Student experiment (10th – 13th grade)	**Conductivity titration**	**Time:** max. 20 min.

Safety:

safety glasses

Instruments:

- a syringe conductivity meter
- retort stand material
- a plastic film canister
- a toothpick for stirring
- variable transformer with plug for electricity
- volt meter
- cable material
- a disposable syringe as a pipette replacement

Chemicals:

- sodium hydroxide (c = 0,1mol/ l)
- hydrochloric acid (c = 0,1mol/ l)

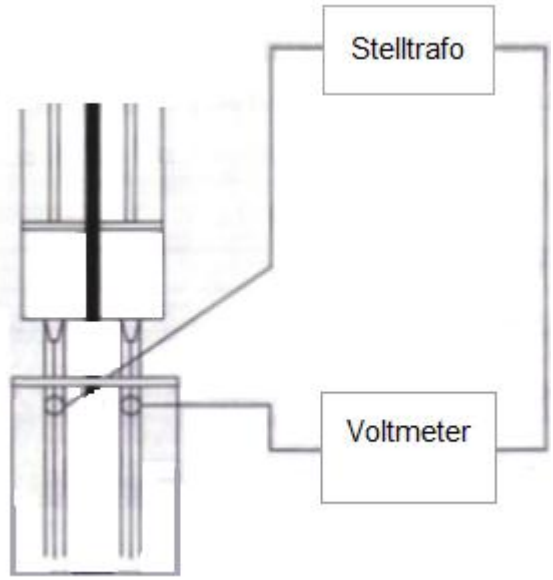
Preparation: Construction of a syringe conductivity meter

Experiment:

- Fill both syringes of the syringe conductivity meter with sodium hydroxide solution, making sure that no air bubbles are present. This also works without needles. Air bubbles can be gotten rid of by turning the syringe tip upwards, tapping on the cylinder with your finger, then pressing the plunger until the solution pushes all air out of the syringe. Repeat as necessary until the syringe is full.
- The syringe conductivity meter should be dried, than carefully attached to the needles.
- Place some dilute hydrochloric acid solution into the film canister using a disposable pipette.
- Carefully fasten the conductivity meter over the film canister with the help of a retort stand.
- Add enough distilled water to the the film canister that the dilute acid solution covers the needles of the meter to a depth of roughly 1 – 2cm.
- Connect the conductivity meter in series to the variable transformer and the volt meter. Turn on both devices, making sure that the variable transformer is running on AC current. Choose the initial electric current, so that it has a value of about 2/ 3 of the measurement zone you have selected.

Experiment:

- Titrate the sodium hydroxide from one of the syringes in the conductivity meter into the acid solution using steps of about 1 – 2ml volume each time. Stir the solution using the toothpick after addition of each amount to ensure a thorough mixing of the solution.
- Record the measurements shown by the volt meter.



Observations: The level of recorded current becomes weaker, before rising again.

Results:

The conductivity reaction follows the following equation:

$$Na^+ + OH^- + H^+ + Cl^- \rightarrow Na^+ + Cl^- + H_2O$$

Adding sodium hydroxide lessens the number of H^+ ions due to their combination with OH^- to form water, H_2O, thus reducing the overall conductivity of the solution. This is at its lowest when the acid has been totally neutralized. Further addition of base means an increasing OH^- ion concentration, thus providing replacement ions which can conduct electricity. The observed electrical current rises once again due to their increasing presence as more sodium hydroxide is added to the film canister.

Disposal: The solutions can be diluted and poured down the drain.