

Chapter 4: Physical Properties of Soil and Soil Formation

Goals:

- Students who complete this module will know and be able to:
- Describe how the soil cycles essential plant nutrients between plant, water and air, and also functions as the source and storehouse of nutrients for living things.
- Explain how human activity influences nutrient balance in soil.
- Describe ways to make the soil a sustainable natural resource and protect the environment.

Engage: Soil is Charged!

Part A. Soil is Charged

After completing the demonstration answer the following question.

H ⁺	NO ₃ ⁻	SO ₄ ⁻²
Cl ⁻	Mg ⁺²	Mn ⁺²
NH ₄ ⁺	K ⁺	
Ca ⁺²	Al ⁺³	

1. Which nutrient ions (listed above) will attach to charged sites (exchange sites) on the soil particles?

Part B. Everything is Chemical Video

Questions to accompany video.

1. Which 4 chemical elements make up 95% of all plants and animals?
2. Where are these elements found in the soil?
3. Name 5 types of Inorganic Matter found in the soil. Why are these elements important?
4. How do the sugar chains in potatoes differ from those in corn stalks?
5. How do farmers use chemistry?

Explore: Soil Nutrients

Part A. Sources of Essential Elements

See provided student handouts.

Part B. Nutritious Nitrogen

See provided student handouts.

Part C. Everything is Chemical

Review questions provided above.

Part D. Crops and Nutrition

What is the difference between a macro and micronutrient? Give examples and sources of each.

What is meant by a "balanced diet" and how does it improve our health?

Explain: Plant Soil Interactions

Part A. Nourishing the Planet

See provided student handouts.

Part B. Cation Exchange

Answer the following questions after viewing the video.

1. What allows nutrients to "cling-on" to soil particle surfaces?
2. What defines a "cation" vs. "anion"?
3. Describe the process of Cation Exchange.
4. How does it affect plant's ability to uptake nutrients?
5. In regions of "low CEC" what strategies can farmers take to make sure that plants get the nutrients that they need, while not over-fertilizing?

Part C. Chemistry in Plant Nutrition

See provided student handouts.

Part A. Chemistry in Plant Nutrition and Growth

Part B. Humanity against Hunger

Part C. Investigating Calcium Deficiency - lab exercise

Part D. Fertilizers and the Environment

After reading, ask students the following suggested questions:

1. How do plants respond to a lack of nutrients?
2. What are sources of fertilizer?
3. How do farmers know how much fertilizer to add?
4. How do soil nutrients improve the quality of crops that we consume?

https://serc.carleton.edu/kskl_educator/index.html

Evaluate: Feed the Planet in 2050

Complete the online role play or answer the test questions linked to the website.