

Oceanography Exercise 5
PROPERTIES OF SEAWATER

Short answers

- (1) What are the three most abundant cations in seawater?
- (2) What are the three most abundant anions in seawater?
- (3) What are the thermocline, halocline, and pycnocline?
- (4) What is approximately the average salinity of seawater?
- (5) Explain concisely what is meant by the law of constant proportions as applied to the salinity of seawater.

Calculations (Show your calculations)

- (1) How many calories are required to increase the temperature of 2 grams of water from 4° C to 32° C?
- (2) How many calories are required to increase the temperature of 2 grams of water from -1° C to 102° C?
- (3) One basin of the Great Salt Lake in Utah has brine that is nearly 30 **percent** salt. What is the equivalent value in parts per thousand (as used for seawater salinity)?

(4) Calculate the salinity of the following seawater samples that have measured chlorinities:

<u>Chlorinity</u> (‰)	<u>Salinity</u> (‰)
18.0	
19.1	
14.7	
2.2	

(5) (a) Calculate the residence time (in years) of sodium (Na) in the world ocean. The total amount of sodium in the ocean is 1.5×10^{22} grams. The annual input of sodium to the ocean is 2.2×10^{14} grams per year.

(b) Calculate the annual rate of input (in grams per year) of potassium (K) to the ocean. The total amount of potassium in the ocean is 5.21×10^{19} grams. (You need to find one piece of information in your textbook.)

Remember that residence time equals the total mass of a substance in the ocean divided by the annual rate of input.

Longer Answers

(1) Why is salinity in the open ocean higher between 20 to 30 degrees north and south latitude than at the equator or the polar regions?

(2) What is the difference between conservative and non-conservative distributions in seawater? Name one conservative element or compound, and two non-conservative elements or compounds.

(3) (a) Explain why dissolved oxygen has a minimum concentration between 500 and 1000 meters water depth in the temperate and subtropical Atlantic Ocean.

(b) At this same depth (500 to 1000 m) would you expect the dissolved concentration of each of the following to be higher, lower, or the same as the concentration in surface water (0 to 100 meters); explain why:

carbon dioxide

phosphorus

nitrate (nutrient)

ratio of Mg^{2+} : Na^+

helium

(4) (a) Why is open ocean seawater greenish blue?

(b) Explain the term “photic zone” and give the approximate depth in the open ocean.

(c) What is a representative depth for the photic zone on a continental shelf away from the mouth of a river (that is, not near a source of suspended sediment particles)? Is seawater on the shelf the same color as in the open ocean? (Explain your answer)

(5) Water has unique physical and chemical properties because of hydrogen bonding between molecules. Name four of these properties.