Water Transparency Protocol

Purpose

To determine water transparency using a Secchi disk (still, deep waters) or turbidity tube (flowing or shallow waters)

Overview

The Secchi disk is a widely used measure of the transparency of water to light. The Secchi disk transparency depends on the amounts of suspended and colored material in the water, material that comes from either sediment washed into a water body or biological activity in the water body. A turbidity tube is used to measure transparency of flowing waters, or where use of a Secchi disk is impractical.

Time

10-15 minutes

Level

All

Frequency

Weekly

Key Concepts

- Determining water transparency using a Secchi disk or turbidity tube
- Light scattering
- Suspended particles
- Light absorption
- Water color
- Productivity

Skills

- *Using* a Secchi disk or turbidity tube
- *Designing* measurement strategies
- *Recording* data
- *Interpreting* results

Materials and Tools

Secchi disk:

- 5 m length of rope (or longer or shorter, depending on depth of the water at the site)
- Latex enamel spray paint: black and white
- 2.5-3 cm diameter by 15 cm long steel pipe
- Drill
- Circular piece of wood 2.5 cm thick and 20 cm diameter
- 2 hook screws
- 15 cm length of string
- Small bottle of wood glue or super glue
- Waterproof markers (red, blue, and black)
- Meter stick

Turbidity tube:

- Clear plastic tube, approx. 1 m long (depending on transparency of water at your site) and 4.5 cm diameter (e.g. Clear plastic fluorescent light casing, found at hardware or lumber stores)
- White cap that fits securely on the bottom of the tube (a cap to a PVC pipe fits nicely)
- Black permanent marker
- Meter stick

Preparation

If a Secchi disk is not ordered, one must be made. To make one, follow the directions in Design and Learning Approach.

If a turbidity tube will be used, it must be made before going to the study site.

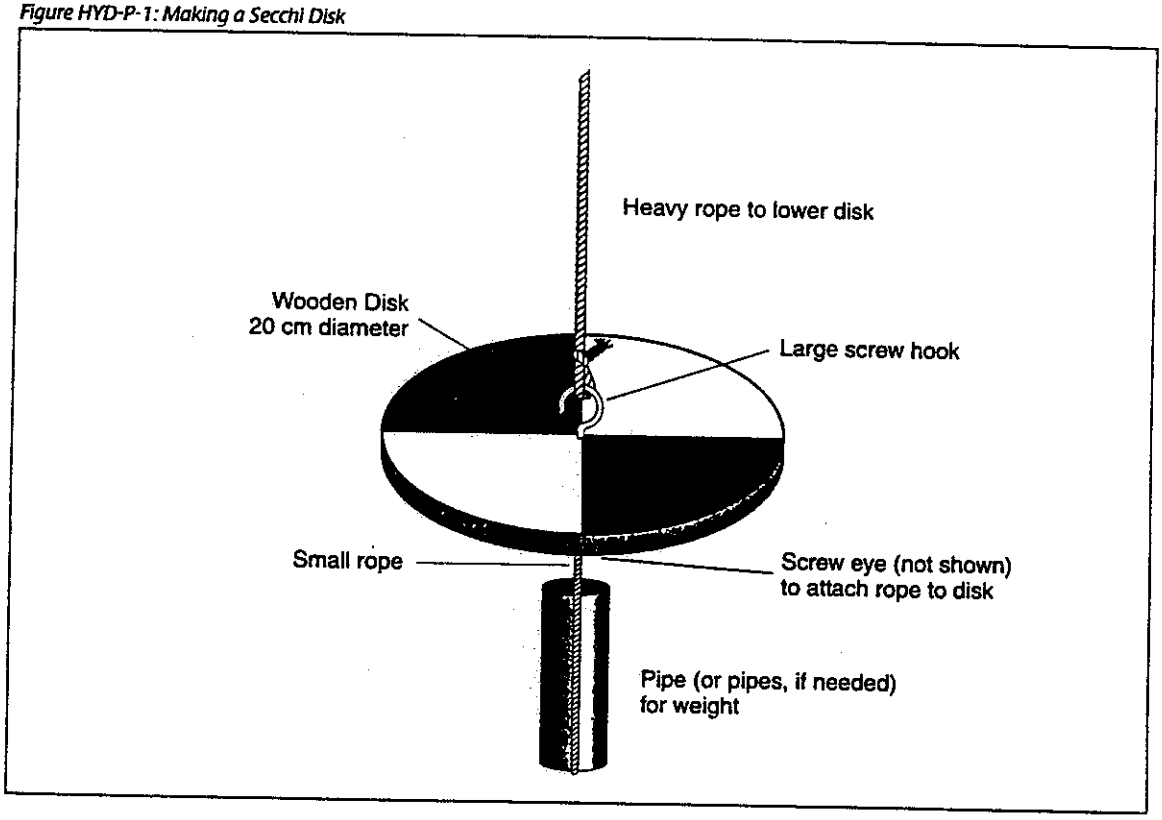
Prerequisites

A brief discussion of how the Secchi disk or turbidity tube can be used in the indication of water transparency is necessary before students make their first measurement.

To make a Secchi disk:

1. Divide top of wooden disk into four quadrants drawing lightly in pencil (draw 2 lines crossing at a 90 degree angle).
2. Paint two opposite quadrants in black and the other two in white.
3. Screw a hook screw into the top center and bottom center of the disk. Then tie the 5-m (or longer) rope through the hook screw in the top of the disk.
4. Tie a short piece of rope through the hook screw on the bottom of the disk and string it though the pipe. Tie a large knot at the bottom of the pipe so that it does not fall off when hanging vertically underneath the disk.
5. Hold the rope attached to the top of the disk and use the meter stick and measure distance from the disk. Mark rope with a black waterproof marker every 10 cm. Mark every 50 cm up from the disk with a blue marker and every meter with a red marker. Now you are ready to make a measurement.

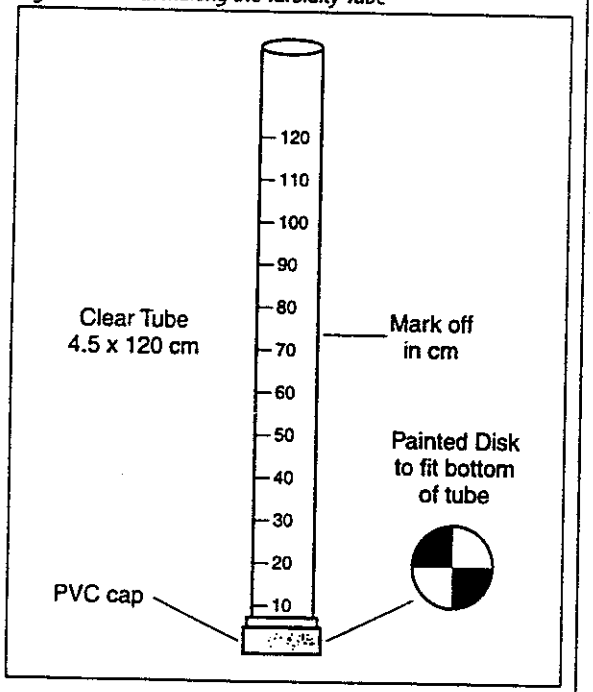
Figure HYD-P-1: Making a Secchi Disk



To make a turbidity tube:

1. Put PVC cap over one end of clear tube. Cap should fit tightly so water cannot leak out.
2. Cut a disk from wood, plastic, or cardboard the same size as the tube diameter.
3. Divide the disk into fourths. Paint alternating quadrants black and white. Seal the disk by laminating or painting with varnish to make it waterproof.
4. Glue the disk in the bottom of the tube, painted side facing up (toward the open end of the tube).
5. Use a marker and meter stick to make a scale on the side of the tube, beginning at the top of the disk with 0 cm.

Figure HYD-P-2: Making the Turbidity Tube



How to Measure Transparency

Make sure that Secchi disk and turbidity tube measurements are made in the shade with the sun to your back to make an accurate and reproducible reading. If there is no shade available, use an umbrella or a large piece of cardboard to shade the particular area where the measurement is being made. For the turbidity tube the shadow of the observer should be adequate.

Different individuals may see the Secchi disk or the bottom of the turbidity tube disappear at different water depths. For this reason, whenever possible the transparency observation should be made by three different students and each of their observations submitted to the GLOBE Student Data Server.

Secchi disk

1. Lower the disk slowly into the water until it just disappears. If possible, grab the rope at the surface of the water and mark this point on the rope (e.g. use a clothes pin). If it is not possible to mark the rope at the water surface, mark the rope a known distance above the water.
2. Then raise the Secchi disk until it just reappears into view. Grab the line at the surface of the water when the Secchi disk reappears and mark this point (or some known distance above the water). The rope should now be marked at two points. There should only be a few centimeters difference between these two points.
3. Record both depths on your Hydrology Investigation Data Work Sheet to the nearest 1 cm.
4. If the two depths differ by more than 10 cm, repeat the measurement, recording the new depths on your Hydrology Investigation Data Work Sheet.
5. Using the *Cloud Cover Protocol*, determine the cloud cover. Determine the distances between where each observer marked the rope and the water surface. Record both on your Hydrology Investigation Data Work Sheet. If the rope was marked at the water surface enter 0.

6. Submit your depths along with the cloud cover and distance from the mark to the water surface to the GLOBE Student Data Server. **Note:** Enter data for each observer, not the average of the different observations.

Note: If the Secchi Disk reaches the bottom of your study site and you can still see it, simply record the depth to the bottom by referring to the point where the rope is at the water surface and put a greater than (>) symbol in front of the measurement both on your data work sheet and when you submit the value to the GLOBE Student Data Server.

Turbidity tube

1. Pour sample water into the tube until the image at the bottom of the tube is no longer visible when looking directly through the water column at the image. Rotate the tube while looking down at the image to see if the black and white areas of the decal are distinguishable.

2. Record this depth of water on your Hydrology Investigation Data Work Sheet to the nearest 1 cm.
3. Submit your depth to the GLOBE Student Data Server. Enter data for each observer, not the average of the different observations.

Note: If you can still see the image on the bottom of the tube after filling it, simply record the depth as > the depth of the tube.

Table HYD-P-1: Solubility of Oxygen in Water Exposed to Air at 750 mm Hg Pressure

Temp °C	Solubility mg/L	Temp °C	Solubility mg/L	Temp °C	Solubility mg/L
0	14.6	16	9.9	32	7.3
1	14.2	17	9.7	33	7.2
2	13.8	18	9.5	34	7.1
3	13.5	19	9.3	35	7.0
4	13.1	20	9.1	36	6.8
5	12.8	21	8.9	37	6.7
6	12.5	22	8.7	38	6.6
7	12.1	23	8.6	39	6.5
8	11.9	24	8.4	40	6.4
9	11.6	25	8.3	41	6.3
10	11.3	26	8.1	42	6.2
11	11.0	27	8.0	43	6.1
12	10.8	28	7.8	44	6.0
13	10.5	29	7.7	45	5.9
14	10.3	30	7.6	46	5.8
15	10.1	31	7.4	47	5.7