MiSP Speed of Light and Sound Worksheet #3

Comparing the Speed of Sound and the Speed of Light in Air and Water

You have learned a number of differences between electromagnetic waves, like light, radio frequency and sound waves. One of these differences involves the ability to travel in a vacuum.

1. Can light travel in a vacuum? _____. Explain why or why not.
   _____
   _____
   _____
2. Can sound travel in a vacuum? _____. Explain why or why not.
   _____
   _____
   _____
3. There is also a difference in what happens to light and sound waves when they travel through different media. Complete the table below and then graph the data to see the difference.

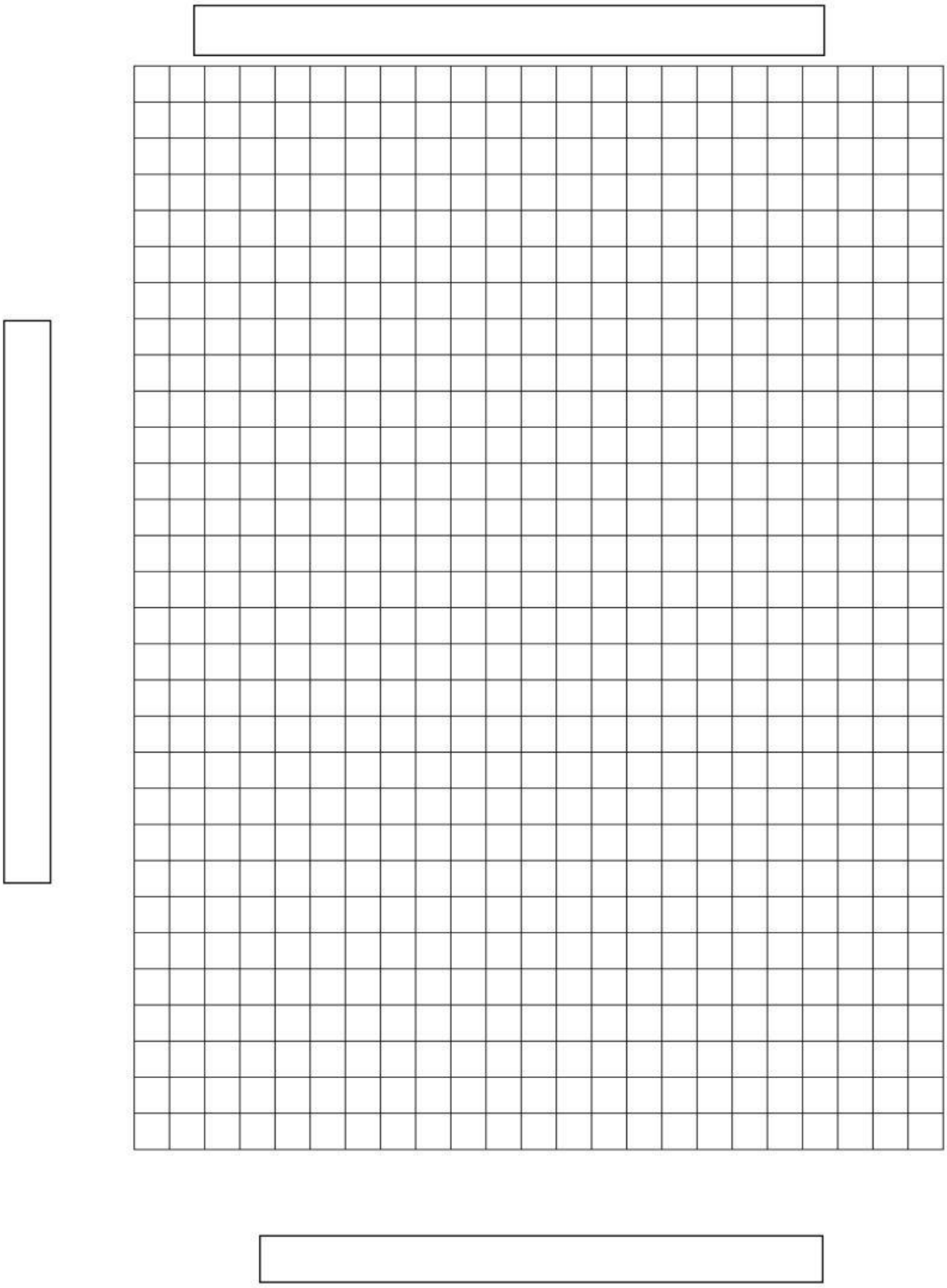
Time traveled	Distance (m) traveled			
	Sound in air	Sound in water	Light in air	Light in water
0 seconds	0	0	0	0
1 second	343	1482	300,000,000	225,500,000
2 second				
3 second				

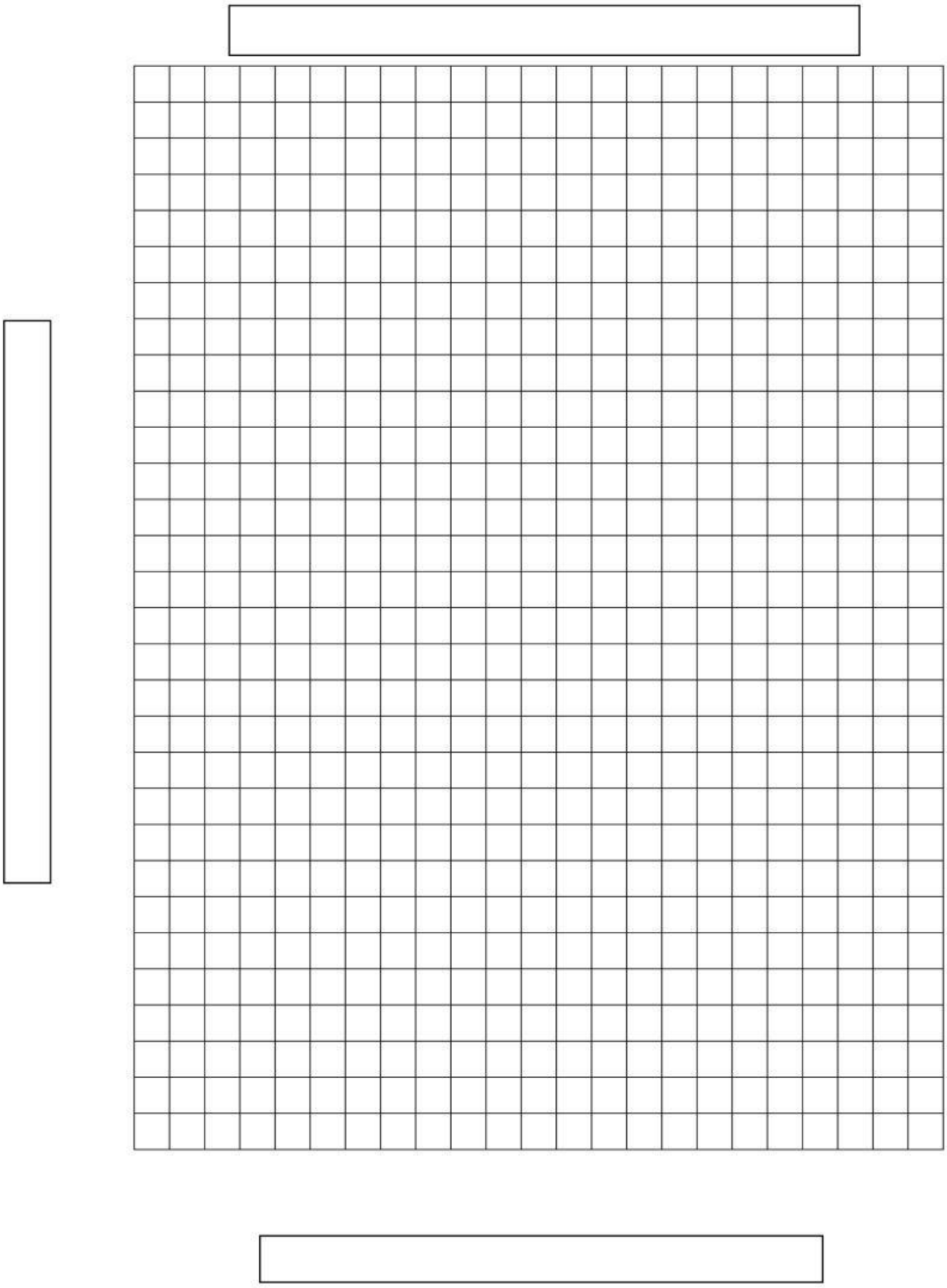
4. Convert the distance data for the distance traveled by light into millions of meter rather than in meters. Place the new data in the table below.

Time traveled	Distance (m) traveled		Distance (million m) traveled	
	Sound in air	Sound in water	Light in air	Light in water
0 seconds	0	0	0	0
1 second	343	1482		
2 second				
3 second				

5. Graph the data. Make one graph for sound and one for light. Plot distance on the y-axis and time on the x-axis. You will have two lines on each graph. Use different symbols or colors to show the data points for distance traveled in air and the data points for distance traveled in water.

6. Draw separate lines connecting the data points for air and for water on both of your graphs. Make a legend for your graphs.





Analysis

1. For each of the lines on your sound graph, pick two points (ordered pairs) and calculate the difference in distance and the difference in time between the points. Divide the difference in distance by the difference in time.

Ordered Pair (x_1, y_1) (x_2, y_2)	Difference in distance (meters)	Differences in Time (sec)	Difference in distance / Difference in time
air			
water			

2. Speed = difference in distance/difference in time. What is the speed of sound in air and in water?
   a. Speed of sound in air: _____
   b. Speed of sound in water: _____

3. For each of the lines on your light graph, pick two points (ordered pairs) and calculate the difference in distance between the points. Divide this by the difference in time between the two points.

Ordered Pair (x_1, y_1) (x_2, y_2)	Difference in distance (million meters)	Differences in Time (sec)	Difference in distance / Difference in time
air			
water			

4. What is the speed of sound in air and in water?

    a. Speed of light in air: _____
    b. Speed of light in water: _____

5. Does sound travel faster in air or in water? _____

6. Does light travel faster in air of in water? _____

7. Which line was steeper on the sound graph, the line for air or the line for water? _____

8. Which line was steeper on the light graph, the line for air or the line for water? _____

9. Using what you know about the differences between electromagnetic waves and mechanical waves, write a possible explanation for the difference between sound and light when they travel in air and water.

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