

Moon Soil Analysis

Preparation of soil:

- dry soil sample over a hot plate to remove any moisture present
- grind the soil into small bits

Purpose:

The purpose of this study is to determine the pH of a soil sample.

Materials:

- pH meter
- de-ionized water

Procedure:

- mix 10g of the soil sample with 20ml of de-ionized water
- measure the pH with a pH meter

Purpose:

The purpose of this study is to determine the existence and content of specific elements and compounds in a sample of moon soil. The particles that will be tested for are carbonate and calcium.

Carbonate

Materials:

- a hot plate
- a 100ml volumetric flask
- 2 M/L Hydrochloric acid solution
- 0.1 M/L Sodium hydroxide solution

Method:

- mix 10g of soil with 20ml of the HCl solution and allow to react for approximately 15 minutes.
- Heat the solution and allow to react for another approximate 15 minutes.
- Centrifuge the solution.
- Filter with a funnel and transfer filtrate to the volumetric flask

- Use this soil solution with phenolphthalein indicator and titrate with the NaOH solution.

Analysis:

Net ionic equation of reaction:



Since the number of H⁺ ions is known, it can be determined how many reacted to form water with the oxygen atom given by the carbonate ion. The quantity of carbonate that reacted to form carbon dioxide can then be determined using this quantity.

H atoms reacted with CO₃²⁻ = original number of H atoms – number of H atoms remaining

The number of hydrogen ions that have remained can be determined by adding a base to the solution and observing how much of the base is needed to neutralize the remaining H atoms.

Calcium

Materials:

- 250mL Erlenmeyer flask
- 0.01 N EDTA
- 2 N sodium hydroxide
- ammonium purpurate

Method:

- Pipette 10 - 20 mL soil saturation extract, having not more than 1.0 meq Ca into a 250-mL Erlenmeyer flask.
- Dilute to 20 - 30 mL with DI water, add 2 - 3 mL 2 N sodium hydroxide solution, and about 50 mg ammonium purpurate indicator.
- Titrate with EDTA. The color change is from red to lavender or purple.

Analysis:

Note: In solution EDTA can pick up hydrogen atoms and exist as [EDTA²⁺], however, this species does not act as a chelating agent. Therefore, it is necessary to keep the pH of the titration at 10 in order to drive the equilibrium of the compound to the [EDTA⁴⁻] variety. This is why the base is added to the solution before titration.

In order to determine the endpoint in the titration a metal ion indicator is used. This indicator will also form a complex with the metal ion, though not as strongly as the [EDTA⁴⁻]. When EDTA is first added to the solution it will bind with the free metal ion, but as the supply of free metal ions depletes it will begin to react with the metal ion that is bound to the indicator.

(<http://www.chem.pacificu.edu/Projects2003/pages/Protocols/CalciumTitration.htm>)



As the EDTA is added calcium is unbound from the indicator to bond with the stronger compound. Once all the calcium has been transferred, the now stripped indicator will cause the solution to change color. The amount of calcium can then be determined since it is proportional to the amount of moles of EDTA added to the solution.