

Birzeit University
Soil Mechanics, ENCE 331
Homework Assignment 1
(Due to 02 Nov 2023, 11:00 p.m.)

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1. Referring to Weight-Volume Relationships, for a given soil, show that:

a. $\gamma_{sat} = \gamma_d + \left(\frac{e}{1+e}\right) \gamma_w$

b. $\gamma_d = \frac{eS\gamma_w}{(1+e)\gamma_w}$

c. $e = \frac{\gamma_{sat} - \gamma_d}{\gamma_d - \gamma_{sat} + \gamma_w}$

d. $w_{sat} = \frac{n\gamma_w}{\gamma_{sat} - n\gamma_w}$

2. For a given soil, the moist unit weight is 17.8 kN/m^3 , the moisture content is 14%, and the specific gravity of the soil solids is 2.69, find the following:

- Dry unit weight
- Void ratio
- Degree of saturation
- Various quantities of the phase diagram for unit volume of soil shown in

Fig. 1-1.

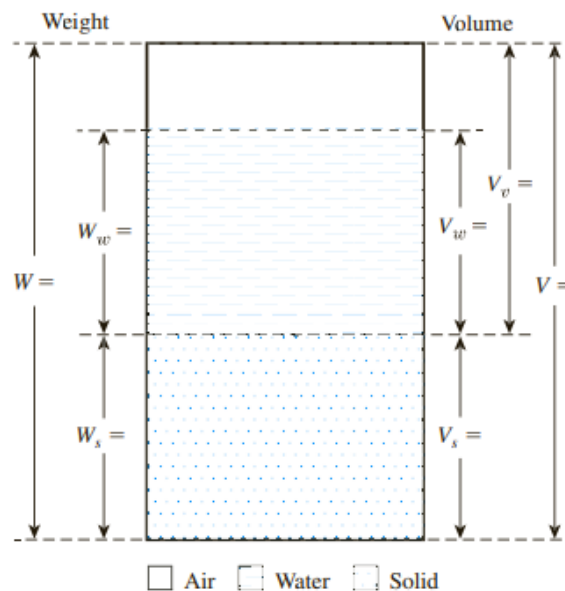


Fig. 1-1: Unit volume of soil element of three phases.

3. Liquid Limit test was conducted on a soil and the collected results are given below:

Number of blows N	Moisture content %
12	35.2
19	29.2
27	25.4
37	21

Determine;

- Draw the flow curve.
 - Liquid Limit of the soil
 - Plastic Limit of the soil if you know that $PI = 6.5$.
 - Liquidity Index of the soil if $w_{in situ} = 23.8\%$.
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4. Two saturated clay soil samples (sample I, and sample II) are subjected to the Shrinkage Limit test, find the Shrinkage Limit and the Shrinkage ratio of the given samples. The test results are given below:

Parameter	Volume cm^3	Mass g
$V_{i(I),(II)}$	19.3, 20.6	---
$V_{f(I),(II)}$	16, 13.8	---
$M_{1(I),(II)}$	---	37, 47.5
$M_{2(I),(II)}$	---	28, 34.6

5. The sieve analysis of five soils and the liquid and plastic limits of the fraction passing through the No. 40 sieve are given below. Classify the soils by:
- AASHTO classification system and give the group index for each soil.
 - Unified soil classification system, find the group symbols for the fine-grained soils.

Soil	Sieve Analysis- Percent Finer			Liquid Limit	Plasticity Index
	No. 10	No. 40	No. 200		
1	98	80	50	38	29
2	100	92	80	56	23
3	100	88	65	37	22
4	85	55	45	28	20
5	92	75	62	43	28