

# Soil Mechanics Midterm Exam

Time: 2 hours

Name:

ID #:

1. Sieve analysis data for a 500 g inorganic soil are shown in the table below:

US Standard Sieve No.	Sieve Opening (mm)	Mass Retained on Each Sieve (g)
4	4.75	0
10	2.00	10
20	0.85	15
40	0.425	20
60	0.25	35
100	0.15	50
200	0.075	100
Pan	-	270

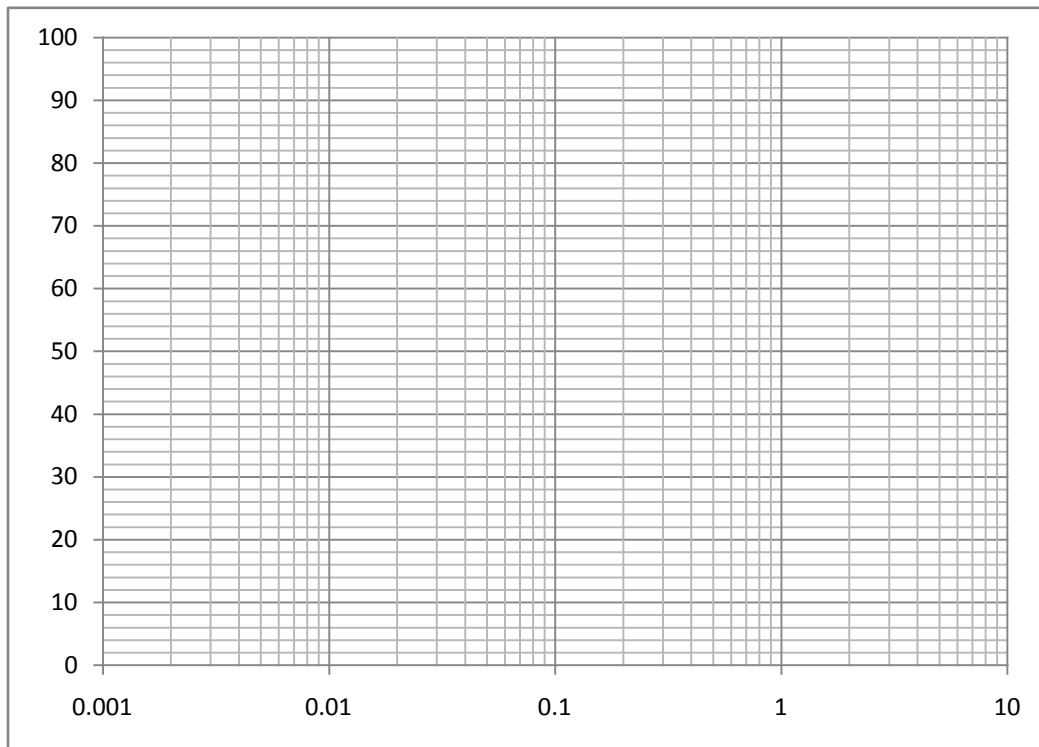
Liquid and plastic limits of the soil are 60% and 20%, respectively. Equations of U-line and A-line are:

U-line:  $PI = 0.9(LL - 8)$

A-line:  $PI = 0.73(LL - 20)$

- a. Plot Grain Size Distribution (GSD) Curve
- b. Classify the soil according to USCS.

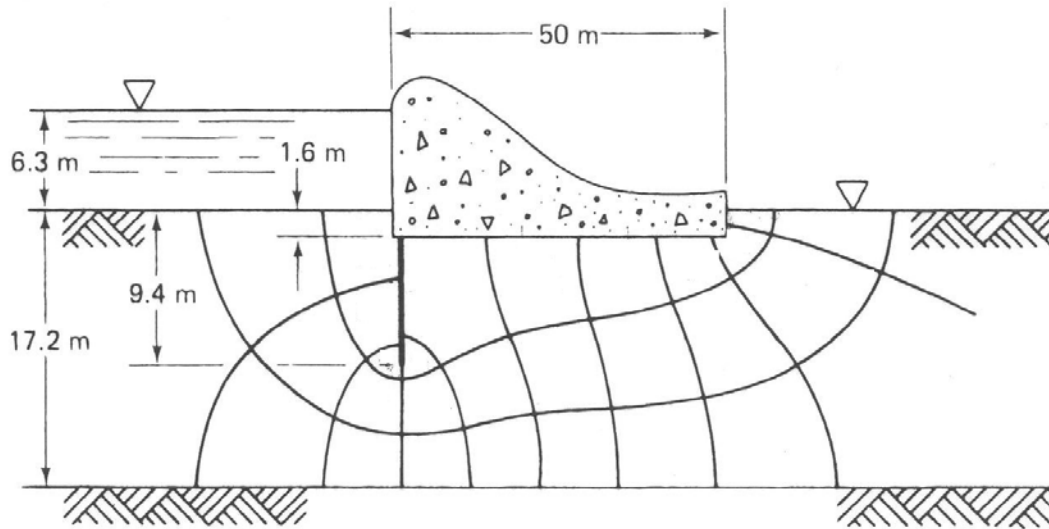
(15 points)



2. Describe the atomic structure of Kaolinite and type of bonding in it (15 points).

3. The values of minimum void ratio and maximum void ratio for a pure silica sand were found to be 0.46 and 0.66, respectively. What is the corresponding range in the saturated density in  $\text{kg/m}^3$  (15 points).

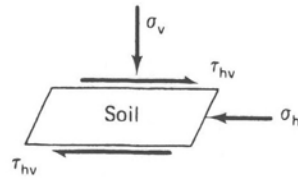
4. The section through a dam is shown in the figure below:



- Compute the flow under the dam per meter of dam if the coefficient of permeability is  $2.4 \times 10^{-6}$  m/s.
- Find the net pressure distribution on the cutoff wall.

(25 points)

5. The state of stress on a small element is  $\sigma_v = 28 \text{ kPa}$ ,  $\sigma_h = 14 \text{ kPa}$ , and the shear stress on the horizontal plane is  $+4 \text{ kPa}$ .



- Find the magnitude and directions of the major and minor principal stresses.
- If the material is a loose sand, can you say whether the element is in a state of failure? Why? (Assume  $\varphi = 30^\circ$ ).

(30 points)