



Trench Dive

STEM Sims

Lesson 3: How does Depth Affect Water Density and Pressure?

Imagine having a hundred concrete blocks placed on top of your body. The blocks would crush you in a very short time. When you are under water, all of the water above you is pressing on you in a way similar to the concrete blocks. In this investigation, you'll study how the density of water and pressure are affected by changes in the depth of the water. Put yourself under a little pressure and start this study.

Here are some definitions to help you in your investigation.

Mass -	the amount of matter in something. Usually measured in grams (g).
Volume -	the amount of space something takes up. Usually measured in centimeters cubed (cm^3).
Density -	the compactness of a material. Water density is calculated by dividing its mass by its volume.
g/cm^3 -	a unit used to measure density. (grams/cubic centimeter)
Force -	any push or pull on something. Usually measured in newtons (N).
Area -	a specific part of a surface. Usually measured in meters squared (m^2).
Pressure -	a measure of the force over a given area
Newtons/meter ² -	a unit used to measure pressure
Distance -	a measure of the length of something
Meters -	a unit of measure of depth. One meter is about 3 feet.
Depth -	the distance from the top or surface of something to the bottom of something
Trench -	a very low point in the bottom of the ocean

Prediction - a statement about a future event, often based on experience

Prediction Error - how far a predicted measurement is from the true or actual measurement

Doing the Science

1. Start the Trench Dive Simulation by clicking on the "Simulation" tab.
2. Click on the "Water Density" and "Pressure" buttons to sample the density of the water and the pressure at the surface. Record the data in Table 1.
3. Next, click the green down arrow on the left side of the screen until the depth measurement reaches about 500 m.
4. Click on the "Water Density" and "Pressure" buttons to take another sample of the water density and pressure at 500 m. Make sure to record your data in Table 1.
5. Repeat steps 3 and 4 in increments of about 500 m until you complete Table 1. Some of your depth values will not be exactly 500 increases.

Table 1.

Depth (m)	0	500	1,000	1,500	2,000	2,500	3,000
Water Density (g/cm ³)							
Pressure (N/m ²)							

Do You Understand?

1. In the simulation, click on the blue "Graph" button. Next, click the "Water Density" button. Review the graph and then describe the shape of the density graph.

2. In the simulation, click on the blue "Graph" button. Next, click the "Pressure" button. Review the graph and then describe the shape of the pressure graph.
3. Using scientific reasoning and your data, explain why you think the water density does or does not change with increasing ocean depth.
4. Using scientific reasoning and your data, explain why you think the pressure does or does not change with increasing ocean depth.
5. Using your data, make a prediction on the water density at a depth of 720 meters. Write your prediction in the space below.

Prediction of water density at a depth of 720 meters = _____
6. Describe how you made your prediction of the water's density at 720 meters.
7. After you write down your prediction, use the simulation to take a water density reading at a depth of 720 meters. Write down the actual water density in the space below.

Actual water density at a depth of 720 meters = _____

8. Subtract your predicted water density at the depth of 720 meters from the actual water density. This is the error of your prediction. Write down your prediction error in the space below.

Prediction error = _____

9. Using your data, make a prediction on the pressure at a depth of 1,900 meters. Write your prediction in the space below.

Prediction of pressure at a depth of 1,900 meters = _____

10. After you write down your prediction, use the simulation to take a pressure reading at a depth of 1,900 meters. Write down the actual pressure in the space below.

Actual pressure at a depth of 1,900 meters = _____

11. Subtract your predicted pressure at the depth of 1,900 meters from the actual pressure. This is the error of your prediction. Write down your prediction error in the space below.

Prediction error = _____

12. Which of your predictions, the water's density at 720 meters or 1,900 meters was more correct? Provide a sentence that states the reasoning of your response.

13. You might have noticed that the depth gauge of the submarine broke at a depth of 3,000 meters. Could you use your water density data to find out the depth of the ocean trench after the gauge broke? Explain why or why not.

14. Use the density equation to calculate the mass of 2.000 cubic meters of ocean water at a depth of 2,000 meters.