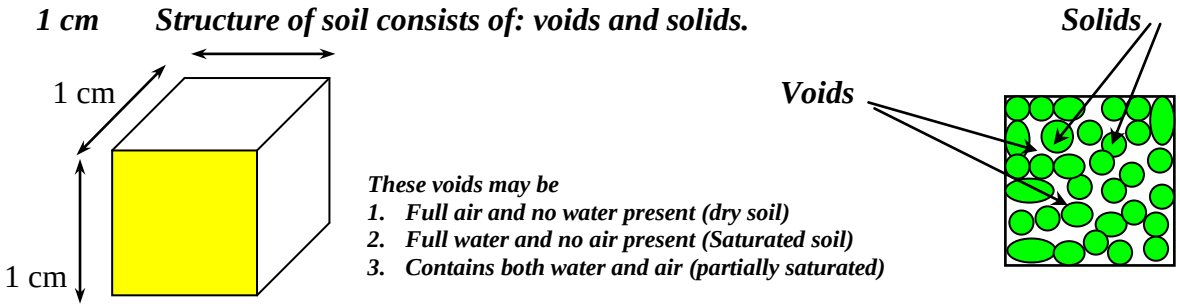
# WATER CONTENT (MOISTURE CONTENT)

Is one of the easiest properties of a soil to obtain, it is also one of the most useful.

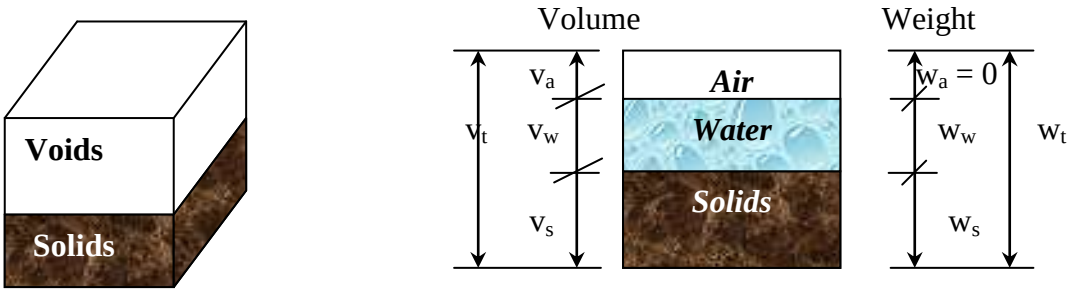
## INTRODUCTION

Assume we have a volume of soil removed from field location in the form of a cube with lateral dimensions of 1 cm (volume =1 $cm^3$) as shown in the following figures.




a) Cube of soil removed from ground b) Element of natural soil

***The Component of soil can be represented by a phase diagram as shown:***




c) Soil solids formed into nonporous volume of less than 1 $cm^3$.

d) Three-Phase diagram: Volumetric and weight relationships for the original soil mass.

## RELATIONS

$w_t = w_s + w_w$ $v_v = v_a + v_w$ $v_t = v_v + v_s = v_a + v_w + v_s$

Definition: water content is the ratio of the weight of water in a given soil mass to the weight of solid particles. The water content is also known as the moisture content. It is commonly expressed as a percentage and may be written:

$$\text{w.c } (w, m) = \frac{W_w}{W_s} \times 100 \quad (\%)$$

Where: $W_w$ = the weight of water. (g)

$W_s$ = the weight of soil solids. (g)

1. The standard and recommended method for determining the water content of soils is the oven drying method with a drying temperature of **105 $^{o}$C** to **110 $^{o}$C**.
2. The alternative methods include the sand bath method, carbide method and alcohol method.

❖ The water content of a soil is an important property. The characteristics of a soil, especially a fine-grained soil, change to a marked degree with a variation of its water content.

## PURPOSES

- To determine **w.c** in a given soil mass.
- It is used to find other properties of soil such as degree of saturation (**S**), dry unit weight ($\gamma_d$), specific gravity (**Gs**), void ratio (**e**), porosity (***n***) and grain size distribution.

## APPARATUS

The equipment for determining water content includes

1. Oven with accurate temperature control.
2. Small metal container.
3. Balance accurate to 0.1 g (0.2 % of the sample weight).

## PROCEDURE

**1.** Clean, dry, and weigh the aluminum Container. ($\mathbf{w_c}$ )

**2.** Select the test sample to be representative of the soil from which it is taken. It is recommended to select the approximate weight of the soil sample depending on soil types as follows;

| **Maximum size of soil particles (95-100)% pass the given sieve** | **Recommended minimum sample weight (gm)** |
|---|---|
| No. 40 (0.42) mm | 10 -50 |
| No. 4 (4.75)mm | 100 |
| 1/2 in sieve (12.5) mm | 300 |
| 1 in sieve (25) mm | 500 |
| 2 in sieve (50)mm | 1000 |

**3.** Place the representative sample of wet soil in the container and immediately determine the weight of the wet soil + container ($\mathbf{w_{w+c}}$ ).

**4.** Place the sample (wet soil + container) in the oven, which is **105 $^{o}$C - 110 $^{o}$C** for **24 hours**.

5. When the sample has dried to a constant weight, obtained the weight of the dry soil + container ($\mathbf{w}_{d+c}$ ).
6. Compute the water content **w.c.**

## CALCULATION

The water content is calculated as follows:

$$\mathbf{W.C.} = \frac{W_{w+c} - W_{d+c}}{W_{d+c} - W_c} \times 100 = \frac{W_{water}}{W_{Solid\ Particles}} \times 100$$

where :

$\mathbf{w_c}$ = is the weight of the container (g).

$\mathbf{w}_{w+c}$ = the weight of the wet soil and container (g).

$\mathbf{w}_{d+c}$ = the weight of the dry soil and container (g).

## Note :

If two or three separate measurements have been made on the same soil specimen, the average value of water content is then calculated.

## DISCUSSION

**In addition of the general questions (from Report Writing) answer the following question**

1- Will the oven temperature change if Organic soil was tested instead of inorganic Soil? If yes, why?
2- If you test a high plasticity soil, what is the expected water content?

## WATER CONTENT (MOISTURE CONTENT)

**Name: ……**

**Class: ……  Group No.: ……**

**Sample description: ……..**

| | **Sample 1** | | | **Sample 2** | | |
|---|---|---|---|---|---|---|
| Depth from ground surface (cm) | | | | | | |
| Can No. | | | | | | |
| Weight of the metal container $\mathbf{w_c}$ (g) | | | | | | |
| Weight of the container and wet soil $\mathbf{w}_{w+c}$ (g) | | | | | | |
| Weight of the container and dry soil $\mathbf{w}_{d+c}$ (g) | | | | | | |
| Water Content **%** | | | | | | |
| Average Water Content **%** | | | | | | |

**Signature: ……**

**Test date:**