Chapter 6 Review

Understanding Concepts

1. Classify the following examples as transverse, longitudinal, or torsional vibrations.
   (a) A ball attached to a spring is bouncing up and down.
   (b) An agitator moves in an upright washing machine.
   (c) A child swings on a swing.
   (d) A child sits on a swing with the ropes twisted, so the child is spinning as the ropes are unwinding.
2. The mass of a pendulum moves a total horizontal distance of 14 cm in one cycle. What is the amplitude of the vibration?
3. A Canada goose flaps its wings 16 times in 21 s. What is the frequency and period of the wing beat?
4. The world record for pogo jumping is 122 000 times in 15 h 26 min.
   (a) What type of vibration is occurring in the spring of the pogo stick?
   (b) Calculate the average period of vibration.
   (c) Calculate the average frequency of vibration.
5. Points A, B, C, D, and E are marked on a stretched rope (**Figure 1**). Pulses X and Y have the same shape and size, and travel through this rope at the same speed.
   (a) Which point(s) would have an instantaneous upward motion if both pulses moved to the right?
   (b) Which point(s) would have an instantaneous downward motion if pulse X moved to the right as pulse Y moved to the left?
   (c) Which point(s) would have no motion, provided the pulses moved in opposite directions?

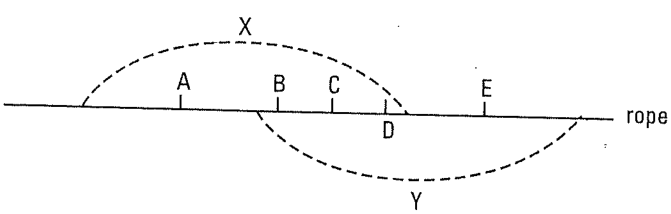

Figure 1

6. A sonar signal (sound wave) of 5.0×10^2 Hz travels through water with a wavelength of 3.0 m. What is the speed of the signal in water?
7. Water waves with a wavelength of 6.0 m approach a lighthouse at 5.6 m/s.
   (a) What is the frequency of the waves?
   (b) What is their period?
8. The distance between successive crests in a series of water waves is 5.0 m; the crests travel 8.6 m in 5.0 s. Calculate the frequency of a block of wood bobbing up and down in the water.
9. Two people are fishing from small boats located 28 m apart. Waves pass through the water, and each person's boat bobs up and down 15 times in 1.0 min. At a time when one boat is on a crest, the other one is in a trough, and there is one crest between the two boats. What is the speed of the waves?
10. The wavelength of a water wave is 3.7 m and its period is 1.5 s.
    (a) What is the speed of the wave?
    (b) What is the time required for the wave to travel 1.0×10^2 m?
    (c) What is the distance travelled by the wave in 1.00 min?
11. A boat at anchor is rocked by waves whose crests are 32 m apart and whose speed is 8.0 m/s. What is the interval of time between crests striking the boat?
12. The wavelength of a water wave is 8.0 m and its speed is 2.0 m/s. How many waves will pass a fixed point in the water in 1.0 min?
13. When a car moves at a certain speed, there is an annoying rattle. If the driver speeds up or slows down slightly, the rattle disappears. Explain.
14. A 6.0-m rope is used to produce standing waves. Draw a scale diagram of the standing wave pattern produced by waves having a wavelength of
    (a) 12 m (b) 6.0 m (c) 3.0 m
15. Standing waves are produced in a string by sources at each end with a frequency of 10.0 Hz. The distance between the third node and the sixth node is 54 cm.
    (a) What is the wavelength of the interfering waves?
    (b) What is their speed?
16. You send a pulse down a spring that is attached to a second spring with unknown properties. The positive pulse returns to you as a positive pulse, but with a smaller amplitude. Is the speed of the waves faster or slower in the second string? Explain your reasoning.
17. When a stone is dropped into water, the resulting ripples spread farther and farther out, getting smaller and smaller in amplitude until they disappear. Why does the amplitude eventually decrease to zero?
18. When standing waves are produced in a string, total destructive interference occurs at the nodes. What has happened to the wave energy?

19. Each diagram in **Figure 2** shows an incident pulse travelling toward one end of a rope. Draw a diagram showing the reflected pulse in each case.

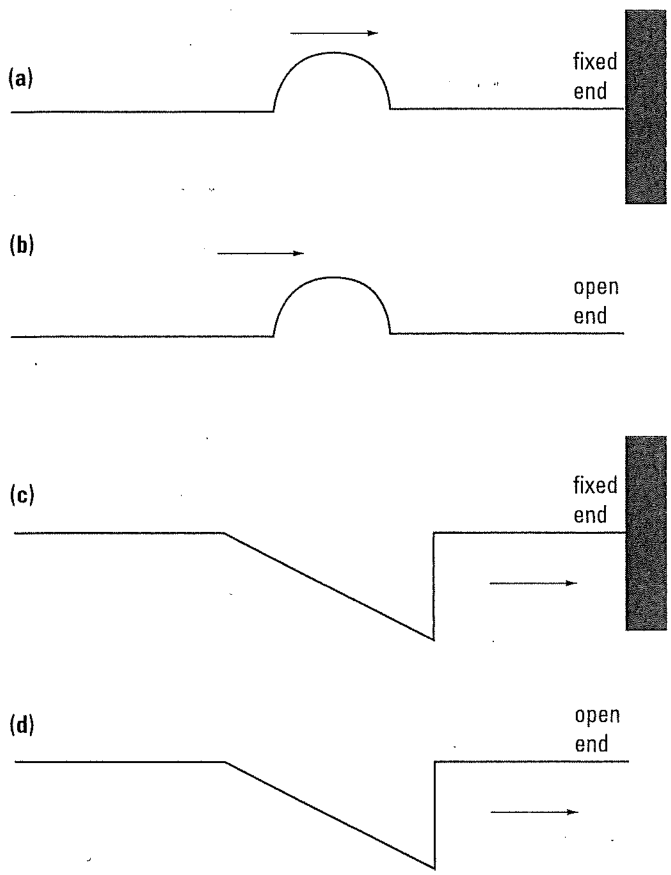

Figure 2

20. Apply the principle of superposition to draw the resultant shape when each of the sets of pulses shown in **Figure 3** interferes. (Draw the diagrams so that the horizontal midpoints of the pulses coincide.)

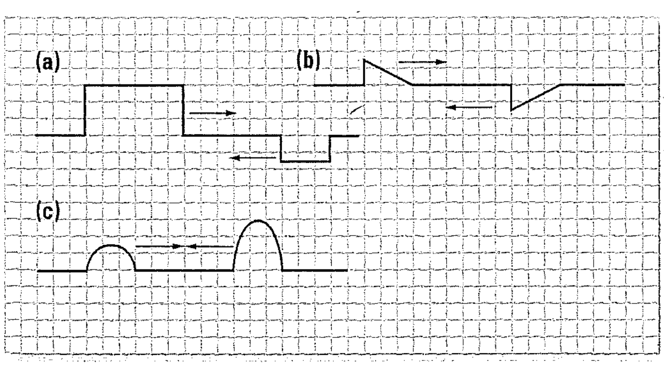

Figure 3

Applying Inquiry Skills

21. Draw a diagram illustrating structural features an offshore oil-drilling platform might possess to withstand very high waves.

Making Connections

22. A tsunami is a fast-moving surface wave that travels on an ocean after an underwater earthquake or volcanic eruption. In the deep ocean the wavelength might be over 250 km, the amplitude only about 5 m, and the speed up to 800 km/h. The wave might pass under a ship and not even be noticed, but it can strike a shore with an amplitude of perhaps 30 m and do severe damage. How is it possible that a wave that is seemingly harmless at sea can do such damage onshore?

23. The energy of earthquakes is transmitted by waves that are both longitudinal and transverse. Only one of these types of waves travels in the interior of Earth. Do some research to answer the following questions. Follow the links for Nelson Physics 11, Chapter 6 Review.
    (a) Which type of wave is it?
    (b) Why is this type of wave the only one that travels in the interior of Earth?

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24. Find out the frequency at which your favourite local television station broadcasts its signal. If the speed of the electromagnetic waves emitted by the station tower is 3.0×10^8 m/s, what is the wavelength of the waves?

Exploring

25. Prepare a written report explaining why the development of the pendulum was a scientific landmark. Follow the links for Nelson Physics 11, Chapter 6 Review.

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26. At the 2000 Summer Olympics in Sydney, Australia, the construction of the swimming pool and the lane ropes led to less water turbulence for the swimmers, improving their times. Find out what changes were made and why they reduced turbulence. Follow the links for Nelson Physics 11, Chapter 6 Review. Summarize your findings in a report with a maximum length of 200 words.

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