

Module 3 Assignment

Started: Sep 24 at 8:36pm

Quiz Instructions

Question 1

1 pts

Hydrogen bonds are:

- ☐ weak in water with low pH and strong in water with high pH
- ☐ Weak in ice, moderate in liquid water and strong in water vapor
- ☐ Weak and temporary in liquid water
- ☐ polar and covalent

Question 2

1 pts

As pure water approaches its freezing point, the density decreases. Why does this happen?

- ☐ Ice takes up a smaller surface area than liquid water.
- ☐ The hydrogen bonds become rigid, allowing it to expand slightly.
- ☐ The water compresses into ice.
- ☐ The hydrogen bonds break as the molecules compress.

Question 3

1 pts

What is the main cause of stratification in northern polar waters?

- ☐ Salinity differences between the surface and deeper layers
- ☐ Pressure differences between layers
- ☐ Temperature differences between the surface and deeper layers
- ☐ Different plankton abundances

Question 4

1 pts

Why does the ocean not boil or freeze solid in different regions of the world?

- ☐ Heat is transported by oceanic and atmospheric circulation.
- ☐ Heat is able to be transferred to water vapor.
- ☐ The thermal inertia of water is low in certain regions.
- ☐ The latent heat of fusion and vaporization balance the heat energy inputs and outputs.

Question 5

1 pts

The amount of heat energy required to raise one gram of water by one degree (Celsius) is known as:

- ☐ temperature
- ☐ latent heat of fusion
- ☐ heat capacity
- ☐ sensible heat

Question 6

5 pts

Water has a number of unique properties that affect our everyday lives. Match each of the following characteristic features with examples of how those properties affect our lives.

hydrogen bonds

[Choose] ▼

polar nature

[Choose] ▼

latent heat of fusion/vaporization

[Choose] ▼

density

[Choose] ▼

heat capacity

[Choose] ▼

Question 7

1 pts

In iron deficient regions, adding iron to the oceans might reduce global warming by:

- ☐ increasing photosynthetic production of carbon dioxide.
- ☐ increasing photosynthetic use of carbon dioxide.
- ☐ increasing photosynthetic production of oxygen.
- ☐ increasing photosynthetic use of oxygen.

Question 8

5 pts

Salinity Part A

Consider the following scenario: you take a sample of pure, filtered seawater at 35 parts per thousand (ppt) salinity and using a lab scale you measure its mass: it weighs 1 kg (=1,000g). You put your sample over a boiler and evaporate the water completely so that all you have left in the container are the salts that were previously dissolved in the seawater.

Theoretically, how many grams of total salt residue would you get after you evaporate all the water out of the container? (round your answer so that there are no decimals)

Hint: the rationale behind "parts per thousand" or ppt is similar to that of percentage (i.e. parts per 100), so 35 ppt=3.5%

Question 9

5 pts

Salinity Part B

Consider the following scenario: you take a sample of pure, filtered seawater at 35 parts per thousand (ppt) salinity and using a lab scale you measure its mass: it weighs 1 kg (=1,000g). You put your sample over a boiler and evaporate the water completely so that all you have left in the container are the salts that were previously dissolved in the seawater.

How many grams of sodium (Na^+) are in the residue? (round your answer up so that there are no decimals)

Hint: use table 7.1 on page 202 of your textbook (specifically the column called "Percent by Mass") as a guide for relative abundance of each major constituent of seawater; note that percent by mass will be the same for water at 34.4ppt and water at 35 ppt, but the grams per kilogram will be different!

Question 10

5 pts

Salinity Part C

Consider the following scenario: you take a sample of pure, filtered seawater at 35 ppt salinity and measure its weight. It weighs 2 kg (2000 grams). You put your sample over a boiler and evaporate the water completely.

How many grams of total salt residue would you have gotten? (round your answer up so that there are no decimals)

Question 11

5 pts

Salinity Part D

Consider the following scenario: you take a sample of pure, filtered seawater at 35 ppt salinity and measure its weight. It weighs 2 kg (2000 grams). You put your sample over a boiler and evaporate the water completely. How many grams of sodium (Na^+) would be in the residue? (round your answer up so that there are no decimals)

Hint: use table 7.1 on page 202 of your textbook (specifically the column called "Percent by Mass") as a guide for relative abundance of each major constituent of seawater; note that percent by mass will be the same for water at 34.4ppt and water at 35 ppt, but the grams per kilogram will be different!

Question 12

5 pts

Estuary Data Part A

Oceanographers often take measurements of the physical and chemical properties of seawater to help characterize a particular area of ocean or estuary. In this section, you will use previously existing data to create graphs and interpret the data to answer common questions about a local estuary. Estuaries are inland bodies of water that have a freshwater river flowing into them on one end and a connection to the ocean on the other end.

The data in the Table below was taken from measurements using a YSI Model 85 Temperature-Conductivity meter in Newport Bay, California, an estuary that opens to the Pacific Ocean through an inlet. See photo below.



First examine the data below. Then choose the correct answer that describes the trend of **salinity**, **temperature**, and **density** from Site 1 to Site 8 at the sea surface (depth of 0 meters).

Site	Depth (meters)	Temperature ($^{\circ}\text{C}$)	Salinity (ppt)	Density (g/cc)
1	0	20.6	13.591	1.00837
2	0	19.7	29.897	1.020952
	1	19.5	30.097	1.021155
	2	19.2	30.395	1.021457
3	0	19.4	30.795	1.021712
	1	19.3	30.893	1.021811

	2	18.8	31.498	1.022398
	3	18.6	31.601	1.022526
4	0	18.8	31.499	1.022398
	1	18.8	31.598	1.022474
	2	18.6	31.601	1.022526
	3	18.5	31.702	1.022627
	4	18.5	31.702	1.022627
5	0	18.5	31.995	1.022851
	1	18.3	32.101	1.022981
	2	18.0	32.201	1.023131
	3	17.9	32.296	1.023227
	4	17.5	32.402	1.023404
	5	17.4	32.404	1.02343
6	0	18.4	32.199	1.023032
	1	18.4	32.198	1.023031
	2	18.2	32.195	1.023078
	3	18.1	32.198	1.023104
	4	17.9	32.203	1.023156
7	0	18.2	32.196	1.023078
	1	17.9	32.297	1.023228

	2	17.9	32.102	1.023079
	3	17.5	32.299	1.023326
	4	17.3	32.399	1.0236
	5	16.2	32.595	1.023854
8	0	17.0	32.4	1.023521
	1	16.9	32.403	1.023546
	2	16.6	32.497	1.023688
	3	16.5	32.5	1.023713
	4	16.74	32.322	1.023521
	5	16.3	32.504	1.023762
	6	16.0	32.6	1.023903
	7	15.6	32.699	1.024068

- ☐ Temperature, salinity and density remain constant as expected
- ☐ As we move from site 1 to site 8, sea surface temperature increases and decreases depending on the site while salinity and density both drop dramatically.
- ☐ Temperature abruptly increases, salinity and density remain the same as we move from site 1 to site 8
- ☐ As we move from site 1 to site 8, sea surface temperature gradually decreases, while both salinity and density increase

Question 13

5 pts

Estuary Data Part B

Using the same data from the previous question (see data below), which site do you think is closest to the ocean and which is furthest?

Site	Depth (meters)	Temperature (°C)	Salinity (ppt)	Density (g/cc)
1	0	20.6	13.591	1.00837
2	0	19.7	29.897	1.020952
	1	19.5	30.097	1.021155
	2	19.2	30.395	1.021457
3	0	19.4	30.795	1.021712
	1	19.3	30.893	1.021811
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	3	18.6	31.601	1.022526
4	0	18.8	31.499	1.022398
	1	18.8	31.598	1.022474
	2	18.6	31.601	1.022526
	3	18.5	31.702	1.022627
	4	18.5	31.702	1.022627
5	0	18.5	31.995	1.022851
	1	18.3	32.101	1.022981
	2	18.0	32.201	1.023131
	3	17.9	32.296	1.023227
	4	17.5	32.402	1.023404

	5	17.4	32.404	1.02343
6	0	18.4	32.199	1.023032
	1	18.4	32.198	1.023031
	2	18.2	32.195	1.023078
	3	18.1	32.198	1.023104
	4	17.9	32.203	1.023156
7	0	18.2	32.196	1.023078
	1	17.9	32.297	1.023228
	2	17.9	32.102	1.023079
	3	17.5	32.299	1.023326
	4	17.3	32.399	1.0236
	5	16.2	32.595	1.023854
8	0	17.0	32.4	1.023521
	1	16.9	32.403	1.023546
	2	16.6	32.497	1.023688
	3	16.5	32.5	1.023713
	4	16.74	32.322	1.023521
	5	16.3	32.504	1.023762
	6	16.0	32.6	1.023903
	7	15.6	32.699	1.024068

- ☐ Site 8 is the closest to the ocean and site 1 the furthest.
- ☐ Site 3 is the furthest from the ocean and site 1 the closest
- ☐ Site 5 is the closest from the ocean and site 3 the furthest
- ☐ The answers to these questions can not be derived from the data provided by the table
- ☐ All sites are equally far from the ocean

Question 14

5 pts

Estuary Data Part C

Use the same estuary data (see below). In general, how does salinity, temperature and density change with DEPTH in the bay?

Site	Depth (meters)	Temperature ($^{\circ}\text{C}$)	Salinity (ppt)	Density (g/cc)
1	0	20.6	13.591	1.00837
2	0	19.7	29.897	1.020952
	1	19.5	30.097	1.021155
	2	19.2	30.395	1.021457
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	7	15.6	32.699	1.024068

- ☐ Temperature changes considerably, while salinity and density remain the same
- ☐ Temperature decreases with depth while salinity and density increase with depth
- ☐ These variables do not change with depth; they remain the same from surface to the bottom
- ☐ Temperature increases as we measure closer to the bottom, while salinity remains the same and density decreases
- ☐ The answers to these questions can not be derived from the data provided in the table

Question 15

5 pts

Estuary Data Part D

Using the same data as before (see below), what is the scientific explanation for the general vertical trends of temperature, salinity and density that we notice as we move from the surface to the bottom of the bay? In other words, how do you explain the answers you gave in the previous question?

Site	Depth (meters)	Temperature (°C)	Salinity (ppt)	Density (g/cc)
1	0	20.6	13.591	1.00837
2	0	19.7	29.897	1.020952
	1	19.5	30.097	1.021155
	2	19.2	30.395	1.021457
3	0	19.4	30.795	1.021712
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	6	16.0	32.6	1.023903

7	15.6	32.699	1.024068
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- ☐ The water gets heated from below because the land is warm, which causes salinity to increase and density to decrease as we move from the surface to the bottom.
- ☐ Denser (i.e. saltier and colder) water tends to sink while less dense water (i.e. less salty and warmer) will float near the surface.
- ☐ There is no scientific explanation for the observed trends
- ☐ Those vertical trends in temperature, salinity and density can only be explained on a case by case basis

Question 16

1 pts

Which of the following is a true statement about gases dissolved in seawater?

- ☐ Gases dissolve better in warmer water than in colder water.
- ☐ Nitrogen is present in a lower percentage than oxygen or carbon dioxide.
- ☐ Dissolved oxygen levels are lower in the deepest regions of the ocean
- ☐ Dissolved carbon dioxide levels are much higher in the ocean compared to the atmosphere

Question 17

1 pts

How does oxygen enter seawater?

- ☐ as a result of decomposition of plant and animal remains
- ☐ as a by-product of photosynthesis and diffusion from the surface
- ☐ through the respiration of animals.
- ☐ through oxidation of metal ions in seawater.

Question 18

1 pts

Why does the ocean often have a higher pH than it does at depth.

- ☐ The photons of light entering surface water break apart acid molecules
- ☐ Warmer surface water can dissolve less carbon dioxide and photosynthesis removes it
- ☐ There is more carbonic acid at the surface than there is in deeper water
- ☐ The ocean's buffer system does not work at the surface due to warm water

Question 19

1 pts

What causes the solar heating of Earth to have seasonal variations?

- ☐ The length of the Earth's rotation
- ☐ The tilt of the Earth
- ☐ Variations in distance from the sun
- ☐ The Coriolis Effect

Question 20

1 pts

Which of these factors has the least effect on air's density?

- ☐ argon content
- ☐ distance from the surface of the Earth
- ☐ temperature
- ☐ water content

Question 21

1 pts

Moving air accounts for what proportion of heat moving poleward?

- ☐ 50%
- ☐ 2/3
- ☐ 1/3
- ☐ zero

Question 22

1 pts

What is true of the Intertropical Convergence Zone (ITCZ)?

- ☐ It coincides with areas of strong winds.
- ☐ It coincides with the geographical equator.
- ☐ It is subject to seasonal variations.
- ☐ It is the result of the convergence of a Hadley cell and Ferrel cell

Question 23

1 pts

Which of the following is a result of the Coriolis effect?

- ☐ causes winds to blow in the opposite direction of the Earth's rotation
- ☐ causes winds to deflect to the left in the northern hemisphere
- ☐ causes winds to deflect to the right in the southern hemisphere
- ☐ causes winds to deflect to the right in the northern hemisphere

Question 24

1 pts

Which is true regarding water in polar regions?

- ☐ it is more productive than tropical water
- ☐ it is less productive than tropical water
- ☐ there is a major thermocline between the surface and deeper water
- ☐ downwelling keeps nutrients from rising to the surface

Question 25

1 pts

How does over-fishing affect coral reefs?

- ☐ physical destruction by fishing tackle
- ☐ less calcium carbonate for the building of their skeletons
- ☐ removal of fish also removes valuable fertilizer

- ☐ algae may overgrow coral

Question 26

1 pts

How do some fish keep from freezing in polar waters?

- ☐ large bodies with small surface area to volume ratios
- ☐ migrate to lower latitudes in the winter months
- ☐ keep moving to generate internal heat
- ☐ antifreeze in blood

Question 27

2 pts

Match the atmospheric cell with its location.

Hadley Cell

between 30 degrees and 60 ▼

Ferrel Cell

between 60 degrees and the pole

Question 28

4 pts

Relating Weather & Climate Part 1

Use the following links to find information about monthly and annual differences in temperatures in Los Angeles and Phoenix. Then, answer the following questions keeping in mind their geographic location and climate.

<http://www.usclimatedata.com/climate/los-angeles/california/united-states/usca1339> [_ \(http://www.usclimatedata.com/climate/los-angeles/california/united-](http://www.usclimatedata.com/climate/los-angeles/california/united-states/usca1339)

[states/usca1339\)](#)

<http://www.usclimatedata.com/climate/phoenix/arizona/united-states/usaz0166>

[\(<http://www.usclimatedata.com/climate/phoenix/arizona/united-states/usaz0166>\)](http://www.usclimatedata.com/climate/phoenix/arizona/united-states/usaz0166)

How does the *annual* temperature range (i.e. maximum temp. recorded minus the lowest temp. recorded) differ between Los Angeles and Phoenix?

- ☐ LA and Phoenix have identical annual temperature ranges
- ☐ Annual temperature ranges of LA and Phoenix are not comparable
- ☐ Over the course of the year, LA has a larger average range of temperature than Phoenix (i.e. temperature varies more in LA than in Phoenix)
- ☐ Over the course of the year, Phoenix has a larger average range of temperature than LA (i.e. temperature varies more in Phoenix than in LA)

Question 29

4 pts

Relating Weather & Climate Part 2

Use the following links to find information about monthly and annual differences in temperatures in Los Angeles and Honolulu. Then, answer the following questions keeping in mind their geographic location and climate.

<http://www.usclimatedata.com/climate/los-angeles/california/united-states/usca1339> [\(<http://www.usclimatedata.com/climate/los-angeles/california/united-states/usca1339>\)](http://www.usclimatedata.com/climate/los-angeles/california/united-states/usca1339)

<http://www.usclimatedata.com/climate/honolulu/hawaii/united-states/ushi0026>
[\(<http://www.usclimatedata.com/climate/honolulu/hawaii/united-states/ushi0026>\)](http://www.usclimatedata.com/climate/honolulu/hawaii/united-states/ushi0026)

How does the *annual* temperature range differ between these two locations?

- ☐ Over the course of the year, LA has a larger average range of temperature than Honolulu (i.e. temperature varies more in LA than in Honolulu)
- ☐ Annual temperature ranges of LA and Honolulu are not comparable

- ☐ LA and Honolulu have identical annual temperature ranges
- ☐ Over the course of the year, Honolulu has a larger average range of temperature than LA (i.e. temperature varies more in Honolulu than in LA)

Question 30

4 pts

Relating Weather & Climate Part 3

All of the factors below contribute to differences in climate (such as we saw in the previous questions) except one. Choose the one factor below that DOES NOT significantly contribute to differences.

- ☐ Proximity to active volcanoes
- ☐ Proximity to the equator (latitude)
- ☐ Proximity to a large body of water (such as the ocean or a large lake)
- ☐ Location in relation to the Hadley, Ferrel and Polar cells.
- ☐ The fact that water's specific heat is higher than land's specific heat

Question 31

12 pts

Relating Weather & Climate Part 4

List and FULLY explain all the factors that account for temperature ranges and climate differences between:

- a) LA and Phoenix
- b) LA and Honolulu

Hint: Consider latitude, proximity to the ocean, the ocean's water properties, ocean/atmospheric phenomena.

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   12pt

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Question 32

12 pts

Using what you learned from the textbook reading and video episodes.....How did the oceans become salty AND how do we know that the salts come from more than just one source?

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