Short Answer Questions

1. What is Darcy's Law? State the assumptions under which it is valid.?

2. What is seepage pressure and how does it affect the stability of soil structures?

3. Explain the term "critical hydraulic gradient" and its implication for soil boiling or heave.

Calculation Problems

Figure 1 shows water flow through the soil specimen contained in a cylindrical tube. The specimen's hydraulic conductivity k is 3.4×10^{-4} cm/s. Determine:

1. Pressure heads at points A, B, C, and D in each piezometer.
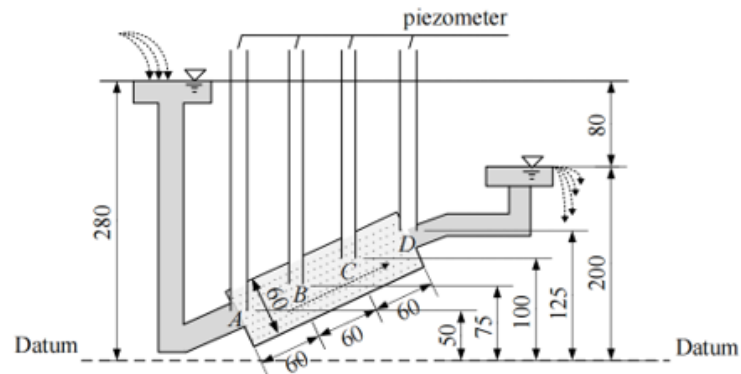
2. The volumetric flow rate through the soil specimen.

Figure 1: Schematic diagram of the problem

A sand sample with a cross sectional area of 35 cm^2 and a length of 20 cm was used in a constant head hydraulic conductivity test. Under a head loss of 60 cm, 120 ml of water was collected in 6 min. The dry weight of the sand used for the test was 1120 g, and $G_s = 2.68$. Determine: 1) the hydraulic conductivity (in units of cm/s); 2) the Darcy velocity; and 3) the seepage velocity.

Two lines of sheet piles were driven in a river bed as shown in Figure 2. The depth of water over the river bed is 2.5 m. The trench level within the sheet piles is 2 m below the river bed. The water level within the sheet piles is kept at trench level by resorting to pumping. If a quantity of water flowing into the trench from outside is 0.3 m^2/h per unit length of sheet pile, what is the hydraulic conductivity of the sand? What is the hydraulic gradient immediately below the trench bed?
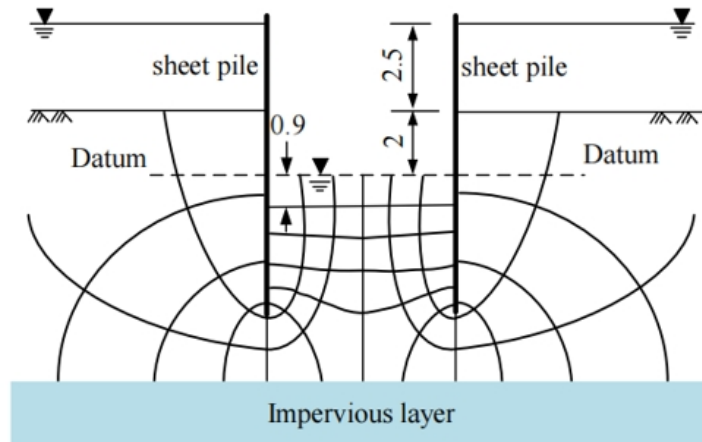

Figure 2: Schematic diagram of the problem