to be valid in terms of probable linear laminar flow—that is, is the flow Darcian? Record results in Table 7.4, on page 58.

16. Estimate the sources of error in this procedure.