

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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**United States. Congress. House.
Committee on Science and
Astronautics**



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Laboratory Exercises to Accompany Invitation to Oceanography Pinet, Paul R. Pinet, 2006-06 The Exercises In This Laboratory Manual Are Designed To Make Use Of Safe Readily Available Inexpensive And Reusable Materials Many Of The Labs Are Group Based Activities That Demonstrate Principles Typically Discussed In Lecture The Exercises Require Just Minimal Knowledge Of Science And Math Lab Exercises to Invitation T Pb Pinet, 2003-03 **Proceedings of the**

Symposium ,1965 Proceedings of the Symposium United States. Navy Symposium on Military Oceanography,

Chemical Reference Materials for Oceanography Michio Aoyama, Chikako Cheong, Akihiko Murata, 2025-03-22 This open access book explores the history production and certification of reference materials for essential parameters in oceanography and provides a comprehensive understanding of them to readers Because inorganic macro nutrients salinity dissolved oxygen and carbonate system parameters including dissolved inorganic carbon total alkalinity and pH are essential parameters in oceanography they can be used to define biogeographic provinces monitor ocean health and detect decadal scale oceanic climate changes Without reference materials for these parameters it would be difficult to produce reliable data sets or long term baseline studies that are required to verify global change and oceanic stability The book includes chapters on developing new reference materials for density dissolved oxygen dissolved organic carbon dissolved organic matter and trace metals which are also important in oceanographic studies The lead authors of each chapter regarding these parameters are top scientists in these areas hence this is the most comprehensive book of chemical reference materials for ocean science written by experts in each field The book is a useful resource for readers to find the latest information and status of certified reference materials CRM and reference materials RM and of ways to use CRM in their studies We are in the middle of the United Nations Decade of Ocean Science for Sustainable Development 2021 2030 to which this book makes a timely contribution **Oceanography 1961--Phase 3** United States. Congress. House. Merchant Marine and Fisheries, 1961

National Oceanographic Program -- 1965 United States. Congress. House. Committee on Merchant Marine and Fisheries. Subcommittee on Oceanography, 1964 Committee Serial No 88 23 Includes Interagency Committee on Oceanography reports University Curricula in Oceanography June 1963 p 205 368 Oceanography The Ten Years Ahead June 1963 p 427 492

National Oceanographic Program Fiscal Year 1964 April 1963 p 497 565 and National Oceanographic Program Fiscal Year 1965 Mar 1964 p 569 620 **Marine Bulletin** , **Catalog of Copyright Entries. Third Series** Library of Congress.

Copyright Office, 1979 **Oceanography 1961--phase 3** United States. Congress. House. Committee on Merchant Marine and Fisheries, 1961 Considers H R 4276 the Oceanographic Act of 1961 to establish the National Oceanographic Council the National Oceanographic Data Center and the National Instrumentation Test and Calibration Center and to authorize grants by the Smithsonian Institution to organize and conduct oceanographic research **Education in the Field of**

Oceanography United States. Congress. House. Committee on Science and Astronautics. Subcommittee on Earth

Sciences,1959 Committee Serial No 43 Considers H R 6298 to amend National Science Foundation Act of 1950 to fund programs for educational institutions to develop teaching facilities in oceanography **The Role of the Federal Council for Science and Technology, Report for 1963 and 1964** United States Science and Technology Office,1965 *National Oceanographic Program - 1965* United States. Congress. House. Merchant Marine and Fisheries,1964 *The Report of the President to the Congress on Marine Resources and Engineering Development* United States. President,1967 **Naval Meteorology and Oceanography Command News** ,1997 **Hearings** United States. Congress. House. Committee on Science and Astronautics,1959 *Oceanography 1961* United States. Congress. House. Committee on Merchant Marine and Fisheries,United States. Congress. House. Committee on Merchant Marine and Fisheries. Subcommittee on Oceanography,1961 National Oceanographic Program, 1969 United States. Congress. House. Committee on Merchant Marine and Fisheries. Subcommittee on Oceanography,1969 *NOAA Undersea Research Program ... Report* United States. National Oceanic and Atmospheric Administration,1978 **NOAA's Office of Undersea Research ... Report** United States. National Oceanic and Atmospheric Administration. Office of Undersea Research,1981

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