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Program: B.Tech Civil

Subject: Soil Mechanics

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Q2 A: Weathering

=> Weathering Processe occur at or near the Earth's Surface and Produce changes to the Landscape that influence Surface and Subsurface topography and Land-From development.

=> Weathering is the Physical disintegration or Chemical alteration of rocks at or Near the Earth's Surface.

=> Erosion is the Physical removal and transportation of weathered material by water wind, ice, or gravity.

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Q1 A

Types of Weathering

① Mechanical (Physical) Weathering:

Is the Physical disintegration and reduction in the size of the rocks without changing their chemical composition.

Exp: Exfoliation, Frost wedging, Salt wedging Temperature changes and Abrasion.

② Chemical Weathering:

It is decomposes, dissolves, alters, or weakness the rocks through chemical Processes to form residual materials.

Exp: Carbonation, Hydration, hydrolosis, oxidation, and Solution.

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③ Biological Weathering.

⇒ Biological weathering is the disintegration or decay of rocks and minerals caused by chemical or physical agents of organisms.

Exp: organic activity from lichen and algae, Rock disintegration by Plant or root growth, Burrowing and Tunneling organisms, And acid secretion.

Q1 B

Porosity

=> The Porosity "n" of a given Soil Sample is the ratio of the volume of voids to the total volume of the given Soil Mass.

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

The voids ratio "e" is generally Expressed as a fraction, while the Porosity "n" is Expressed as a Percentage and is, therefore also referred to as Percentage voids.

Q1B

Voids ratio

=> Voids ratio "e" of a given soil sample is the ratio of the volume of voids to the volume of soil solids in the given soil mass

$$e = V_v / V_s$$

Water Content

The water content is defined as the ratio of the weight of water to the weight of solid particles. The water content is expressed as a percentage.

$$W_c = W_w / W_s .$$

Q1 B

Degree of saturation

=> In a given volume of voids of a sample some space is occupied by water and the rest by air. In a fully saturated sample, the voids get completely filled with water. The degree of saturation "S" is defined as the ratio of the volume of water present in a given soil mass to the total volume of voids in it. Thus

$$S = V_w / V_v$$

The degree of saturation is usually expressed as a percentage and is also known as percentage saturation.

For a fully saturated sample $V_w = V_v$ and hence $S = 1$.

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Specific Gravity of Solid Particle

=> Specific gravity of Soil (G_s) is defined as the ratio of the a unit weight of solid Particles to the unit weight of water at 4°c, Specific gravity of soil particle equal from 2.60 to 2.70

$$G_s = \gamma_s / \gamma_w = \frac{\text{Unit weight of Solid Particles}}{\text{Unit weight of water at } 4°c}$$

Where

$\gamma_w = 1.00$ gm/cm^3

$= 1.00$ ton/m^3

$= 9.81$ KN/m^3

$= 62.4$ lb/ft^3

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Q2

A

Given Data

$Vol = 1100\,cm^3 = 1100 \times 10^{-6}\,m^3$

wet mass = 210g = 0.21 Kg

Dry mass = reduced mass = 160g = 0.16 Kg

$S.g = 3$

Req

$W = ?$

$\gamma = ?$

$\gamma_d = ?$

(i) Water content.

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

mass of water c = $M_w = M - M_d$

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9 =

Q =

A

= 0.210 − 0.160

= 0.050 kg

$W_w = 0.05 \times 9.81$

$= 0.4905 N$

● [illegible]

$W_d = 0.16 \times 9.81 = 1.56 N$

$W = \frac{0.4905}{1.56} \times 100$

$W = 31.44 \%$

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(2) Dry density

$$\gamma = W/V$$

$$\gamma = \frac{0.21 \times 9.81}{1100 \times 10^{-6}}$$

$$\gamma = 1870.90\ N/m^2$$

~~$\gamma = 18.62 \times 10^2\ N/m^2$~~

(3) Moist density

$$\gamma_d = \frac{W_d}{V}$$

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

$$\boxed{\gamma_d = 1426.0\ N/m^2}$$

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Q2
B

Proof By def

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

$W = \gamma V$

$\gamma = W / V$

$W = \gamma V$

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

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

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

And $S_r = V_w / V_v$

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Q2

B

$\Rightarrow V_w = S_r \times V_v$

eq (A)

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

$\Rightarrow w = \frac{S_r}{G_s} (V_v/V_s)$

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

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

If soil is saturated

$S_r = 1$

$e = w G_s$

Ans

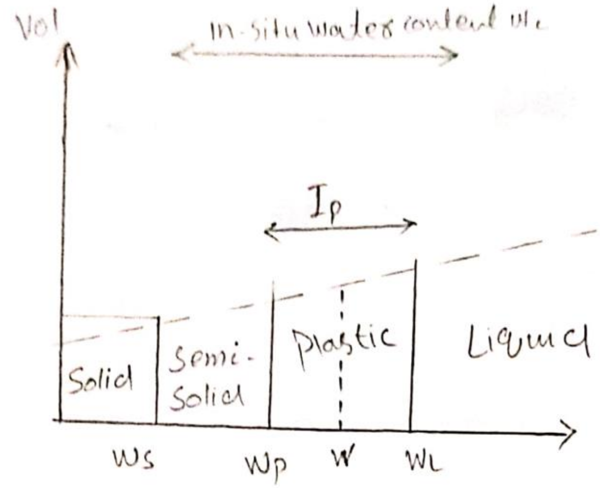
Q 3

Consistency limits (Atterberge limits)

=> The consistency of a fine-grained soil refers to its firmness, and it varies with the water content of the soil.

=> A gradual increase in water content causes the soil caues the soil to change from solid to semi-solid to plastic to liquid states. The water contents at which the consistency changes from one state to the other are called consistency limits (or Atterberg limits)

=> The three limits are knowns as the shrinkage limit (W_s), plastic limit (W_p) and liquid limit (W_L) as shown. The values of these limits cand be obtained from Laboratory tests.



water content.

① Shrinkage Limit:

Is the water content at which the soil changes from the smei-solid state to the solid state. For fine-grained soils. it was observed that a decrease in the water content causes a corresponding ~~des~~ decrease in the volume of the soil. when the soil is in plastic or semi-solid state.

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Q3

② Plastic limit:

=> Plastic Limit is the water content at which a soil changes from the Plastic state to the Semi-solid state. It is the minimum water content at which the soil remains in Plastic state and can be molded to any Shape without rupture.

③ Liquid Limit:

=> Liquid Limit is the water content at which a soil changes from the Liquid state to the Plastic state. It is the minimum water content at which the soil is still in the Liquid state but ~~poss~~ possesses Small shear strength againts flow.
The Liquid limits is not the Same for all soils.