Name _____ Date _____ Class _____

inquiry **Lab A** **55 minutes**

Measuring Wave Speed

When you make a wave on a spring toy, the frequency is how many wavelengths pass a point per second. Wavelength is the distance between one point on the wave and the nearest point just like it. If you can measure the frequency and wavelength of a wave, you can figure out the wave speed.

Ask a Question

How can you determine the speed of a wave?

Materials

meter tapes (2)

masking tape

coiled spring toy

twine, 0.25 m

stopwatch or clock with second hand

Safety

Make Observations

❑ **1.** Read and complete a lab safety form.

❑ **2.** Lay the meter tapes on the floor, crossing each other to make *x*- and *y*-axes. Fasten the meter tapes in place with masking tape.

❑ **3.** Tie a piece of twine around the last coil of the spring toy.

❑ **4.** With a partner, stretch the spring toy along the *x*-axis. One person should hold one end of the spring toy at the *y*-axis. The other person should hold the twine at the end of the stretched spring.

❑ **5.** One student creates a transverse wave by moving his or her hand back and forth along the *y*-axis at a constant rate. When the wave looks the same every time, another student times a 10-second period. At the same time, the third person counts the number of vibrations in 10 seconds. Record the number of vibrations in the data table on the next page.

❑ **6.** As the student continues making the wave, another student should estimate the wavelength along the *x*-axis using the meter tape.

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Lab A continued

❑ **7.** Calculate the frequency of the wave by dividing the number of wavelengths by the 10-second period when you timed the waves. Then calculate the wave speed using the equation: wave speed = frequency × wavelength.

❑ **8.** Repeat steps 5 through 7 using a different frequency.

Trial	Number of Vibrations in 10 s	Frequency (Hz)	Wavelength (cm)	Wave Speed (cm/s)
1.				
2.				

Form a Hypothesis

❑ **9.** Form a hypothesis about the relationship between frequency and wavelength.

_____

_____

Test Your Hypothesis

❑ **10.** Choose a frequency that you did not use during **Make Observations**. Predict the wavelength for a wave with this frequency.

_____

Lab A continued

❑ **11.** Practice making a wave on the spring toy with your chosen frequency. Repeat steps 4–7 for this wave. Did your prediction of wavelength support your hypothesis? If not, revise your hypothesis and repeat steps 4–7.

_____

Lab Tips

- Keep the amplitude constant by moving the same distance on the *y*-axis in each vibration.
- Twenty vibrations in 10 s make a wave with a frequency of 2 Hz.

Analyze and Conclude

❑ **12. Conclude** How close was your prediction of wavelength compared to the actual measurement?

_____

❑ **13. Think Critically** What measurements were the most difficult to make? Suggest ways to improve on the method.

_____

_____

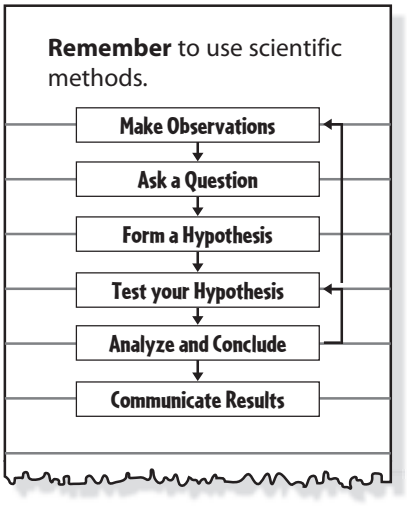
❑ **14. The Big Idea** How did the wavelength, frequency, and wave speed change for the different waves that you created?

_____

_____

Communicate Your Results

Write a report explaining the steps you took in this lab. Include a table of the measurements you made. Be sure to describe sources of error in your measurements and ways that you might improve the accuracy of your experiment.



Name _____ Date _____ Class _____

Inquiry **Lab B** **55 minutes**

Measuring Wave Speed

When you make a wave on a spring toy, the frequency is how many wavelengths pass a point per second. Wavelength is the distance between one point on the wave and the nearest point just like it. If you can measure the frequency and wavelength of a wave, you can determine the wave speed.

Ask a Question

How can you determine the speed of a wave?

Materials

meter tapes (2)

masking tape

coiled spring toy

twine, 0.25 m

stopwatch or clock with second hand

Safety

Make Observations

1. Read and complete a lab safety form.
2. Lay the meter tapes on the floor perpendicular to each other to make an *x*- and *y*-axis. Fasten them in place with masking tape.
3. Tie a piece of twine around the last coil of the spring toy.
4. With a partner, stretch the spring toy along the *x*-axis. One person should hold one end at the *y*-axis. The other person should hold the twine at the end of the outstretched spring.
5. One student creates a transverse wave by moving his or her hand up and down along the *y*-axis at a constant rate. When the wave is consistent, another student times a 10-second period while the third person counts the number of vibrations in 10 seconds. Record the number of vibrations in the data table on the next page.
6. As the student continues making the wave, another student should estimate the wavelength along the *x*-axis using the meter tape.

Lab B continued

7. Calculate the frequency of the wave. Then calculate the wave speed using the equation: wave speed = frequency × wavelength.

8. Repeat steps 5 through 7 using a different frequency.

Trial	Number of Vibrations in 10 s	Frequency (Hz)	Wavelength (cm)	Wave Speed (cm/s)
1.				
2.				

Form a Hypothesis

9. Form a hypothesis about the relationship between frequency and wavelength.

_____

_____

Test Your Hypothesis

10. Choose a frequency that you did not use during **Make Observations.** Predict the wavelength for a wave with this frequency.

_____

11. Practice making a wave on the spring toy with your chosen frequency. Repeat steps 4–7 for this wave. Did your prediction of wavelength support your hypothesis? If not, revise your hypothesis and repeat steps 4–7.

_____

Lab Tips

- Keep the amplitude constant by moving the same distance on the *y*-axis in each vibration.
- Twenty vibrations in 10 s make a wave with a frequency of 2 Hz.

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Lab B continued

Analyze and Conclude

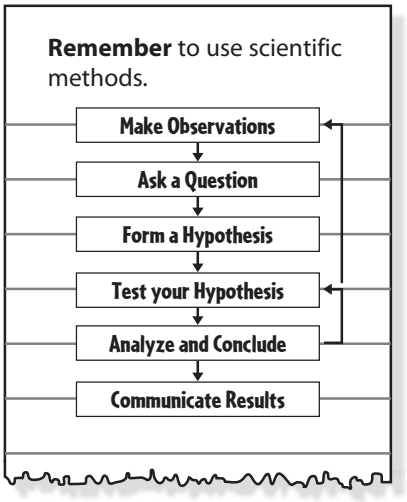
12. Conclude How did your prediction of wavelength compare to your measurement?

13. Think Critically What measurements were the most difficult to make accurately? Suggest ways to improve on the method.

14. The Big Idea How did the wavelength, frequency, and wave speed change for the different waves that you created?

Communicate Your Results

Write a report explaining the steps you took in this lab. Include a table of the measurements you made. Be sure to describe sources of error in your measurements and ways that you might improve the accuracy of your experiment.



Inquiry Extension

Try measuring the wave speed of other waves. Try stretching your spring toy to different lengths or try measuring the wave speed of longitudinal waves. You also might try working with ropes of different thicknesses, different spring toys, or even water in a wave tank.