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Subject: Soil Mechanic

⇒ **Weathering:-** Breaks down and loosens the surface minerals of rocks so then can be transported away by agents of erosion such as water, wind and ice. There are Threetypes of weathering.

i) physical weathering.
ii) chemical weathering.
(iii) Biological weathering.

→ **Physical weathering:-** physical weathering also known as mechanical weathering or disaggregation, is the process class that causes rock due to disintegrate without chemical change. Abrasion (the process by which clasts and other particls are reduced in size) is the primery process in physical weathering Due to temprature, pressure, frost etc

⇒ where Does physical weathering occur :- In place where there is little soil and few plants grows, Such as mountain regions and hots deserts Physical weathering occurs especially.

=> **How Does Physical weather Occurs:-**

Either by repeated melting and freezing of water (mountain and tundra) or by expanding and shrinkage the surface layer of rocke backs by the sun

(2) => **Chemical Weathering:-**

chemical weathering changes rock composition, often transforming them into different chemical reactions when water interacts with minerals. chemical weathering is gradualy and ongoing process as the rock minrology adjusts to the Environment near the surface.

=> Where Does chemical weathering Occur?

These chemical process requires water and occur faster at higher temprature So it is best to have warm, humid climates. The first stage in soil production is chemical weathering (especially hydrolysis and oxidation)

=> **Biological Weathering:-** Bo Biological weathering is the weaking and subsequent break down by plants animals and microbes of rocks.

Growing roots of plants can put stress or pressure on rock Even though the process is physical, a biological process. i.e growing roots exerts the pressure. Biological process can also produce chemical weathering such as when organic acids are produced by plants roots or microorganism that help dissolve minerals.

Q#1(b)

=> **Porosity:-** Porosity refers to the amount of pores, or open space, between soil particals. Pore spaces may be performed due to the movements of roots warms and insects. expanding gasses trapped within thess spaces by ground water.

$$n = \frac{V_v}{V}$$

⇒ Voids Ratio :- It is the ratio between volume of voids and volume of solids in a given soil sample. It is denoted by small 'e'

$$e = \frac{V_v}{V_s}$$

⇒ Water Content :- The ratio of the weight of water to the weight of soil solid [dry weight of soil] in a given soil sample.

$$W_{total} = \frac{W_w}{W_q}$$

$$W = W_s + W_w$$

$$V = V_s + V_a + V_2$$

$$W = \frac{W - W_a}{W_d}$$

⇒ Specific Gravity of soil :-

In soil mechanic specific gravity generly refers to the specific gravity of soil solid and is defined as the ratio of the units weight of soil solids to the units weight of water of the same volume

$$G = G_s = \frac{\gamma_s}{\gamma_w}$$

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⇒ Degree of Saturation:- It is ratio of volume of water present in the voids of given soil sample to the total volume of soil.

$$S_r = \frac{V_w}{V_v}$$

It is usually expressed in percentage. It is also called percent saturation. Its value ranges from 0 to 1 Or 0 to 100 percent

$S_r = 1$ For ⇑ saturated soil

$S_r = 0$ For Fully dry soil

$$S_r = \frac{V_w}{V_v} \quad \text{——— A}$$

$$V_v = V_w + V_a$$

$$V_v = V_w$$

$$S_r = \frac{V_w}{V_v}$$

$$\boxed{S_r = 1}$$

——— xxx ——— xxx ———

xxx ——— xxx ——— xxxx

Q# 02(A)

Given Data:

$W = 1100\ cm^3$

wet Mass, $M_w = 210\ gm = 0.21\ kg$

Dry Mass, $M_d = 160\ gm = 0.16\ kg$

specific gravity, $G_s = 3.0$

Required:-

i water Content = w = ?

(ii) Dry Density = γ = ?

(iii) moist Density = γ_d = ?

solution:

water Content = w = ?

we have equation

$$w = \frac{W_w}{W_d}$$

$M_w = M - M_d \Rightarrow 0.210 - 0.16 = 0.0$

$M_w = 0.05\ kg$

$W_w = M_w g \Rightarrow 0.05 \times 9.81$

$W_w = 0.490\ N$

$W_d = 0.16 \times 9.81 = 1.56\ N$

$$w = \frac{W_w}{W_d} \Rightarrow \frac{0.490}{1.56} \times 100 = 25.6$$

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$$\gamma = \frac{M_w \times g}{\text{Volume}} \Rightarrow \frac{0.21 \times 9.81}{1100 \times 10^{-6}}$$

$$\boxed{\gamma = 0.187 \times 10^{-6}}$$

$$\gamma_d = \frac{M_d g}{V}$$

$$\gamma_d = \frac{0.16 \times 9.81}{1100 \times 10^{-6}}$$

$$\boxed{\gamma_d = 0.00143 \times 10^{6}}$$

CP #02 (b)

⇒ Relation between e, w, G_s and S_r for partially saturated soil.

$$e = \frac{w G_s}{S_r}$$

Proof by def

$$w = \frac{W_w}{W_d}$$

$$w = \frac{W_w}{W_s} \Rightarrow \frac{\gamma_w V_w}{\gamma_s V_s}$$

$$w = \frac{V_w}{\left(\frac{\gamma_s}{\gamma_w}\right) V_s} \quad \text{--- (A)}$$

$\because$

$$\frac{\gamma_s}{\gamma_s} = G_s$$

And

$$S_r = \frac{V_w}{V_v}$$

$$V_w = S_r \times V_v$$

$$w = \frac{S_r \cdot V_v}{G_s \cdot V_s}$$

$$w = \frac{S_r}{G_s} \left(\frac{V_v}{V_s} \right.$$

$$w = \frac{S_r}{G_s} e$$

$$e = \frac{w G_s}{S_r}$$

Note :- If a soil is saturated

$$S_r = 1$$

$$e = w G_s$$

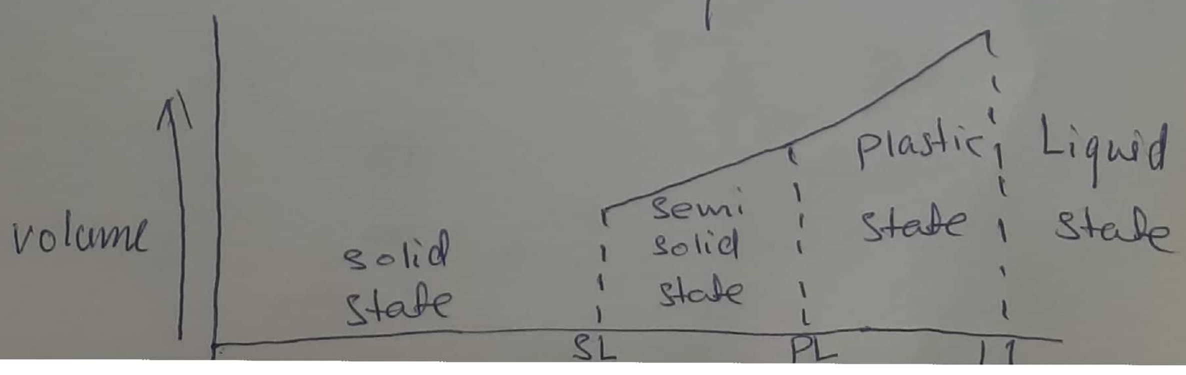
——— xxx ——— xxx ——— xxx ———

xxx ——— xxx ——— xxx ———

CP#03

⇒ **Definition of soil consistency:-** Soil consistancy is the strength with which soil material are held together or the resistance of soil to deformation and rupture. Soil consistancy is measureed for wet, moist and dry soil samples For wet soil, it is express to both stickness and plasticity, as define below. soil consistency maybe estimated in the feild using simple test or may be measured more accurately in the laborty.

⇒ **State OF Consistency OR stages:-** Depending upon water content a soil may have the following stages
(i) solid state (ii) Semi solid (iii) Plastic state (iv) Liquid state.



=> **Consistency Limit (Atterberge Limits)**

The moisture water content at which a fine grained soil changes from one stat of consistency to another state of consistency are termed as consistancy limits or atterberge limit. There are Three Atterbrge limits.

=> ① **Liquid Limit (LL or WL)**:- It is a moisture content at which soil changes from plastic to liquid stat and vice verse

2 => **Plastic Limit (PL/wp)**:- It is a moisture content at which soil changes from its plastic state to semi solid state and vice versa. For lab determination plastic limit is a m.c at which a soil will just begin to crumble (cracks) when rolled into a thread of approx 1/8" in diameter.

3 => **Shrinkage Limits**:- ($SL; W_s$):

It is a moisture content at which soil changes from its semi solid

State to solid state and vice versa.
It is a moisture content at which soil attains constent volume.
i.e. No reduction in volume on further drying

⇒ Seive Analysis:-

It is shrinkage of soil sample through of set a series that have progressively smaller opening.
It is adopted for course grained soil.
It is done by arranging a set of seives in such away that largest seives is cept at the top and smallest seives at the bottom. A reciever pain is kept at the bottom and cover is kept at the top of seive assembly.

⇒ Calculation :-

① Find Retain on each seives a R_1, R_2, R_3 --
② Find %age retain on each seives % % R_1, % R_2
③ Find commulation retain for each sieves as % CR_1, % R_1

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$\% CR_1 = \% R_1 + \% R_2$

$\% CR_3 = \% R_1 + \% R_2 + R_3$

④ find commulation %age passing (% finer) for each sives

$\% CP_1 = 100 - \% CR_1$

$\% CP_2 = 100 - \% CR_2$

$\% CP_3 = 100 - \% CR_3$

⑤ Construct gradation curve

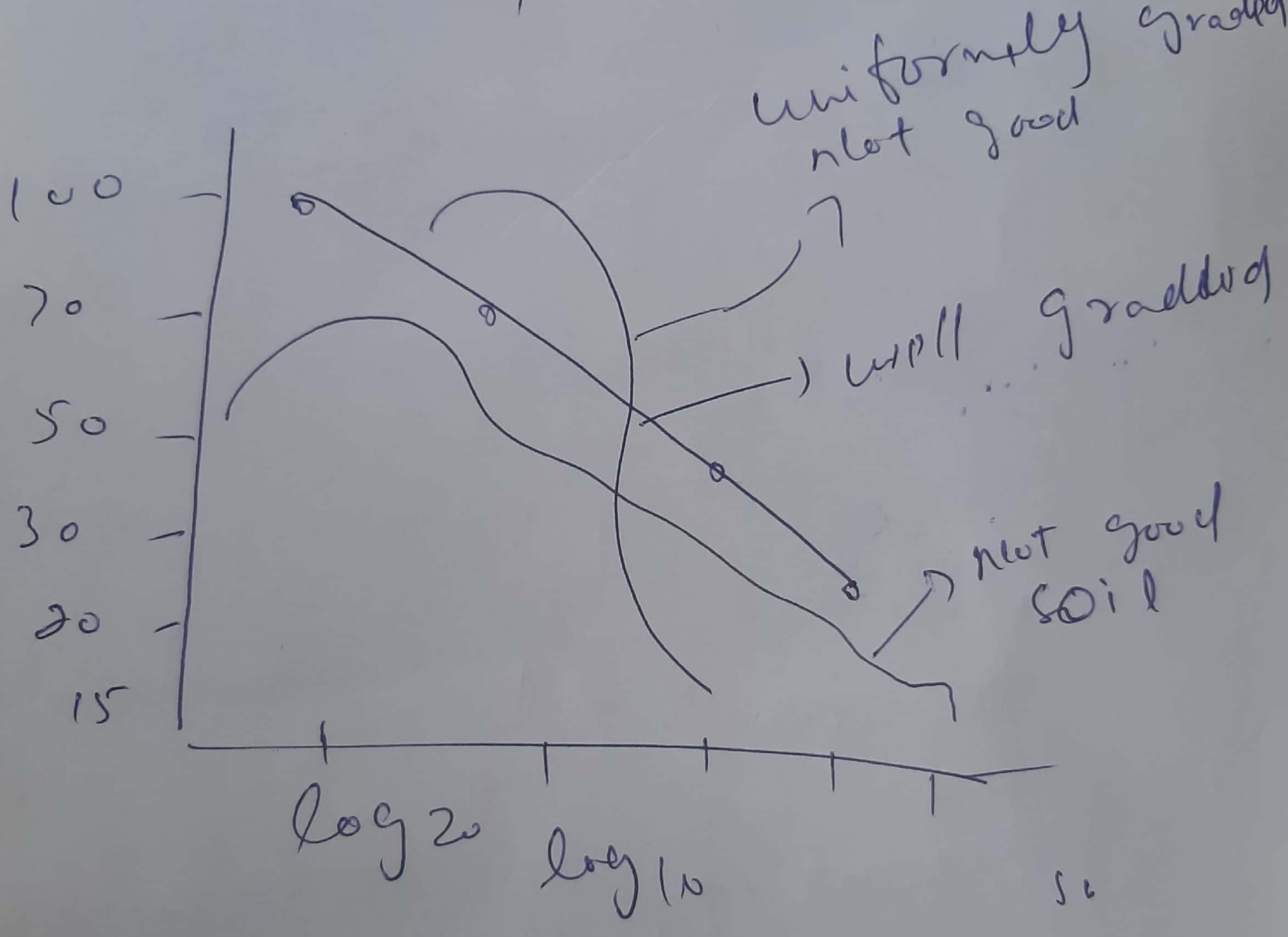
$W = R_1 + R_2 + R_3$ —— wt of pan

Example:- for sieve analysis re-sult find cumalative percent finer for each

Sieve Size	Soil retain	% retain	Cumulative % retain	% fined
20 mm	33	$\frac{33 \times 100}{1000} = 3.3$	3.3	100 − 3.3 = 96.7
10 mm	49	4.4	4.9 + 3.3	100 − 8.2 = 91.8
4.75 mm	85	8.5	16.7	83.2
2 mm	140	14.0	30.7	69.3
1 mm	160	16.0	46.7	53.3
600 micron (abm)	142	14.2	60.4	39.1
425 micron	118	11.8	72.2	23.3
300 "	82	8.2	80.9	19.1
212 "	23	2.3	92.30	7.7
150 "	77			

$$\% R = \frac{R}{W} \times 100$$

% CR = % R,



particle size (sieve size)
on log scale