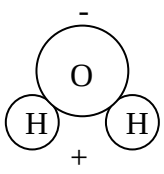
Lab 4: Chemical and Physical Properties of Seawater

Goals

1. Become familiar with the basic chemical and physical properties of seawater
2. Understand what make the oceans salty and where the salts come from

I. What is water?

Water (or **H_2O**) is a molecule composed of one oxygen atom and two hydrogen atoms attached together with a **chemical bond** (energy that holds atoms together). Water is also a **polar molecule** because the oxygen end has a slight negative charge and the hydrogen end as a slight positive charge. This allows water molecules to act like magnets – the positive end attaches to molecules with a negative charge and the negative end attached to molecules with a positive charge.



This polarity gives water some very unique properties such as the ability to:

- attract and attach to other water molecules
- stick to other materials, making them wet
- easily dissolve other polar molecules

II. Seawater Chemistry – Basic Facts

Salinity is an expression of the amount of dissolved solids (= **salts**) in seawater.

Use the Internet to research the answers for the following questions.

QUESTION 1 – What is the average salinity of the world oceans? What is the unit used to express salinity?

QUESTION 2 – What are the main dissolved solids (= salts) present in seawater. Name at least five.

QUESTION 3 – Of all the dissolved solids in seawater, which two are the most abundant?

QUESTION 4. When the two main dissolved solids are combined together, what common substance do they form?

QUESTION 5. What are the main sources of salts in the oceans?

The salinity of seawater is not constant across the ocean surface, but varies with latitude. Salinity is generally:

- low along the Equator
- highest in the sub-tropics and mid-latitudes, and
- lowest at the Poles

QUESTION 6 – Would evaporation increase or decrease salinity in the oceans? Explain your answer.

QUESTION 7 – Would precipitation (rain/snow) increase or decrease salinity in the oceans? Explain your answer.

QUESTION 8. Go to this website: http://aquarius.nasa.gov/gallery-science.php, click on the top left image (Annual mean surface salinity data from NOAA) and enlarge the window so you can clearly see the numbers.

a. Which ocean has the highest salinity - Pacific or Atlantic?

b. What reasons could explain the salinity pattern between the two oceans? (hint: think about the sources of the salts, size of the ocean basins, freshwater sources, etc…)

IV. Heat Capacity Experiment: Soil vs. Water

All materials absorb energy. Some absorb a great deal of heat energy and others less. **Heat capacity is the amount of heat needed to change the temperature of a material**. So, when two substances are exposed to the same heat, the one with a higher heat capacity will absorb more heat, and its temperature will increase slowly, compared to that with a lower heat capacity.

In the following experiment, we will:

a. measure the difference in heat capacity of soil and water, and
b. compare the daily high and low temperatures of two California cities – Long Beach and Palm Springs – and investigate how differences in their daily temperature is relate to differences in the heat capacity of water and soil.

QUESTION 9 – Go to http://www.weather.com/ to help you fill out the table below.

	Long Beach			Palm Springs		
	High T °C	Low T °C	Difference (High-Low)	High T °C	Low T °C	Difference (High-Low)
1/09						
1/10						
1/11						
1/12						

1/13						
1/14						
1/15						
1/16						
1/17						
1/18						
Average						

QUESTION 10 – Where does the temperature fluctuate (vary) the most – in Long Beach or in Palm Springs?

QUESTION 11 – Follow the following steps to conduct the heat capacity experiment:

1. Fill a small beaker with water and place a thermometer in it. Repeat for soil. The bulb of the thermometer should touch the bottom of the beaker for both samples.
2. Let the thermometers stand in each sample for 3 minutes or until the temperature remains constant for one minute.
3. When the temperatures have reached a constant value, record them under time 0 and turn on the heating lamp (position the heating lamp about 15 cm above the two beakers).
4. Take a reading every minute for 15 minutes and record the data in the table below.

Time (mn)	Water Temp (°C)	Soil Temp (°C)
0		
1		
2		
3		
4		
5		

6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

QUESTION 12 – Construct a graph of temperature vs time on the graph paper provided. Be sure to scale and label each axis and give the graph a title.

a. **First graph your data for water temperature (y-axis) vs. time (x-axis). Connect the dots and label the line.**

b. **Then plot your data for soil temperature (y-axis) vs. time (x-axis). Connect the dots and label the line.**

QUESTION 13 - Which graph has a steeper slope (increases more rapidly?

QUESTION 14 - What material has the highest heat capacity – water or soil?

QUESTION 15 – How do your results from the heat capacity experiment relate with your results from the Long Beach & Palm Springs exercise – that is, explain how the heat capacity of water and soil control the daily temperature variations in both of these cities?