

WHAT IS TOTAL KJELDAHL NITROGEN?

The total Kjeldahl nitrogen (TKN) test measures organic nitrogen plus ammonia. Nitrogen is considered "organic" if it is found in molecules containing carbon. Organic nitrogen molecules come from plants and animals in the form of proteins, DNA, and other large molecules essential to life. Ammonia is often introduced to waterways through waste and decomposition. You can determine how much organic nitrogen is present in a water sample by separately measuring ammonia (see our ammonia fact sheet!) and subtracting the ammonia concentration from the TKN concentration.

WHY DO WE MEASURE TOTAL KJELDAHL NITROGEN?

Unlike ammonia, organic nitrogen is not directly toxic to aquatic organisms. However, excess organic nitrogen can contribute to increased growth of plants, cyanobacteria, and algae in aquatic ecosystems. When these die, they can reduce dissolved oxygen levels through decomposition.



The impacts of elevated organic nitrogen levels are similar to the impacts of elevated nitrate and nitrite levels. Because we can calculate organic nitrogen levels from total Kjeldahl nitrogen, it serves as a useful indicator of water quality impacts due to human and animal waste, the primary sources of organic nitrogen in aquatic ecosystems. Inorganic nitrogen sources, such as fertilizer, are instead indicated by elevated nitrate and nitrite levels. We can calculate the total nitrogen in a sample if we analyze it for nitrate + nitrite **and** total Kjeldahl nitrogen, then add the results together.

Community Science Institute data from the Cayuga Lake Watershed indicates that it is rare for total Kjeldahl nitrogen levels to exceed 5 mg/L. In data collected over the past 20 years, total Kjeldahl nitrogen levels from tributaries of Cayuga Lake have only exceeded 5 mg/L in about 1% of water samples.

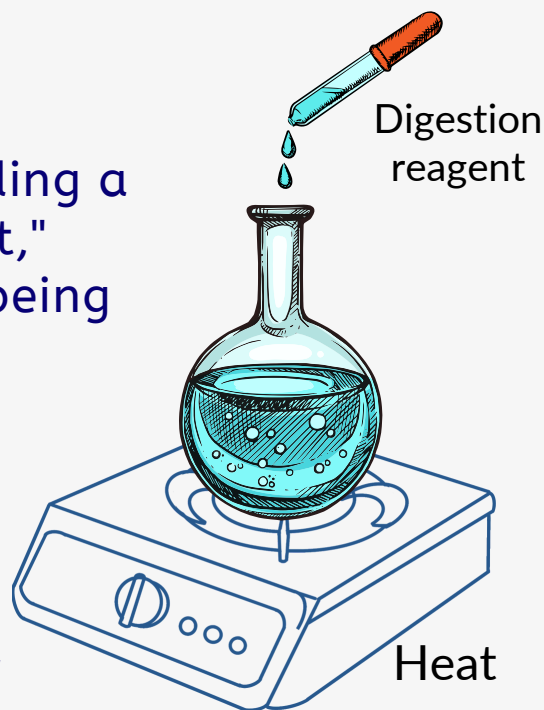
HOW DO WE MEASURE TOTAL KJELDAHL NITROGEN?

In the total Kjeldahl nitrogen test, organic nitrogen is first transformed into ammonium using a process called "digestion." Once all organic nitrogen is in the form of ammonium, it is tested using a probe (see our ammonia fact sheet!). This yields the final result of a total Kjeldahl nitrogen test, or the **sum** of organic nitrogen and ammonia.

"Digesting" organic nitrogen

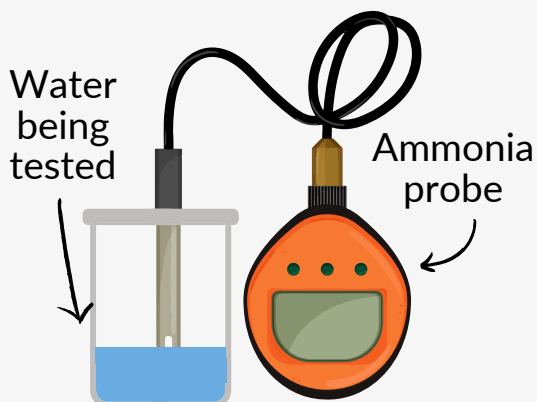
The "digestion" process begins with adding a substance called the "digestion reagent," made up mainly of acid, to the water being tested.

When heat is added to the resulting mixture, all the organic nitrogen is transformed into ammonium. This process is called "digestion" because it is chemically similar to the way food is digested in the human body.



Isolating and testing the ammonium

The ammonium is isolated from other substances in the water sample. This is done by adding a base and boiling, then condensing and collecting this ammonium in acid.



At this point in the testing process, everything that was *once* organic nitrogen has been transformed to ammonium. An ammonia probe, as described in the Ammonia Fact Sheet, detects and displays the total concentration of organic nitrogen plus ammonia, or the **total Kjeldahl nitrogen**.