Soil Moisture Calculation

Introduction

This lesson is a continuation of the tutorial on soil water estimation. In this lesson there are four sets of problems on soil moisture estimations. Your attempts to solve these problems will help you to assess your understanding of the subject on soil water and its estimation.

Calculation of soil moisture content by mass and volume

A soil sample weighed 230 g in a moisture box. The mass of the moisture box was 78 g. After drying at 105 degrees C to a constant mass, the soil and box weighed 204 g. The soil sample filled a 1000 cc container as it was taken from the field. Find the moisture percentage in the soil by mass and by volume.

1. Water (%) by mass:

Wet mass of soil = (wet mass of soil + box)-(mass of box)

= 230 - 78 = 152 g

Dry mass of soil = (dry mass of soil + box)-(mass of box)

= 204 - 78 = 126 g

Water (%) by mass = (wet mass - dry mass / dry mass) x 100

= (26 / 126) x 100 = 21 %

2. Water (%) by volume:

= (vol. of water / bulk vol. of soil) x 100

Vol. of water = mass of water / density of water

= 26 g / 1 g per cc = 26 cc

Hence: Water (%) by volume =(26 cc / 1000 cc) x 100 = 2.6 %

So, the answers are:

1. Water by mass = 21 %

2. Water by volume = 2.6 %

Calculation of forms of soil water on mass basis

The following data represent a soil sample:

Soil mass at field capacity = 85 g Find :
Soil mass at wilting point = 71 g Water (%) at field capacity
Air-dry mass = 64 g Water (%) at wilting point
Oven-dry mass = 58g Available water (%)

$$\text{Water at field capacity} = \frac{85 - 58}{58} \times 100 = 47\ \%$$

$$\text{Water at wilting point} = \frac{71 - 58}{58} \times 100 = 22\ \%$$

Available water = Field capacity - Wilting point

= 47 - 22 = 25%

Calculation of forms of soil water on percentage basis

The soil contained the following moisture contents:

Moisture at field capacity = 25 % Find :
Moisture at wilting point = 16 % Available water (%)
Air-dry moisture = 12 % Capillary water (%)
Oven-dry moisture = 11 % Hygroscopic water (%)

Available water (%) = Field capacity - Wilting point

= 25 - 16 = 9%

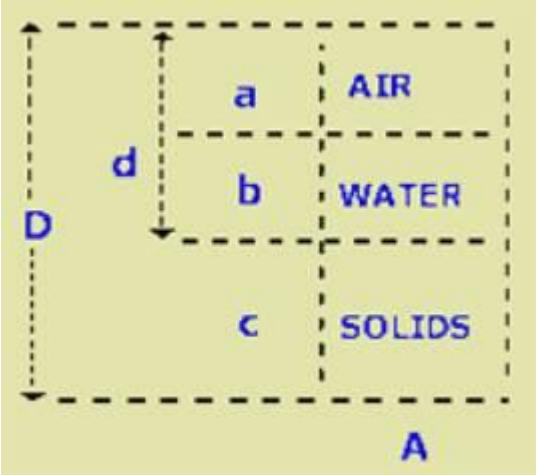
Hygroscopic water (%) = air dry water - oven dry water

= 12 - 11 = 1%

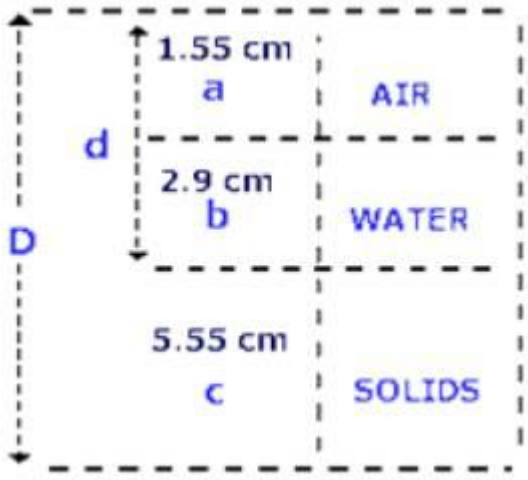
Capillary water (%) = Field capacity - hygroscopic water

= 25 - 1 = 24%

Calculation of depth of water, water holding capacity, porosity



A cube of soil measures 10 cm x 10 cm x 10 cm (D = 10 cm, A = 100 sq cm) and has a total wet mass of 1990 g of which 280 g is water. Assume the density of water is 1 g per cc and particle density is 2.65 g per cc. Find the depth of water, water-holding capacity and aeration porosity of the soil.



$$\text{1. Depth of water} = \frac{\text{water volume}}{\text{surface area}}$$

water volume = mass of water / density of water

= 290 g / 1 g per cc = 290 cc

c = solids volume / surface area

solids volume = solids mass / particle density

= (1760 - 290) g / 2.65 g per cc

= 555 cc

Hence, c= 555 / 100 sq cm = 5.55 cm

Now we will calculate **a** as shown in the diagram:

a =D - (b + c)

=10 cm - (2.9 cm + 5.55 cm) = 1.55

Therefore:

a in the diagram is thus1.55 cm **b** in the diagram is thus 2.9 cm **c** in the diagram is thus 5.55 cm

2. Water-holding capacity (saturation water content)

= mass of water when saturated / mass of dry soil

= mass of water when saturated / mass of dry soil

= 1 g per cc x (1.55 + 2.9) / 2.65 g per cc x 5.55 = .3

Water-holding capacity (%) = .3 x 100 = 30 % 3. Aeration porosity = air filled pore vol. / bulk vol. of soil = aA / DA = a / D = 1.55 cm / 10 cm = .15 Aeration porosity = .15 x 100 = 15 % **So the answers are:** 1. Depth of water = 2.9 cm 2. Water-holding capacity = 30 % 3. Aeration porosity = 15 %

Solving problems on soil moisture content by mass and volume

Solving problems on forms of soil water on mass basis

Solving problems on forms of soil water on percentage basis

Problems on depth of water, water holding capacity and porosity