

Laboratory Exercise #6 - Introduction to Oceanography

A. Introduction

Oceanography is obviously the study of the oceans. However, there are many different branches within the science of oceanography that draw knowledge and expertise from every major scientific discipline. For example, marine biologists study the organisms and the ecology of the oceans. Conversely, physical oceanographers are interested in the physics of the ocean; examining the nature of waves, tides, and ocean currents. Chemical oceanographers examine how the chemistry of the oceans changes with location and time. Finally, geologic oceanographers are mainly interested in how the bedrock and sediments of the ocean crust are formed. This lab will focus mainly on the physical and chemical aspects of seawater and will address the fundamental structure of the world's oceans.

B. Some Definitions

Oceanography to a large extent is greatly influenced by the following three measurable parameters.

Density – Is simply defined as a mass per volume. In oceanography the units are typically expressed as:

$$\text{Density} = \text{Mass (g)} / \text{Volume (cm}^3\text{)}$$

Note that one cm^3 equals one milliliter. Pure water at 4°C has a density that is exactly $1.0000 \text{ g} / \text{cm}^3$.

IMPORTANT SIDE NOTE - Significant Digits – Note that there are four digits after the decimal place. THIS IS IMPORTANT. Scientists refer the number of digits written for a given observation as significant digits. The number of significant digits is a measure of the precision of your data. Basically, what $1.0000 \text{ g} / \text{cm}^3$ indicates is that in the lab you can measure the weight of water to the nearest $0.0001 \text{ g} / \text{cm}^3$, which is to the nearest 0.1 mg ; requiring a high precision analytical balance. Bottom-line – the ten digit number generated by your calculator is almost always not the correct number and you need to learn how to round off your numbers to reflect your ability to measure that number.

Temperature – From a strictly physics prospective, temperature is a measure of the average kinetic energy that water molecules possess. The warmer the water, the more movement will be exhibited by individual water molecules. Lower temperatures will decrease water molecular movement. In pure water at 0°C the movement of water molecules is decreased significantly so that weak chemical (hydrogen) bonds between the water molecules become stronger than the kinetic movement of the water molecules. At this point the water freezes and becomes a solid (ice).

Salinity – Seawater is obviously salty, unlike freshwater, and the measure of the degree of saltiness of seawater is called salinity, expressed in parts per thousand, otherwise known as parts per mil (‰). Average seawater has a salinity of 35 ‰ , which means:

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