Questions 1 to 10 are worth 3 points. Problems 11, 12, and 13 are worth 30, 20, and 20 points respectively.

1. What is the range of clay size particles?
2. What is the coefficient of curvature?
3. What is the name of the analysis used to obtain the grain size of fine grained soils?
4. What is a CH soil?
5. What are the Atterberg limits?
6. What is soil suction?
7. Give the equation used to calculate the effective stress?
8. Define the hydraulic conductivity of a soil.
9. Define the hydraulic gradient.
10. Give the name of a laboratory test used to measure the hydraulic conductivity?

11. A saturated clay sample weighs 12.6 N, has a diameter of 75 mm, and a height of 150 mm. If the water content is 32.9 %, what is the dry unit weight of the clay. The sample is placed in the oven until it is completely dry. Due to shrinkage, the oven dry sample has a diameter of 73 mm and a height of 145 mm. Calculate the unit weight of the dry sample. Compare the dry unit weight of the saturated sample and the unit weight of the dry sample and explain the difference.

12. A grain size analysis leads to the following results.
   - sieve opening = 25.0 mm   percent passing = 100%
   - sieve opening = 4.75 mm   percent passing = 60%
   - sieve opening = 2.0 mm    percent passing = 40%
   - sieve opening = 0.075 mm  percent passing = 30%
   - sieve opening = 0.003 mm  percent passing = 10%
   The plastic limit is 20 % and the liquid limit is 55 %. Classify the soil according to the USCS.

13. A soil deposit is made of a 10 m. thick layer of clay with a total unit weight of 20 kN/m³ below which is a 5 m. thick layer of sand. The ground water level is 2 m. deep. Calculate the total stress, pore pressure, and effective stress at the bottom of the clay layer. How deep can a wide excavation be made in the clay layer before the effective stress at the bottom of the clay layer becomes zero (bottom blows up). **Note:** assume that the pore pressure in the sand layer in unaffected by the excavation.