

Self check of material so far in the soil physics part of the course. You should be able to answer questions like those given below based on the class lectures and assigned reading

Define the saturated moisture content, θ_s .

Is θ_s the same as the porosity, n ? If not, why?

What is the principle of measuring soil moisture using a neutron probe? What are its advantages and limitations?

You have an indoor pot plant. The soil is dry so you rapidly add water until you have a layer of water covering the soil. You then notice that the layer rapidly disappears, why?

On a hot day you are drinking water from a bottle through a straw (*paille*). Is the water in the bottle under compression or tension, why? Is the water in the straw under compression or tension, why?

In soil science, we always subtract atmospheric pressure from the water pressure, why?

The water pressure is p_w , convert this to pressure head, h .

A piezometer (hollow tube or pipe) is placed into an aquifer such that its opening (at the end of the pipe) is 10 m below the ground surface. The water surface in the piezometer is at 5 m below the ground surface. What is the water pressure at 10 m below the ground?

What is a tensiometer?

A tensiometer is placed in the soil such that its ceramic cap is at d_z cm below the soil surface. The ceramic cap is connected via a water-filled tube to the surface. The pressure at the surface of the water in the tube is b hPa. What is the capillary pressure head of the soil in contact with the ceramic cap?

What is the soil moisture characteristic curve of a soil?

Suggest how the soil moisture characteristic curve can be measured.

What is the air entry pressure (pression d'entrée d'air) and why is it different from 1 atm?

The air-entry pressure for a soil is at a capillary pressure of -1 m (in units of head). What is the pore size in the soil at the entry pressure?

What is hysteresis (in a soil moisture characteristic curve)?

What are the causes of hysteresis?

At the air-water interface in a capillary tube, there is a pressure jump across the interface, why?

Water rises in a capillary tube a height h_c . I now take the same tube up a high mountain – is the water in the tube higher or lower than h_c , why?

Darcy's law for vertical flow is $q = -K dH/dz$, what is the reason for the minus sign?

If $H = z + h$, what is the direction of the z axis?

Why is it useful to measure H and h in units of length, i.e., same as z ?

Use Darcy's law to show that, for $K = \text{constant}$, and for steady flow, that h is a linear function of z .

Sometimes we use $h = -\psi$, why?

The hydraulic conductivity, as a function of θ , reduces rapidly when θ decreases from saturation, why?

Describe briefly what a *marmite à pression* is and how it works.

When water enters a dry soil, it preferentially fills the small pores, why?

A 10 m column of dry soil is taken into space on a rocket ship. One end of the column is placed into water. How far does the water move in the soil column? Why?

What is the capillary capacity (*capacité capillaire*) of a soil? How is it calculated? Draw an example curve.

Small mathematics problem:

Darcy's law for steady (i.e., q is constant), unsaturated flow can be written as $q = -K(h) dH/dz$. Find the solution for this equation in the form of an integral.