



Teacher's Guide Answers

Assessment

1. *(a) Epipelagic zone*
2. *(b) density \times acceleration due to gravity \times the depth of the liquid*
3. *(c) both salinity and temperature*
4. *(d) brine*
5. *(a) because the salt in the seawater prevents the water molecules from crystallizing as quickly as those in drinking water*
6. *(b) false*
7. *(b) no*
8. *(d) no, the temperature decreases gradually, then very quickly, then remains constant*

Teacher Notes: Lessons 1 – 4 must be completed prior to students conducting Lesson 5. However, the order in which students complete Lessons 1 – 4 is not important. If time does not permit every student to complete all four lessons, you can assign groups of students to complete one of the four lessons and then have the students share their results with the class so all students have a complete data set for Lesson 5.

Lesson 1: Salinity

Purpose: Students investigate how ocean depth affects the salinity of sea water.

Table 1.

Depth (m)	<i>0 m</i>	<i>300 m</i>	<i>600 m</i>	<i>900 m</i>	<i>1200 m</i>	<i>1500 m</i>
Salinity (psu)	<i>35.60</i>	<i>35.40</i>	<i>34.50</i>	<i>34.60</i>	<i>34.79</i>	<i>34.79</i>

Do You Understand?

1. Did the amount of salinity change with the depth?

Yes, the amount of salinity changes based on depth.

2. Click on the graph of your collected data. Are the points in a straight line?

No the points are not in a straight line. The amount of salinity first decreases and then increases and then hits a plateau.

3. Go back to the simulation and keep taking Salinity samples until you find the lowest salinity amount. Record the depth and salinity below.

Table 2.

Depth (m)	700
Salinity (psu)	34.2

Lesson 2: Temperature

Purpose: Students study how ocean depth is related to the temperature of sea water.

Table 1.

Depth (m)	0	100	200	300	400	500	600	700	800	900	1000
Temperature (°C)	22.8	22.6	22.4	22.2	22.0	20.0	16.0	12.0	8.0	6.0	4.0

Do You Understand?

1. Click on the graph of your collected data. For which depths are the points in a straight line?

For depths 0-400 m, the data points form a straight line.

2. Using scientific reasoning and your data, explain why depth affects temperature the way it does.

The decrease in temperature is gradual as the Sun heats up the surface of the water and then sharply decreases near the depth where the sunlight no longer reaches the water.

- Using the background information above and your own data, predict what the temperature would be like at 1200 meters, and then take a sample. Were you correct?

The background information indicates that the freezing temperature of water is 0 degrees, so it would be impossible for the temperature of liquid water to keep decreasing, as it would turn into a solid at 0 degrees Celsius. The measurement is actually 4.0 degrees Celsius.

Lesson 3: Water Density

Purpose: Students complete an experiment to determine how ocean depth is related to the density of sea water.

Table 1.

Depth (m)	<i>0</i>	<i>200</i>	<i>400</i>	<i>600</i>	<i>800</i>	<i>1000</i>	<i>1200</i>
Water Density (g/cm³)	<i>1.0248</i>	<i>1.0254</i>	<i>1.0261</i>	<i>1.0267</i>	<i>1.0274</i>	<i>1.0280</i>	<i>1.0280</i>

Do You Understand?

- Click on the graph of your collected data. For which depths are the points in a straight line?

The points are in a straight line for depths 0-1000m.

- Using scientific reasoning and your data, explain why depth affects water density the way it does.

Saltwater becomes denser as you go deeper because the temperature and salinity of the water affect density. The colder the water, the denser it is. Therefore, since the temperature decreases as you get further away from the surface, the density increases.

- Using the background information above and your own data, predict what the water density would be like at 1400 meters, and then take a sample. Were you correct?

The water density would still be 1.0280 at 1400 feet because the temperature and salinity are also the same as they were at 1200 feet.

Lesson 4: Pressure

Purpose: Students investigate how ocean depth affects the pressure exerted by the sea water.

Table 1.

Depth (m)	0	200	400	600	800	1000	1200
Pressure (N/cm²)	10	210	410	610	810	1010	1210

Do You Understand?

1. Click on the graph of your collected data. Is there a pattern between depth and pressure?

There is a direct relationship between depth and pressure.

2. Using scientific reasoning and your data, explain why depth affects pressure the way it does.

The further down you dive, the more water/mass is above you, therefore the more pressure you will feel.

3. Using the background information above and your own data, predict what the pressure would be like at 3000 meters, and then take a sample. Were you correct?

Pressure would be 3010 N/cm² at 3000 m.

4. Since gravity is a constant, if density plots in a straight line, will pressure also plot in a straight line? Explain why or why not.

The variables are all directly related, so if one part of the equation increases, the other side of the equation will also increase.

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Lesson 5: Trench Measurement

Purpose: Students determine the depth of an ocean trench.

Table 1.

Depth (m)	0	500	1000	1500	2000	4526
Water Density (g/cm³)	1.0248	1.0264	1.0280	1.0280	1.0280	1.0280
Temperature (°C)	22.80	20.00	4.00	3.99	3.98	3.91
Pressure (N/cm²)	10	510	1010	1510	2010	4536
Salinity (psu)	35.60	34.60	34.80	34.79	34.78	34.71

* Note: Sample data in far right column. For Teachers only, if your student needs help, the trench depth answer will be in the Trench ID number. For example, if Trench ID number is VL4Z4462545X, the answer will be 4526.

Do You Understand?

1. Click the Graph button once you have collected all of your samples. Which variable's graph is a straight line?

Pressure is the only variable graphed in a straight line.

2. With the variable you identified in question 1, what is the relationship between that variable and depth?

Pressure = Depth + 10

3. Calculate the depth of the bottom of the trench based on your pattern. Click on the "Trench Depth" button and enter in your estimate. Were you correct?

Since Pressure was 4536, Depth should be 4526. These numbers are randomized, but the depth will always be Pressure-10.