**Materials and Equipment Needed [for one aquarium experiment]**

A medium-sized Aquarium approximately 25cm high

Foam (To insulate sides and bottom of aquarium)

1 thermometer [-20C to 110Co ] (Temperatures can be readily and directly taken.

Temperatures are to be taken horizontally at depths of 1,3, 5, 9,12,16 and 20cm.)

2 plastic rulers (Positioned rulers horizontally on the inside of aquarium.)

Ice cubes

Cold tap water

Catechol violet crystals

Methylene blue

Alka seltzer tablets

250 watt heat lamp and stand [corresponds to the sun; place 25cm above the water]

Hair dryer

**Aquarium Activity 1**

1. Fill an aquarium with cold tap water and mix in ice. Water should be chilled to 4Co. A small amount of ice should be floating on surface. After 3 to 5 minutes, blow from side-to-side with the hair dryer. After 1 minute, stop hair dyer and record the temperatures of all thermometers.
2. Gently remove surface ice and turn on heat lamp. **CAUTION! TAKE CARE NOT TO SPLASH WATER ON HEAT LAMP.**
3. Record temperatures every five minutes for approximately 50 minutes. Plot temperature changes for each depth on graph paper. Are there temperature changes as a function of depth? Is there an exponential decrease with depth? Why?
4. Drop some Catechol violet crystals randomly over the water surface. Allow the crystals to sink. Note the positions of the trails of crystals. What can you infer about the water currents particularly near the surface?
5. Lightly blow with the hair dyer across the surface of the water from one side and then the other side. Mix the surface water into one homogenous thermal mass. AVOID TO STRONG A BLOW FROM HAIR DYER! Turn off light and allow water to calm. Record the depth of the homogenous red layer and temperature.
6. Next carefully add a layer of ice cubes to the surface. ADD ICE CUBES WITH MIMINMAL DISTURBANCE! Note the convection trails. What is happening to the homogenous red layer and temperature?
7. With a strong wind from the hair dyer complete the mixing of the water in the aquarium and record the temperatures. Explain what may be occurring in regards to the water masses?

**Aquarium Activity 2**

1. Fill aquarium 2/3 full while adding ice liberally to cool the water to 4oC. After Record the temperatures of all thermometers.
2. Next prepare a siphon with a short L-shaped glass tube and at the lower end of the siphon. Rest the glass tube of the siphon in a corner at the bottom of the aquarium. A screw clamp is positioned on the siphon hose to regulate flow.
3. Prepare a 0.3% NaCl solution (at room temperature). Add a small amount of methylene blue to the solution.
4. Start the siphon, allowing the blue liquid to flow to the end of the glass tube. Close clamp.
5. Slowly open the clamp, allowing the salt-laden liquid to flow in a slow, steady stream without turbulence. Position the tube so the salt-laden liquid does not flow into the clear aquarium water.
6. Allow the aquarium to fill the other 1/3 of the aquarium. When the desired level is reached, close the clamp and carefully remove the hose.
7. Carefully remove excess ice from the surface avoiding turbulence.
8. Record temperatures.
9. Turn on heat lamp for 40 minutes.
10. Next distribute catechol violet crystals over the surface of the water. Note what is happening with the crystals.
11. Next distribute the crystals in the upper water layer with a moderate blow with the hair dryer. Note the layers of colors within the aquarium. How do you explain this? What does this mean with respect to temperature, salinity and wind effects?
12. Next drop an Alka-Seltzer table to the bottom of the aquarium. Note what is happening. Explain what may be occurring in regards to the water masses?