Sonar – Measuring Distance with Sound Lab #20

Pre-Lab Discussion

Large submarines cannot afford to add windows so the captain can see where to steer the ship because the pressure would cause the windows to punch out or cause the glass to break. Subs use sonar for navigation.

Research Question

How can you measure distance from the time it takes a sonar ping to return?

Hypothesis

When a sonar ping is sent out, it travels to an object and is then reflected back. The time for the ping to return is a measure of _____ the distance to the object.

Sonar stands for _____

Sonar is a device that measures _____

Theory

Write the equation that relates sonar time travel to distance: _____.

Materials

backstop ruler meter stick ball stopwatch

Method

1. Use a textbook and a ruler to make a ramp.
2. Place the end of the ruler 0.50 meters from the backstop.
3. Let the ball run down the ramp. Start the time when the ball reaches the end of the ruler. Record the time for the ball to reflect off the backstop and return to the start. Record your data on the data table.
4. Repeat step 3 until you have a total of three consistent times (no bouncing or odd behavior of the ball).
5. Move the ramp so the end of the ruler is 1.00 meters from the backstop.
6. Repeat steps 3 and 4 recording your data on the table.

Data Collection and Processing

Data Table		
	Time for 0.50 m ping (s)	Time for 1.00 m ping (s)
Trial 1		
Trial 2		
Trial 3		
Average Time		

Conclusions

1. Compare the average times for the 0.50 meter sonar ping and the 1.00 meter ping. Does it take exactly twice as long for the 1.00 meter ping?

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2. It is very usual in this experiment for the time required for the 1.00 meter ping to be more than twice the time required for the 0.50 meter ping. Explain why this usually happens. Does this problem usually occur for submarines in the ocean? Explain.

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3. If we were using sonar in a submarine in the ocean, what variable would we need to be able to calculate the distance from the sub to an object?

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4. List two factors that might change the speed of sound in the ocean water. Explain if the factor would increase or decrease the speed of sound.

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5. The speed of sound in salt water is 1530 meters per second. If a ping requires 0.75 seconds to return, calculate the distance to the object. (Show all your work, units and cancellations.)

6. Name three creatures that use sonar.

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