WAVES

Physics

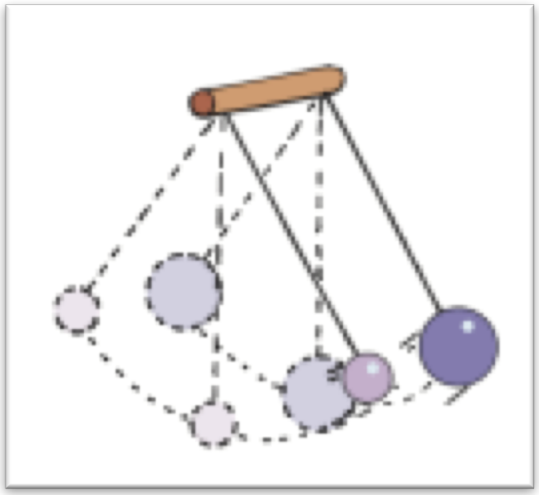
Waves

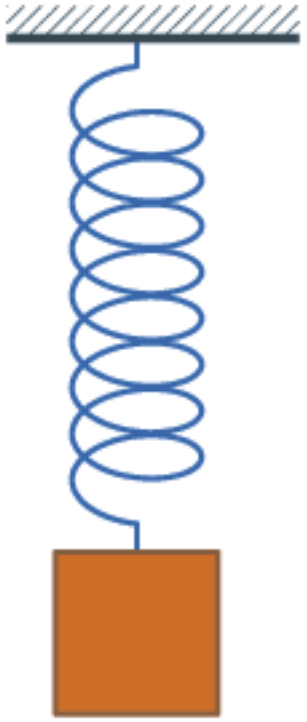
Waves transmit ENERGY from one place to another.

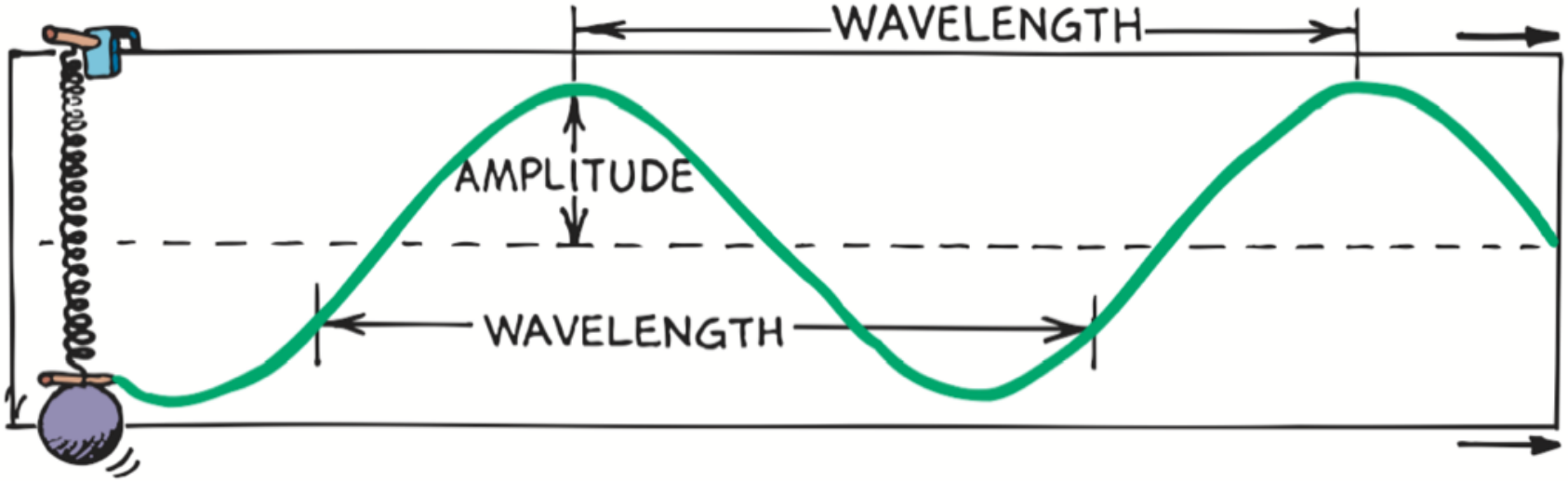
- The source of all waves is something that <u>vibrates.</u>

Simple Harmonic Motion

- Simple Harmonic Motion (SHM) – Back and forth oscillatory motion.
- Ex: Pendulums, Springs
- Motion looks like a sine curve.







- **Crest –** high point on a wave
- **Trough –** low point on a wave
- **Amplitude (A) –** the distance from the midpoint to the crest.
  - The amplitude of a wave is a measure of how much **energy** it carries.
- **Wavelength (λ)–** the distance from the top of one crest to the top of the next one (or between successive identical parts of the wave)

Frequency and Period

- **Frequency (f)–** number of vibrations an object makes per second
  - Units = Hertz (Hz = cycle/second)
- **Period (T) –** number of seconds it takes to go through one vibration
  - Units = seconds
- Frequency (f) and period (T) are reciprocals of each other.
- **Ex:** If the frequency of a wave is 4 Hz, what is its period?

$$f = \frac{1}{T}$$

$$T = \frac{1}{f}$$

Wave Motion

- Most of the information around us gets to us in some form of wave.
- Sound is energy that travels to our ears in the form of one kind of wave.
- Light is energy that comes to our eyes in the form of a different kind of wave.
- The signals that reach our radios and TVs also travel as waves.

Wave Motion

- When energy is transferred by a wave from a vibrating source to a distant receiver, there is *no* transfer of matter between the two points!
- The energy transferred from a vibrating source to a receiver is carried by a *disturbance* in a medium, not by matter moving from one place to another within the medium.

A circular water wave in a still pond moves out from the center in an expanding circle.

Wave Speed

- The speed of a wave depends on the medium through which it travels.
- Whatever the medium, the speed, wavelength, and frequency of the wave are related

Wave speed = wavelength X frequency

$$v = \lambda \times f$$

[m/s] = [m] x [Hz]

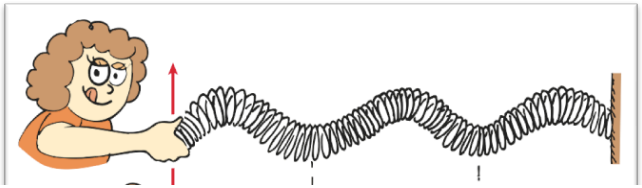
$$v = \lambda \times f$$

- Complete the following table:

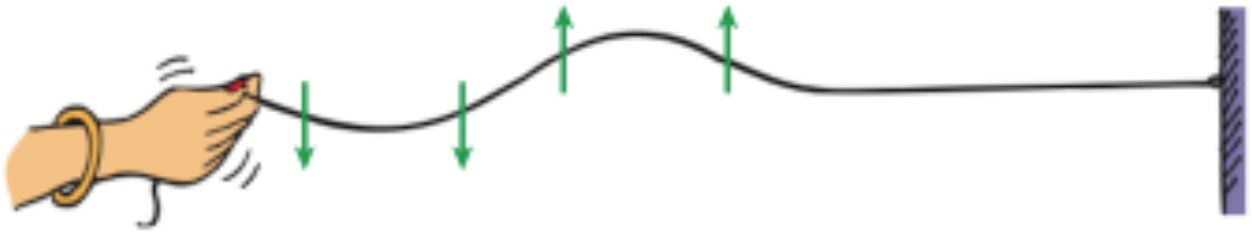
Table 25.1 Sound Waves

Wavelength (m)	Frequency (Hz)	Wave Speed (m/s)
2.13	160	
1.29		340
	396	340
0.64	528	

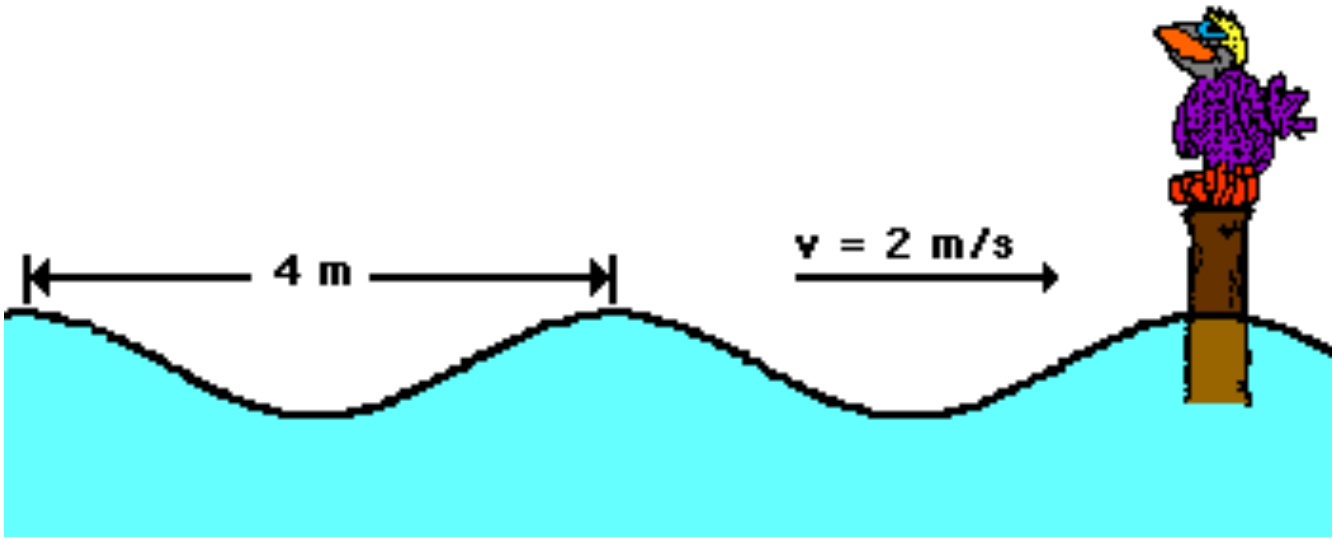
Transverse Waves

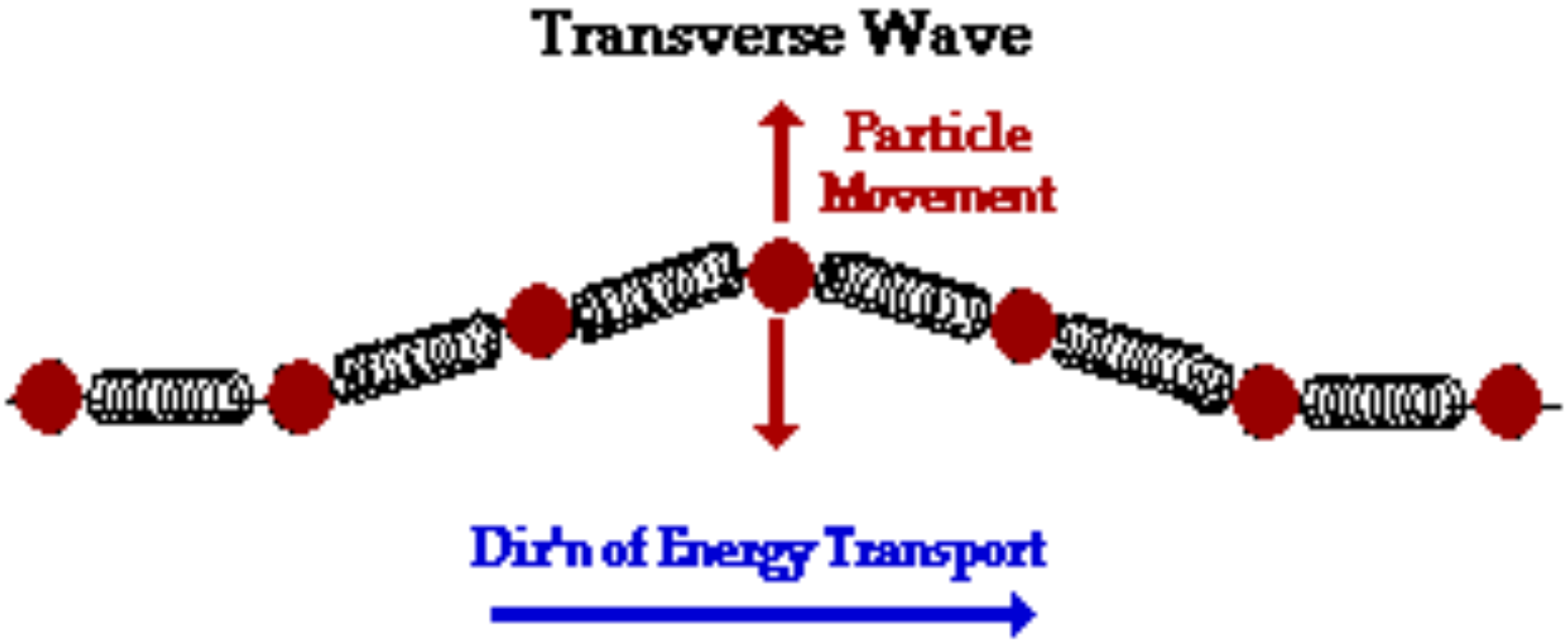


- **Transverse Waves –** the motion of the medium is at right angles to the direction in which the wave travels
- Examples: stretched strings in musical instruments, waves on surfaces of liquids, radio waves, light waves, and s-waves (earthquakes)



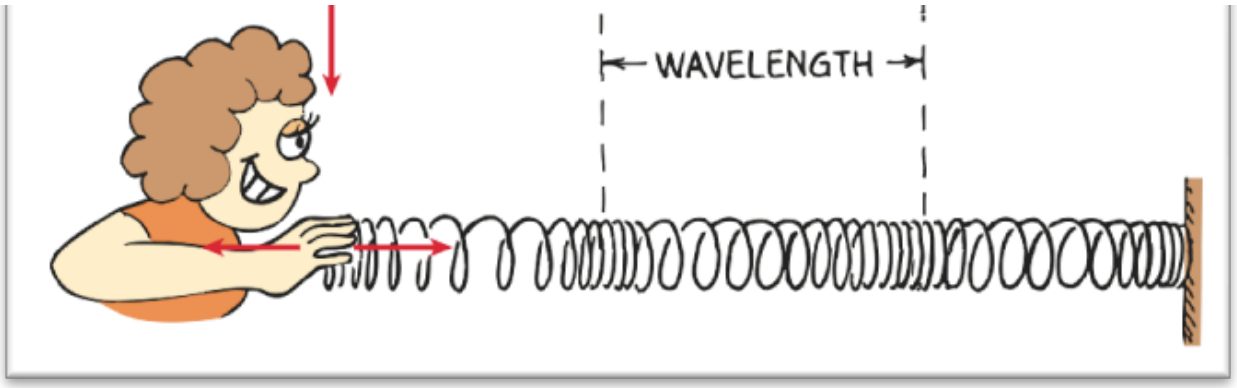
Ex: The water waves below are traveling with a speed of 2 m/s and splashing periodically against the Wilbert's perch. Each adjacent crest is 4 meters apart and splashes Wilbert's feet upon reaching his perch. How much time passes between each successive drenching?

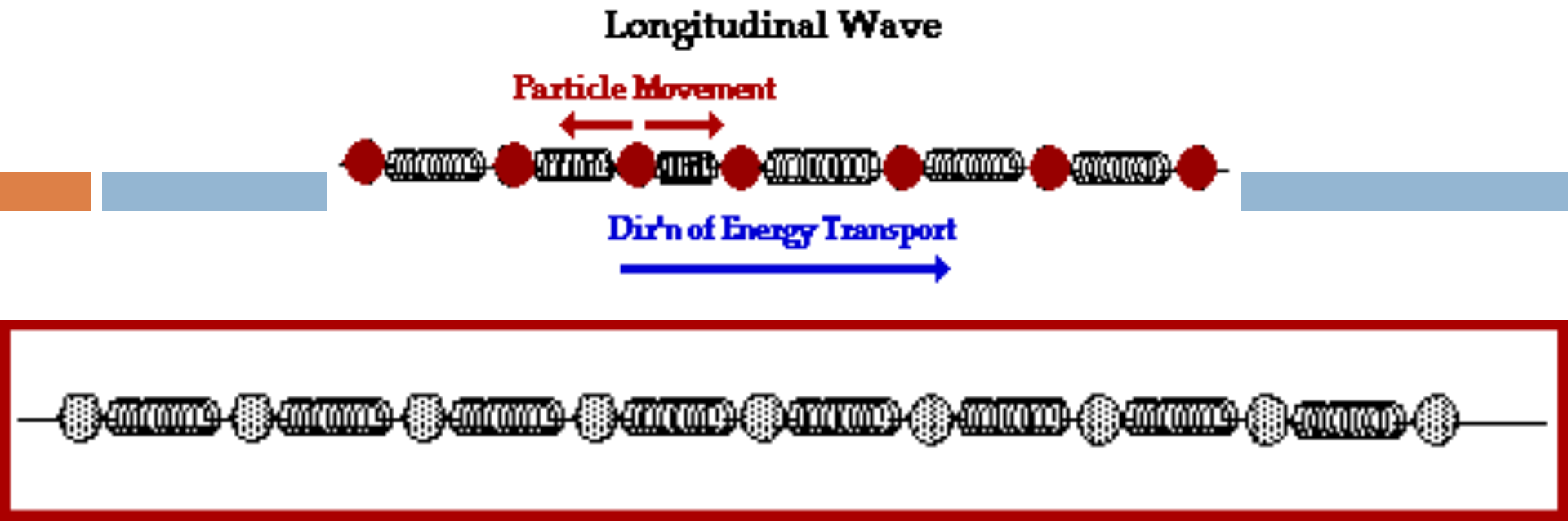



Transverse Wave
Particle Movement
Dir'n of Energy Transport

Longitudinal Waves

- **Longitudinal Waves –** particles move along the direction of the wave
- Examples: sound waves and p-waves (earthquakes)





Ex: A hiker shouts towards a vertical cliff 800 m away. The echo is heard 2.33 s later. What is the speed of the hiker's voice in air?