NEVADA CLIMATE CHANGE PORTAL

Volumetric Water Content Experiment

Grade Level: 9-10
Objective: The objective of this experiment is to determine the water content in experimental samples, while understanding various measuring methods. Students will learn how to calculate the amount of water in available samples; thus, understanding the use of volumetric water content data made available by NevCAN monitoring sites.

Background Knowledge:

Water content is frequently used in a wide range of scientific and technical work, and is typically expressed as a ratio, which can range from 0 (if completely dry) to the value of the materials' porosity at saturation. It can be given on a volumetric or mass (gravimetric) basis.

Volumetric water content, θ, is defined mathematically as:

$$\theta = \frac{V_w}{V_T}$$

where Vw is the volume of water and VT = Vs + Vv = Vs + Vw + Va is the total volume (that is soil volume + water volume + air space).

Gravimetric water content is expressed by mass (weight) as follows:

$$u = \frac{m_w}{m_b}$$

where mw is the mass of water and mb is the bulk mass. The bulk mass is taken as the total mass, except for geotechnical and soil science applications where oven-dried soil (ms, see the diagram) is conventionally used as mb.

Materials and Equipment:

- Laptop or paper and pencil to compile experiment report
- Digital camera for observation
- Testing samples (collect soils in your region from different depths)
- Standard kitchen oven OR toaster oven
- Small digital weight scale

Introduction:

In this experiment we will test the water content of substances found in nature. Methods of calculating water content includes the weighing and observation of samples before and after dehydration.

Research Questions:

- How is water content measured?
- Are there better ways of measuring water content?
- How can this information improve existing technology?

- How does this experiment relate to the data collected by NevCAN?

Terms and Concepts to Start Defining:

- Gravimetric water content
- Humidity
- Moisture
- Saturation
- Volumetric water content

Experimental Procedure:

1. Collect ½ cup samples of regional soil, at different depths, as determined per your teacher. (Example: topsoil-2 inches, 5 inches, 10 inches, etc.)
2. Label each sample accordingly and make observations. What is the colour of the soil? What does the soil look like?
3. Weigh each sample prior to dehydration, record in grams.
4. Dehydrate soil samples on at a time for the same amount of time. Changing drying time will cause an issue with final results.
5. Weight the dehydrated soils and make observations.
6. Calculate what percentage of the soil was water by subtracting the dehydrated weight from the hydrated weight. Divide this value by the entire weight of the soil and multiplying by 100.
7. Make a chart comparing the water content of all soils.
8. Write up a report of your methods, hypothesis and findings.