Name: _____   Date: _____

Waves

20.1

READ

A **wave** is a traveling oscillator that carries energy from one place to another. A high point of a wave is called a **crest**. A low point is called a **trough**. The amplitude of a wave is half the distance from a crest to a trough. The distance from one crest to the next is called the **wavelength**. Wavelength can also be measured from trough to trough or from any point on the wave to the next place where that point occurs.
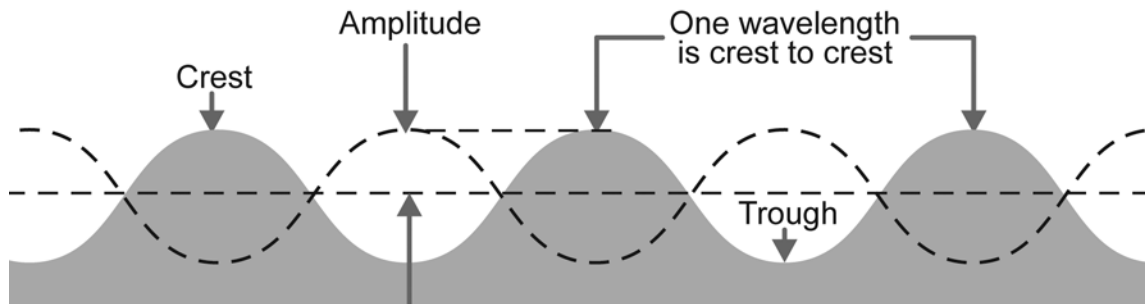
The speed of a wave

Speed (m/sec) → $v = f \lambda$ ← Frequency (hertz), Wavelength (meters)

EXAMPLE ▶

The frequency of a wave is 40 Hz and its speed is 100 meters per second. What is the wavelength of this wave?

| Given	Solution
Frequency = 40 Hz; Speed = 100 m/sec	$\dfrac{100 \text{ m/sec}}{40 \text{ Hz}} = \dfrac{100 \text{ m/sec}}{40 \text{ cycles/sec}} = \text{Wavelength}$
Looking for	
The wavelength	2.5 meters = Wavelength
Relationships	
Speed = Frequency × Wavelength, therefore	The wavelength of this wave is 2.5 meters.
Speed ÷ Frequency = Wavelength	

PRACTICE ▶

1. On the graphic at right label the following parts of a wave: one wavelength, half of a wavelength, the amplitude, a crest, and a trough.

    a. How many wavelengths are represented in the wave above?

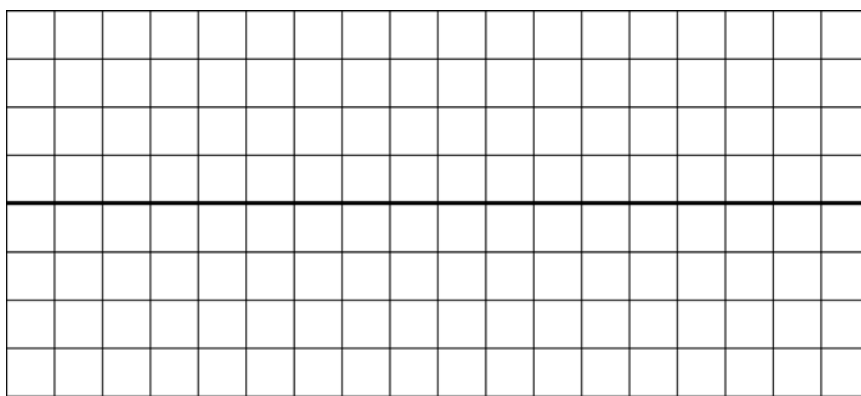   b. What is the amplitude of the wave shown above?
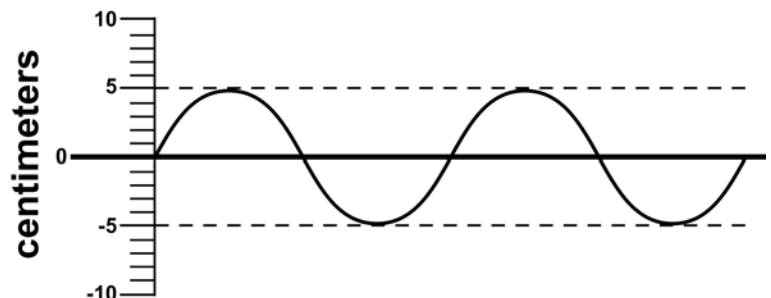
2. Use the grids below to draw the following waves. Be sure to label the *y*-axis to indicate the measurement scale.

   a. A wave with an amplitude of 1 cm and a wavelength of 2 cm
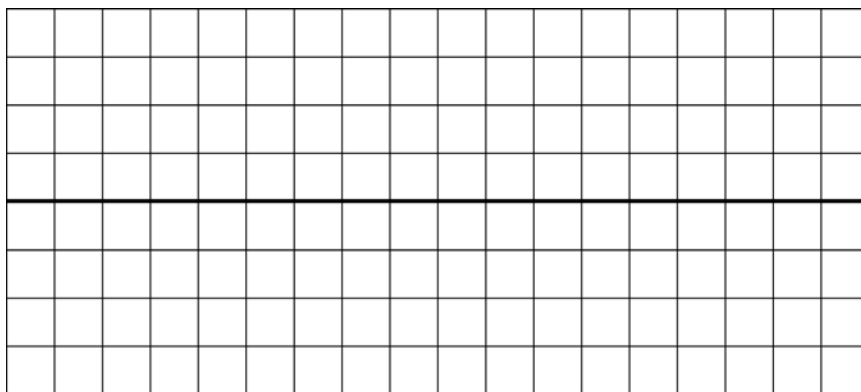
    b. A wave with an amplitude of 1.5 cm and a wavelength of 3 cm

3. A water wave has a frequency of 2 hertz and a wavelength of 5 meters. Calculate its speed.

4. A wave has a speed of 50 m/sec and a frequency of 10 Hz. Calculate its wavelength.

5. A wave has a speed of 30 m/sec and a wavelength of 3 meters. Calculate its frequency.

6. A wave has a period of 2 seconds and a wavelength of 4 meters.Calculate its frequency and speed.
   Note: Recall that the frequency of a wave equals 1/period and the period of a wave equals 1/frequency.

7. A sound wave travels at 330 m/sec and has a wavelength of 2 meters. Calculate its frequency and period.

8. The frequency of wave A is 250 hertz and the wavelength is 30 centimeters. The frequency of wave B is 260 hertz and the wavelength is 25 centimeters. Which is the faster wave?

9. The period of a wave is equal to the time it takes for one wavelength to pass by a fixed point. You stand on a pier watching water waves and see 10 wavelengths pass by in a time of 40 seconds.

    a. What is the period of the water waves?

    b. What is the frequency of the water waves?

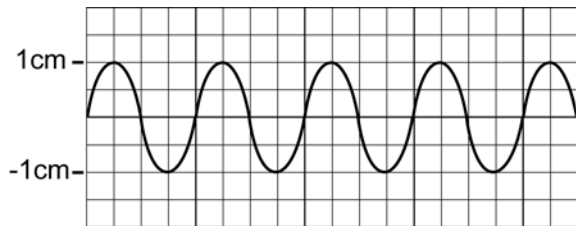   c. If the wavelength is 3 meters, what is the wave speed?
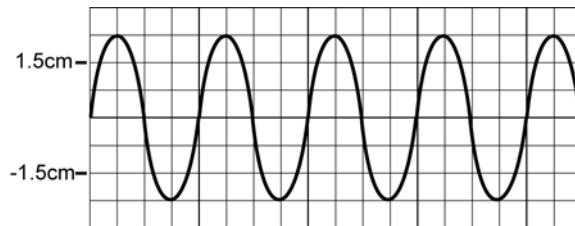
20.1 Waves

1. Diagram:
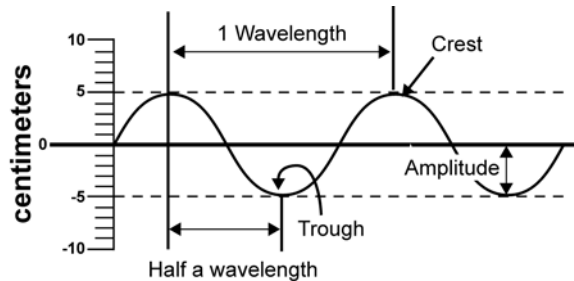
a. Two wavelengths
b. The amplitude of a wave is the distance that the wave moves beyond the average point of its motion. In the graphic, the amplitude of the wave is 5 centimeters.

2. Answers are:
   a. Diagram:

   b. Diagram:

3. 10 m/sec
4. 5 m
5. 10 Hz
6. frequency = 0.5 Hz; speed = 2 m/sec
7. frequency = 165 Hz; period = 0.006 sec
8. A's speed is 75 m/sec, and B's speed is 65 m/sec, so A is faster.
9. Answers are:
   a. 4 sec
   b. 0.25 Hz
   c. 0.75 m/sec