

**MINISTRY OF EDUCATION**  
**SECONDARY ENGAGEMENT PROGRAMME**  
**INTEGRATED SCIENCE**  
**GRADE 9**

**WEEK 12**

**LESSON 2**

**Topic:** Terrestrial environment

**Sub-topic:** Soil properties

**Objectives:** After readings and observing students will accurately

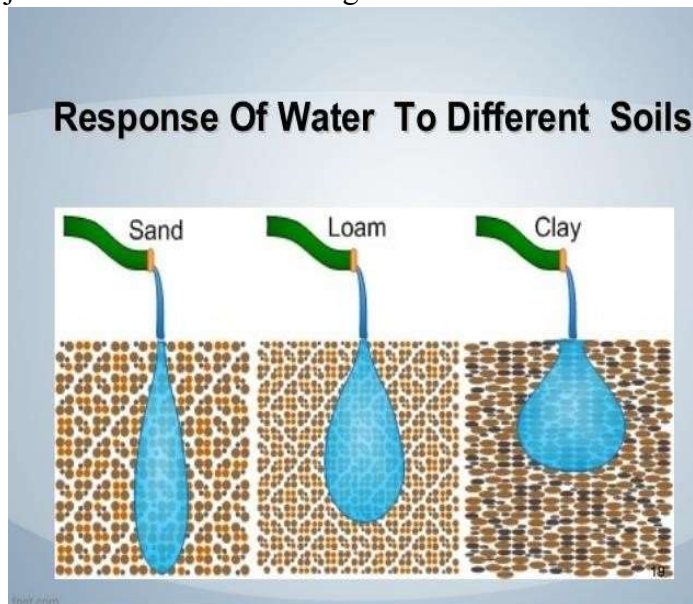
- Define each of the following in one sentence: retention, permeability, air space, capillarity
- Describe the effects of the pH of the soil in two sentences
- Describe the importance of the properties of soil

**Content**

Retention

The action of absorbing and continuing to hold a substance.

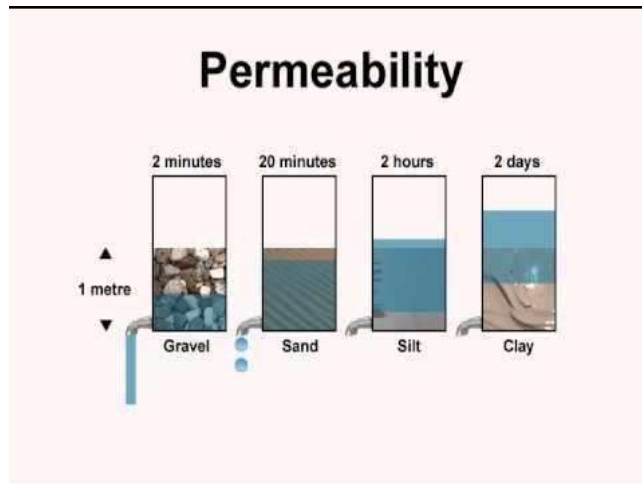
Water retention in the **soil** can be understood as the **water** retained by the **soil** after it runs through the **soil** pores to join **water** bodies such as groundwater or surface streams.



**Picture showing water retention of soils**

Permeability

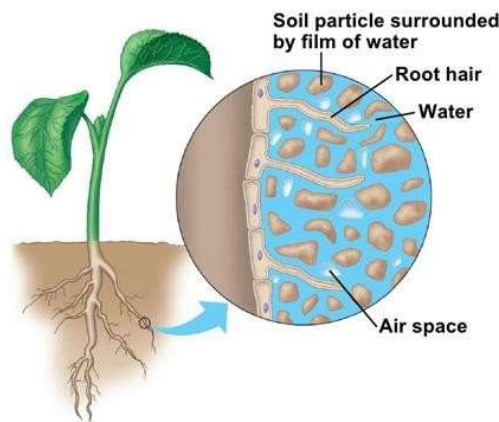
*Permeability* in fluid mechanics and the Earth sciences (commonly symbolized as  $k$ ) is a measure of the ability of a porous material (often, a rock or an unconsolidated material) to allow fluids to pass through it.



Picture showing permeability of soils

Air space

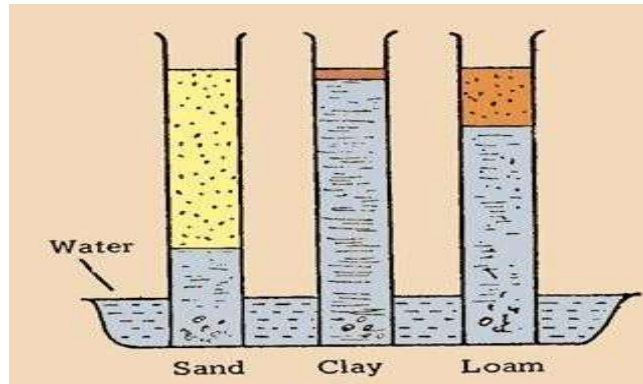
The **air space** provides room for the **soil** to hold water and dissolved nutrients needed by the plant. The **air** also provides oxygen, which is needed by the roots of all plants and most (but not all!) microorganisms that live in the **soil**.



Picture showing the air space in the soil

Capillarity

*Capillary* action is the ability of a liquid to flow in narrow spaces without the assistance of, humidity with air roots. *Capillary* action for the uptake of *water* has been described in some small animals, such as *Ligia exotica* and *Moloch horridus*.



**Picture showing Capillarity action**  
**Soil pH**

Soils can be naturally acid or alkaline, and this can be measured by testing their pH value.

Having the correct pH is important for healthy plant growth. Being aware of the long-term effects of different soil management practices on soil pH is also important. Research has demonstrated that some agricultural practices significantly alter soil pH.

Soil pH is a measure of the acidity or alkalinity of the soil.

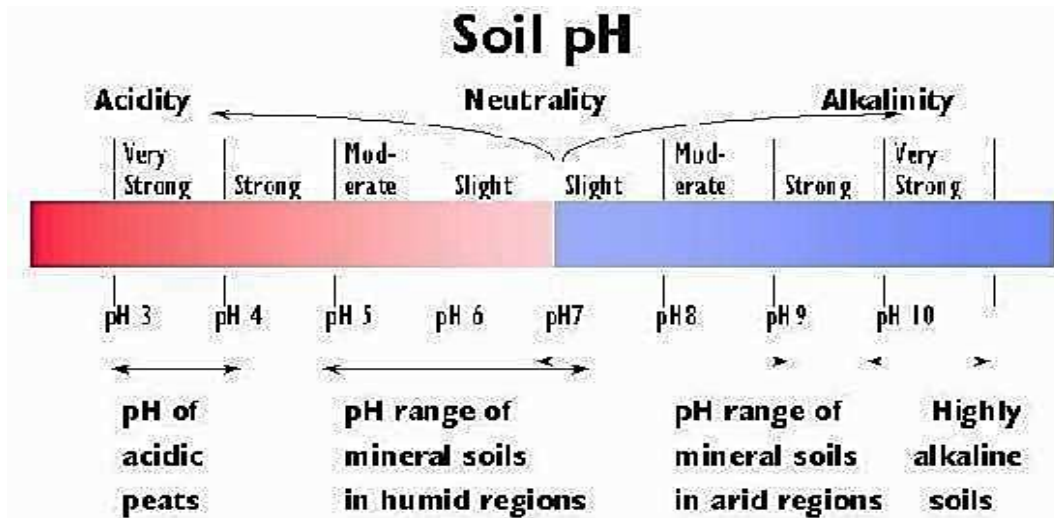
A pH value is a measure of hydrogen ion concentration. Because hydrogen ion concentration varies over a wide range, a logarithmic scale (pH) is used: for a pH decrease of 1, the acidity increases by a factor of 10.

It is a 'reverse' scale in that a very acid soil has a low pH and a high hydrogen ion concentration. Therefore, at high (alkaline) pH values, the hydrogen ion concentration is low.

Most soils have pH values between 3.5 and 10. In higher rainfall areas the natural pH of soils typically ranges from 5 to 7, while in drier areas the range is 6.5 to 9.

Soils can be classified according to their pH value:

- 6.5 to 7.5—neutral
- over 7.5—alkaline
- less than 6.5—acidic, and soils with pH less than 5.5 are considered strongly acidic.



Picture showing the different pH in soil

### Importance of soil properties

A good soil structure is important to allow **air** and **water** into the soil which are vital for healthy plant growth. It will improve drainage and reduce soil erosion caused by excess surface run-off. Without structure, soils will suffer from anaerobism, waterlogging and nutrient lock-up, and, ultimately, plants will die.

### Homework

1. Why is soil important?
  - a) Justify your answer.

### References

Bernard, Myrna et.al (2003) Science in Daily Life Book 3 (Unit 5) Ministry of Education  
<https://www.rolawn.co.uk/soil-structure>  
<https://www.sciencelearn.org.nz/resources/957-soil-properties>