Marine Science - Water Stratification Lab

READ ALL INSTRUCTIONS BELOW BEFORE BEGINNING

Introduction

Temperature and salinity both influence the density of water. Colder water is more dense than warmer water, and saltier (more saline) water is more dense than fresh water. Remember that density is mass per unit volume, so a liter of cold salt water has more mass (is heavier) than a liter of warm fresh water. Ocean currents are often determined by the salinity and temperature, and therefore density, of various water masses. The distribution of marine life, especially small organisms such as plankton, is often dependent upon the layering of more dense water below less dense water in the thermocline. In this lab you will demonstrate stratification (horizontal layering) of four solutions of different densities. You will use salt to adjust the salinity (and therefore density) of the water, and food coloring to label solutions of water of different densities. You will create your own model of a stratified water column. Note that for this model, your salt concentrations will be greater than the salinity actually found in the ocean (usually ca. 3.5% or 35 ppt).

Objectives

Students learn to make saline solutions of varying concentrations using graduated cylinders to measure water volume and balances to weigh salt. Students demonstrate what a stratified water column looks like. Students understand that their water column represents a model of stratification in the ocean.

Materials

Tap water
Salt
Food coloring
Balances
400 ml beakers (use plastic cups instead of beakers)
100 ml graduated cylinders
plastic spoons
plastic pipettes
small test tubes
colored pencils or markers

Procedure

1. Work in pairs. Each pair will need four beakers (or plastic cups), four pipettes and one test tube.

2. You will mix and label three salt solutions in each of three beakers (cups), one 20% (200 ppt), one 10% (100 ppt) and one 5% (50 ppt) using the following measures:

    20% solution – 100 ml tap water and 20 g salt
    10% solution – 100 ml tap water and 10 g salt
    5% solution – 100 ml tap water and 5 g salt

Use a plastic spoon to stir your solutions until all salt is dissolved – remember to label each cup!

3. Put 100 ml tap water into a fourth cup. You should now have four beakers with water of different densities.

4. Squeeze several drops of different colored food coloring into each of your solutions. You can decide how you want your colors layered. Remember that the most dense solution (20 %) will be the bottom layer and the least dense (tap water only) will be the top layer, so choose colors that have good contrast in adjacent layers.

5. Stir your solutions again so that the food coloring is thoroughly mixed in with the solution.

6. After your solutions are mixed and colored you are ready to make your model of a stratified water column. Use the plastic pipettes to squeeze a small amount of each color into a small test tube. Remember you want to see the layers clearly separated as different colors. You may need several attempts to achieve the desired effect. **If the colors mix together in the tube then pour it out and rinse it and try again.**

7. Label your test tube with the name of your group and place it in the rack at the front of the room.

8. RINSE ALL GLASSWARE AND PIPETTES AND LEAVE MATERIALS NEXT TO THE BIG SINK ON THE SIDE OF THE ROOM. **FAILURE TO CLEAN UP WILL RESULT IN DEDUCTION OF POINTS.**

9. On a separate sheet of notebook paper, write a brief report (one-two pages, one report per group) that includes:

1 - a hypothesis;
2 - the objective of this experiment;
3 - the materials used and procedures (methods);
4 – your results including a color drawing of your test tube showing the colors of the four layers with each salinity labeled;
5 - your conclusions from the experiment.

Then answer the following question at the end of your report.
How do you think the layering of water of different densities would affect small organisms such as plankton that live near the surface of the sea?
(hint – think about what determines buoyancy and where plankton get their energy)?