Water Clarity

Swift, Shallow Water

Accompanying Worksheet: W-W-02

Objectives: Students will construct and utilize a transparency tube to determine the turbidity of a water source.

Considerations:

1. This protocol is best for swift-flowing or shallow water, such as creeks or streams. For deeper or calm sample sites such as ponds, reference the Water Transparency: calm, deep water protocol for the use and construction of Secchi disks.
2. If you choose, you can perform this protocol on one sampling occasion and analyze your results, perhaps as part of a site characterization. However, we believe it works best when many samples are taken throughout the year at a given site and the collective data are analyzed at the end of the study, allowing students to correlate water transparency with other factors such as rainfall.

Materials

Transparency Tube Construction

Option 1:

___ Clear plastic tube 4-5 cm in diameter and over 1 m long

___ PVC cap or other method of sealing the tube. We recommend rubberbands and parafilm.

Option 2: (low-cost, do-it-yourself method)

___ clear 2-liter soda bottles (x3)

** Other bottles that are narrower and more cylindrical, such as SmartWater bottles, are more ideal. We only list soda bottles because they are easiest to obtain.

___ duct tape

___ scissors

___ Wooden, plastic, or metal disk cut to the approximately diameter of the cylinder

___ Metal washers

___ Superglue

___ Black permanent marker

___ White waterproof paint

___ Meter stick or ruler

In the field

___ bucket

___ transparency tube

___ Worksheet W-W-02

___ cup or pitcher

___ thermometer

Instructions:

Creating the Transparency Tube

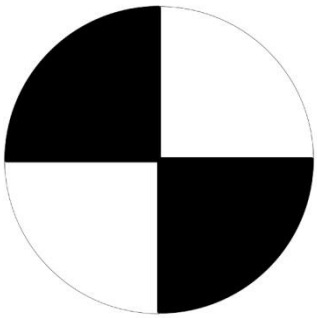
Option 1:

1. Create your cylinder by cutting the clear tubing so that it is approximately 120 cm long. Shorter lengths are acceptable, but we recommend at least one meter.
2. Seal one end of the tube with the PVC cap. If you do not have one, wrap parafilm around the edge as tightly so the portion covering the opening is as taut as possible. Use rubberbands to hold down excess parafilm around the base of the tube.
3. Starting at the base, make a mark every centimeter along the tube until you reach the top.
4. Skip to Step 5.

Option 2:

1. Cut the soda bottles. Leave the bottom of one intact, removing only the top at the point where the cylindrical shape widens to its fullest. For the other two, remove both the top and bottom so only the cylindrical middle portion of the bottle remains.
2. Place the bottles end to end so that they form one long cylinder. Duct tape the seams, on both the inside and the outside, to prevent water leakage.
3. If you believe your rig is stable enough to add a fourth bottle, do so. This will bring the height of your cylinder to over one meter.
4. Starting at the base (where the shape becomes a normal cylinder; ignore the small "feet" on the bottoms of soda bottles), make a mark every centimeter along the tube until you reach the top.

5. Divide the disk into quadrants by drawing two diameter lines through the center at 90 degree angles. Paint one set of opposing quadrants black and the other white (see figure right).



6. If your disk is made of a material that floats, glue the washers to the bottom of the disk until it sinks.

    a. Alternatively, if you used a PVC cap to seal your tube, you can simply paint the pattern on the upward side of the cap instead of creating a disk.

7. Drop the disk into the cylinder and manipulate it so that it is face-up and level.

In the Field

1. Place the thermometer in the water. Wait two minutes and record the temperature on the sheet.
2. Collecting your samples: ideally, samples are collected from the middle of the stream, at a point with minor flow, such as an eddy whirlpool. Without disturbing the silt at the bottom, gently dip the bucket into the stream and collect a sample of water. Return the bucket to the bank.
3. Place the tube on the bank so that it is vertical and level.
4. Scoop out some water with the cup, and begin slowly pouring the water into the tube.
5. As you are pouring, position yourself so that you are looking directly down the tube
    a. This works best with two students: one to slowly pour, another to observe.
6. Continue incrementally pouring water into the tube until the pattern at the bottom is no longer visible.

7. Record the amount of water (in cm) required to obscure the pattern. If you have filled the tube to its maximum and the pattern is still visible, simply record “greater than [height of tube]”.
8. Repeat the procedure twice more with different students observing. Make sure to mix up the sample in the bucket as particles may have settled.

Adapted from GLOBE Water Transparency Protocol:
http://www.globe.gov/documents/11865/354449/hydro_prot_transparency.pdf