

pH MEASUREMENT

EQUIPMENT/REAGENTS:

300 mL BOD bottle
pH meter
pH standards (10, 7, 4)

PROCEDURE:

A. IN THE FIELD:

After three rinses, fill a 300 mL BOD bottle by "glugging" bottle just below the surface of the water. You will also need about 200 mL of surface water but this can be taken from extra water you have from either surface samples or PML samples.

B. IN THE LAB:

1) Setup and calibrate pH meter using 2 standards that bracket the pH of the water being measured. This is done as follows:

- a) Turn the instrument on and wait until it starts measuring.
- b) Rinse probe well with DI water. Wipe it gently with a Chem-Wipe and rinse again.
- c) Press 2nd, then CAL
- d) When "C1" appears, put the probe in the lower pH buffer (either 4 or 7) and wait for it to flash at the appropriate pH. Press YES.
- e) Remove the probe and rinse thoroughly. This means immerse in clean DI or Tap water, wipe gently with a chem wipe and rinse again in new, clean tap or DI water.
- f) When "C2" appears, put the probe in the higher pH buffer (either 7 or 10) and wait for it to flash at that pH. Press YES.
So, how to you choose which pair of buffers to us? Look at the historical pH data for the lake you want to measure. If the pH is between 7 and 10, use 7 and 10. This condition is rare at UNDERC. Tenderfoot, Morris, Ward and sometimes Plum get this high. Peter Lake when we added nutrients had a pH above 9. For most lakes the historical pH is between 4 and 7. If you calibrated and then got a pH of 7.5, the 4 and 7 calibration would still be valid. If you got a pH of 8, it is best to recalibrate with 7 and 10. Organize the samples to be measured so you can do all the ones between 4 and 7 in one group and all the ones between 7 and 10 in another.
- g) Check to be sure that the calibration curve has a slope that is close to 1.00.

h) Rinse probe and start measuring. This time you really have to rinse well. Rinse (immerse in tap or DI), chem wipe, and then two more rinses in new, clean tap or DI water.

Why so much rinsing? pH standards are strongly buffered with lots of concentrated chemicals in them. UNDERC lakes are much less strongly buffered than the standards. Tap water is ok for all this rinsing since it is not wildly different from UNDERC lake water. DI is OK too.

2) To measure:

a) Place probe in sample water (use surface water from light depth 1) to cover it for 15 minutes, discard sample, repeat.

b) insert probe in the sample BOD bottle for 5 minutes, then read pH (reading should be stable for 1 minute).

Why are you doing all this? There are two reasons. For a pH electrode to work properly it needs to be in isotonic equilibrium with the sample. This takes a while. So even after the buffer has been rinsed it needs to sit a while in something very close to what will actually be measured. Short cuts here are possible. For example, Peter and Paul lakes (unless we are eutrophying one of them) are close enough that if you get the electrode in equilibrium with Paul water it is close enough for Peter water. Roach, Crampton, North Gate Bog could be done as a series as well. Tenderfoot, Morris and Ward all have higher ionic strength than most of the others. The reason for the sealed BOD bottle is that CO₂ which exchanges with the atmosphere affects pH. Most of the UNDERC lakes are supersaturated in CO₂. If you left a sample open to the atmosphere, the pH would eventually be higher than the true pH.

3) Upon completion, rinse the probe well in several exchanges of DI, turn off meter and cover probe. Make sure the probe cover is moist with pH probe solution.

Buffer solutions should be replaced weekly. Never put the probe directly from one buffer into the other.

Suppose you get weird values of pH. For many of our lakes the pH can be checked by measuring the partial pressure of CO₂ and the DIC. You need to know two more things to do this, temperature and atmospheric CO₂. These methods are explained in the DIC and CO₂ sections of the manual. The method for calculating pH from CO₂ and DIC is explained in the file "pH by Gas chromatography.doc" and can be calculated using the spreadsheet "pH by GC.xls" which are located in the "Updated Methods for Manual" directory.