Sampling Procedures

Quality Assurance and Quality Control

A quality assurance and quality control (QA/QC) plan is necessary to ensure that test results are as accurate and precise as possible. Accuracy refers to how close a measurement is to its true value. Precision means the ability to obtain consistent results. Accurate and precise measurements are achieved by,

- practicing the measurement techniques of the protocols;
- collecting the water sample or invertebrate sample as directed;
- performing tests immediately after collecting the water sample;
- carefully calibrating, using and maintaining testing equipment;
- following the directions of a protocol exactly as described;
- repeating measurements to check their accuracy and to determine any sources of error;
- minimizing contamination of stock chemicals and testing equipment ;
- checking to be sure the numbers submitted to the GLOBE Student Data Server are the same as those recorded on the *Hydrosphere Data Sheets*; and
- examining your data for reasonableness and anomalies.

Calibration

Calibration is a procedure to check the accuracy of testing equipment. For example, to ensure that the pH instruments are functioning properly, a solution of known value is tested. Calibration procedures vary among the measurements and are detailed in each protocol. Certain calibrations must be done in the field just before the measurement is taken. Other calibration procedures are done in the classroom.

Collecting the Water Sample

If students are able to SAFELY reach the water body (within arms' reach), then water temperature, pH, dissolved oxygen, and electrical conductivity measurements can be taken on site (*in situ*) directly at the water's edge. However, the measurements of alkalinity, salinity, and nitrate require a sample to be taken with a bucket using the bucket sampling procedure. For electrical conductivity, if the temperature of the water sample is outside the range of 20-30˚C, then allow the sample to adjust to the temperature within that range before conducting the measurement.

Important: The sequence in which the measurements are performed is critical to their accuracy and precision. Transparency measurements should be taken first, followed immediately by the water temperature measurements, the dissolved oxygen test, then electrical conductivity or salinity, pH, alkalinity, and finally nitrate.

If taking water measurements when students are collecting freshwater macroinvertebrates, collect water quality measurements first.

Testing for transparency, temperature, and dissolved oxygen must be done on site (*in situ*) immediately after collecting the water sample. Do not let the bucket of water sit for more than 10 minutes (preferably less) before taking the measurements and keep the water sample out of the sun. Take a new sample after 10 minutes.

A sample of surface water can be used with the transparency tube. The Secchi disk measurement is only appropriate for deeper water and measurements are generally taken from a bridge or pier, away from the water's edge.

The dissolved oxygen test may be started in the field and completed within 2 hours in the classroom. To do this, the sample is first fixed in the field (see the directions in your dissolved oxygen kit for fixing the sample).

Important: Dissolved oxygen measurements have limited value unless the temperature of the water is known. Measure dissolved oxygen only if you are able to measure water temperature. If your site has salty or brackish water you must also measure salinity in order to interpret the dissolved oxygen measurements.

Samples may be bottled (see *Bottling a Water Sample for Classroom Testing Field Guide*) and tested for pH, alkalinity, nitrate, and salinity or electrical conductivity after returning to the classroom. Measurement of pH and nitrate should be completed within two hours of collecting the sample. Alkalinity, electrical conductivity or salinity may be conducted within 24 hours. However, it is necessary to measure electrical conductivity before measuring pH to make sure the electrical conductivity is high enough to measure pH accurately. See *pH Protocol*.

Safety

Consult the Material Safety Data Sheets (MSDS) that come with test kits and buffer solutions. Also consult your local school district's safety procedure guidelines. If you are testing potentially contaminated water or using kits with chemicals, latex gloves and safety goggles are strongly recommended.

Disposal of Liquid Waste

After tests have been conducted, all resulting solutions or liquids (except for the ones produced by the nitrate analysis and salinity titration) should be collected in a wide-mouthed screw top plastic waste container and disposed of in a school sink or utility sink while flushing with excess water. Or, they should be disposed of according to your local school district's safety procedure guidelines. The wastes from the nitrate analysis and the salinity titration (which typically contain cadmium and chromate) should be collected in separate containers and disposed of according to your local school district's safety procedure guidelines.

Measurements (in the order to be taken)	**Maximum time allowed between collecting the water sample and taking the measurements**
Transparency (Secchi disk)	Testing always made *in situ*
Transparency (tube)	10 minutes
Water Temperature	10 minutes
Dissolved Oxygen	10 minutes at site or within 2 hours after sample is fixed
pH (using paper)	10 minutes on site or 2 hours after sample is bottled
pH (using meter)	10 minutes on site or 2 hours after sample is bottled
Conductivity	10 minutes on site or 24 hours after sample is bottled
Salinity (hydrometer)	10 minutes on site or 24 hours after sample is bottled
Salinity (titration kit)	10 minutes on site or 24 hours after sample is bottled
Alkalinity	10 minutes on site or 24 hours after sample is bottled
Nitrate	10 minutes on site or 2 hours after sample is bottled

Collecting a Water Sample in a Bucket

Field Guide

Task

Collect a water sample in a bucket for testing.

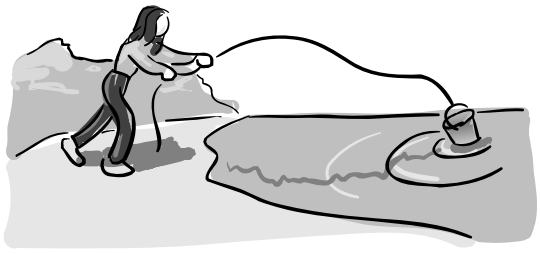
What You Need

- ❑ Bucket with rope tied securely to handle
- ❑ Latex gloves (recommended)

In the Field

1. Rinse the bucket with sample water from the site. To avoid contamination, do not pour the rinse water back into the sampling area. Be careful not to disturb the bottom sediment. Do not use distilled water to rinse the bucket or use the bucket for any other purpose.
2. Hold tightly onto the rope. If your sampling site is a stream, throw the bucket out to a well-mixed area (a riffle), a little distance from the shore. Ideally, the water should be flowing at least slightly. If you are sampling from a lake, bay, or the ocean, stand on the shore and throw the bucket as far out as possible to collect your sample.
3. If the bucket floats, jostle the rope until some water enters the bucket. You should always take a sample from the top surface water. Be careful not to let the bucket sink to the bottom or stir up bottom sediment.
4. Allow the bucket to fill about 2/3 to 3/4 full and pull it back in with the rope.
5. Immediately begin testing procedures or bottle the sample (see *Bottling a Water Sample for Classroom Testing Field Guide*).

Rinsing the water bucket.



Casting the bucket.

Bottling a Water Sample for Classroom Testing

Field Guide

Task

Bottle a water sample to take back to the classroom for testing pH, conductivity or salinity, alkalinity, and nitrate.

What You Need

- ❑ 500-mL polyethylene bottle with lid
- ❑ Permanent marker
- ❑ Masking tape
- ❑ Latex gloves

In the Field

1. Label a 500-mL polyethylene bottle with your school's name, the teacher's name, the site name, the date and time of collection.
2. Rinse the bottle and cap with sample water 3 times.
3. Fill the bottle with sample water until the water forms a dome shape at the top of the bottle so that, when the cap is put on, no air is trapped inside.
4. Put on the cap and seal the cap of the bottle with masking tape.

   Note: Tape serves as a label, and an indicator of whether the bottle has been opened. Tape should NOT be in contact with the water sample itself.
5. Store these samples in a refrigerator at about 4˚ C until they can be tested (within 2 hours for pH and nitrate and within 24 hours for alkalinity and salinity or electrical conductivity).
6. Once the seal is broken, first do the test for salinity or electrical conductivity, then pH, then nitrate test, and then alkalinity. The sample will need to reach 20˚ - 27º C before testing for electrical conductivity. Ideally, all the measurements should be performed during the same lab session.