

Electrolyte Strength

Skills to Develop

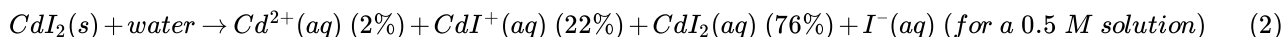
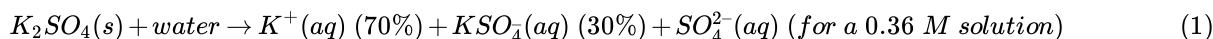
- Define the 3 types of electrolytes
- Describe the relationship between solubility and electrolyte strength

Electrolyte means a solute that allows a water solution to conduct electricity. Electrolytes produce ions when they dissolve in solution. Salts are usually electrolytes, while molecular substances usually aren't, unless they are acids or bases.

Strong and Weak Electrolytes

The situation gets a little bit more complicated, though, because of the distinction between strong electrolytes and weak electrolytes. A strong electrolyte, like NaCl, splits up completely into sodium and chloride ions in solution. Likewise, a strong acid like HCl splits up completely into hydrogen and chloride ions in solution. Salts are often strong electrolytes, and strong acids are always strong electrolytes. Weak acids are weak electrolytes, and most other molecular compounds are non-electrolytes.

Many textbooks incorrectly state that all salts or ionic compounds are strong electrolytes. However, many ionic compounds or salts of transition metals or alkaline earth metals are not strong electrolytes. When they dissolve, some of the ions separate, but some stay together. Here are some examples:



As you can see, these salts are electrolytes (they do produce ions) but if you do calculations assuming that they separate completely into sulfate, potassium, cadmium(II) and iodide ions, you might get very wrong answers! They are not strong electrolytes. In general, the lower the concentration and the lower the charges on the ions, the "stronger" the electrolytes will be. Alkali metals other than lithium are usually strong electrolytes especially when the anion also has a small charge, and in dilute solutions (<0.1M). Alkaline earth metal compounds are weaker electrolytes, and other metals are even weaker still. We'll talk more about why this is later.

Solubility and Electrolyte Strength

Solubility can cause some confusion here. For instance, it's possible that a compound is a strong electrolyte, but just not very soluble. For this reason, it would not be able to produce a solution with lots of ions, because it isn't soluble, not because the ions are still attached to each other in the solution. In general, it makes sense to guess that if the ions in a compound are very strongly attracted to each other, the compound will be less soluble, and also it might be a weaker electrolyte because even in solution the ions will be bonded to each other. However, electrolytes also look stronger at lower concentrations, because if the ions split up, they are less likely to find each other again.

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- Emily V Eames (City College of San Francisco)

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