

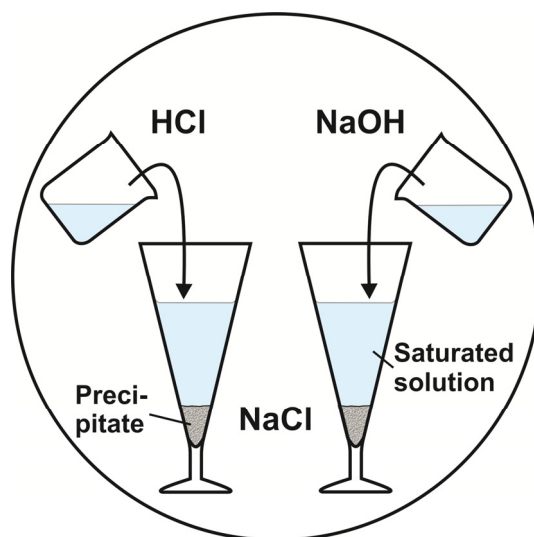
Solubility Product of Table Salt

Equipment:

2 goblets (conical glass cups)
2 glass beakers

Chemicals:

saturated solution of sodium chloride
concentrated hydrochloric acid
saturated solution of sodium hydroxide



Safety:

concentrated hydrochloric acid (HCl):



H314-335-290

P234-260-305 + 351 + 338-303 + 361 + 353-304 + 340-309 + 311-501

Concentrated hydrochloric acid causes severe irritation of the eyes, even irreparable burns with corneal opacity are possible. On the skin, the acid causes severe burns with redness, blisters, and burning pains.

saturated solution of sodium hydroxide (NaOH):



H290-314

P280-301 + 330 + 331-305 + 351 + 338-308 + 310

A saturated solution of sodium hydroxide also causes severe eye and skin burns.

The experiment obligatorily has to be carried out in a fume hood. It is also necessary to wear safety glasses and protective gloves.

Procedure:

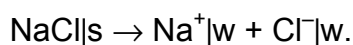
The goblets are approximately half filled with the saturated solution of sodium chloride. Subsequently, the concentrated hydrochloric acid is added to the solution in the first goblet, while the saturated solution of sodium hydroxide is added to the solution in the second goblet.

Observation:

In both cases, a white precipitate appears. When NaOH is added, this process takes a little bit longer compared to the addition of HCl.

Explanation:

In the saturated table salt solution, solid NaCl is in equilibrium with its ions:



This heterogeneous equilibrium can be described by the solubility product:

$$K_{sd}^{\circ} = c_r(\text{Na}^+) \times c_r(\text{Cl}^-).$$

If the concentration of one of the ions is increased, e.g. $c(\text{Na}^+)$ (in the form of sodium hydroxide solution), the concentration of the second, $c(\text{Cl}^-)$, must decrease in order to maintain equilibrium. This means that NaCl inevitably precipitates from the solution.

Disposal

The saline solutions can be added to the waste water after appropriate dilution.