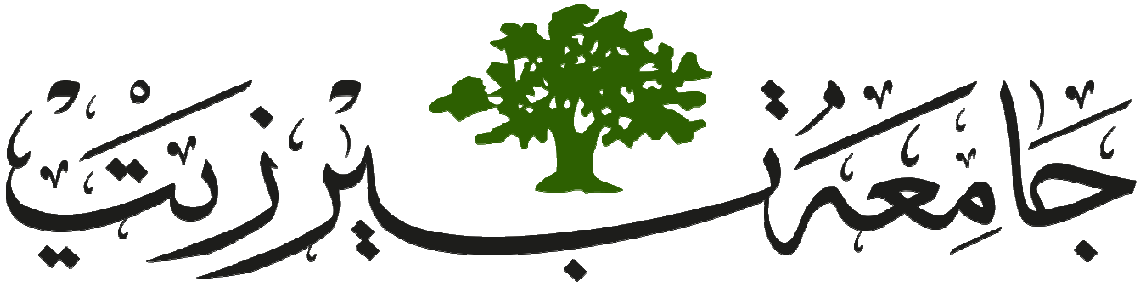


**Faulty of Engineering and Technology**

**Civil Engineering Department**

**Soil Lab**

**ENCE311**

# Experiment #1 :

# " Specific Gravity "

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**Contents :**

## Introduction :

Soil is a non-cohesive aggregate of minerals, inorganic materials and voids that include (air + water). Where it is referred to as a three-phase material. Soil mechanics is a branch of science concerned with studying the physical properties of soils and how the soil interacts, and this is done because the soil is what receives the loads from the structure and helps support it. Soil is known to be a heterogeneous substance because it differs from one region to another and therefore each type behaves differently and supports different amounts of loads and therefore, the soil must be classified and studied accordingly to determine the most efficient way to use what we have, the type of structure and the way it is loaded onto the soil. All of these tests help determine the best safety standards that ensure maximum safety and prevent major breakdowns that may cost time and money.

Some of the characteristics of soil that can be classified by are its specific gravity and free bloating index. It is known that the specific gravity is the ratio between the density of a substance and the density of water, and the range of specific gravity according to soil standards is [2.6-2.9], so each domain has its own class and name. The density of an object is known to be determined by dividing mass by volume. The mass of a substance can be determined using an electronic balance, and you need an accuracy of 0.1 grams because the soil samples are small in size, but to determine the size of an irregular body, Archimedes's law is to be applied as it states that the displaced mass of a solid in water equals the volume of the substance, and thus if The weight of a given volume of water was known and the weight of the specified volume of water and the mixture of the sample After that, the difference between the two samples plus the weight of the sample gives us the volume required to determine the density of the substance.

*Specific gravity S.G. is given in this relation:

$$G_s = \frac{\text{unit weight (or density) of soil solids only}}{\text{unit weight (or density) or water}}$$

$$G_s = \frac{W_s / V_s}{\rho_2} = \frac{W_s}{V_s \rho_w}$$

Where:

$M_s$: Mass of soil solids (g)

$V_s$: Volume of soil solids ($cm^3$)

$P_w$: Density of water ($g/cm^3$)

$P_s$: Density of solid ($g/cm^3$)

* Soil classification based on specific gravity.

| Soil Type | Range of $G_s$ |
|---|---|
| Sand | 2.63–2.67 |
| Silts | 2.65–2.7 |
| Clay and silty clay | 2.67–2.9 |
| Organic soil | less than 2 |

## Purpose:

To determine the specific gravity of the soil that we are dealing with, and then determine the category to which it belongs by comparing the result we obtained with the specific classifications, because determining the specific weight of the soil is important in calculating the percentage of void, porosity, unit weight, degree of saturation.

## Materials and Equipment's :

Look at the **" Table 1 "** that show the equipment we used in this experiment :

| Equipment | The name of it : | Equipment | The name of it : |
|---|---|---|---|
|  Figure 1 | **Flask** |  Figure 2 | **Soil** |
|  Figure 3 | **Evaporating Dish** |  Figure 4 | **Funnel** |
|  Figure 5 | **Balance** |  Figure 6 | **Plastic Squeeze** |
|  Figure 7 | **Sieve** |  Figure 8 | **Vacuum Pump** |

" Table 1 "

## Procedure :

- A **50g** of soil which passed from ***sieve #10*** was taken.
- The sample was put in a plate and mixed with water.
- The water flask was taken and was filled up to **500ml** and weighted.
- the sample of soil and water was put in the flask.
- A vacuum pump was used to remove the air from the voids for **5mins**.
- Water was added to the flask.
- The flask was weighted again.
- The steps above was repeated for another sample.

## Data and Calculations :

**Data :**

| | Trial 1 | Trial 2 |
|---|---|---|
| Mass of flask + water filled to mark, WJ (g) | 664.9 g | 664.9 g |
| Mass of dry soil, Ws (g) | 50 g | 50 g |
| Mass of flask + soil + water filled to mark, W2 (g) | 694.3 g | 694.5 g |

**Calculations :**

For trial 1 :

Volume = $( W_1 + W_s ) – W_2 = 664.9 + 50 – 694.3 = 20.6$

Specific Gravity = Density of Soil / Density of water

= mass of soil / volume * 1

= 50 / 20.6 = 2.427

For trial 2 :

Volume = $( W_1 + W_s ) – W_2 = 664.9 + 50 – 694.7 = 20.2$

Specific Gravity = Density of Soil / Density of water

= mass of soil / volume * 1

= 50 / 20.2 = 2.475

## Results and Conclusion :

**Results :**

There are two results :

1. 2.427 " Trial 1 "
2. 2.475 " Trial 2 "

**Conclusion :**

The error of our experiment is ( $\pm$ 0.02 ) , according to our results we conclude that the difference between the two results = 0.048 , this error is too much and higher than the normal error . The reasons of this error we will discuss in the **( Sources of errors )** .

## Sources of errors :

- There is an error in the weight of the sample, as its weight can be greater or less than 50 grams
- The water level added in thevolumetric flask in the first attempt is greater or less than the water level in the second attempt
- Not enough air was drawn from the sample
- The remains of parts of the sample (soil mixed with water) on the plate

## References :


- Soil lab manual
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