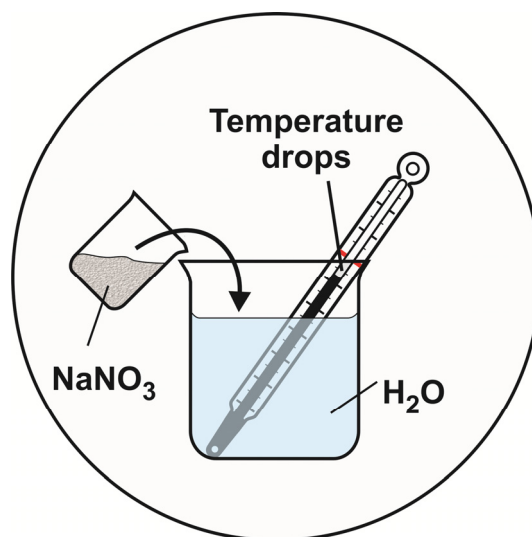


Cooling during Dissolving of Sodium Nitrate in Water

Equipment:

500 mL glass beaker
demonstration thermometer with clamp
and ring stand or digital thermometer
with sensor and large display
50 mL glass beaker
glass rod
mortar with pestle



Chemicals:

deionized water
solid sodium nitrate

Safety:

sodium nitrate (NaNO_3):



H272-302
P260

Sodium nitrate causes serious eye irritation. Therefore, it is necessary to wear safety glasses and protective gloves.

Procedure:

Preparation: The sodium nitrate is mortared and then filled into the small beaker.

Procedure: The large beaker is filled with water. The demonstration thermometer is fixed with the clamp in such a way that it dips well into the solution (or the sensor of the digital thermometer is placed in the beaker). The solid sodium nitrate is then poured all at once into the water and subsequently, one stirs vigorously with the glass rod.

Observation:

The glass of the large beaker fogs up visibly and a strong decrease in temperature can be observed.

Explanation:

Sodium nitrate in an aqueous solution with a concentration of 1 kmol m^{-3} at room conditions requires just about twice as much entropy as it does in its solid state. Therefore, when NaNO_3 is dissolved in water, the solution cools down so strongly due to the salt extracting entropy from the water. In order to keep the temperature constant, entropy must be absorbed from the surroundings. As is the case in almost every process, entropy is generated here too, but it is not enough to cover the high additional entropy demand of the salt.

Disposal:

Diluted with a lot of water, the salt solution can be flushed away with the waste water.