STUDY GUIDE

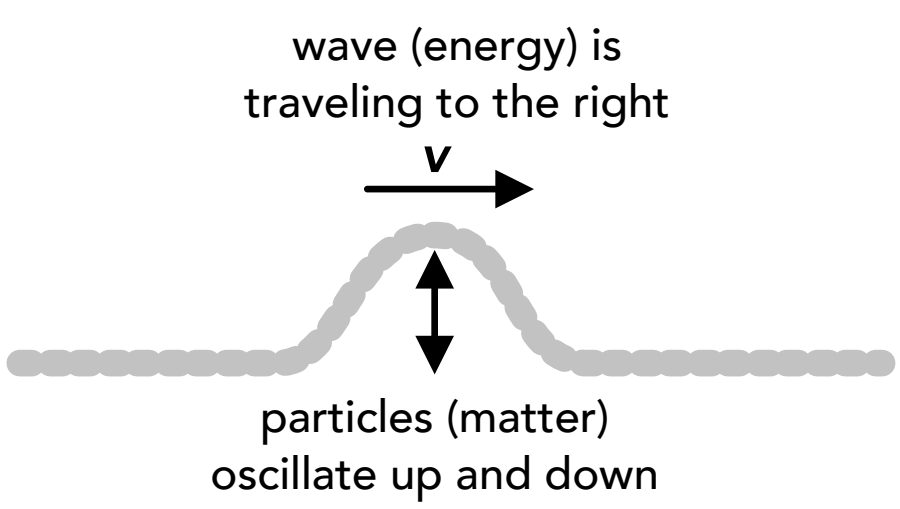
WAVES

Waves

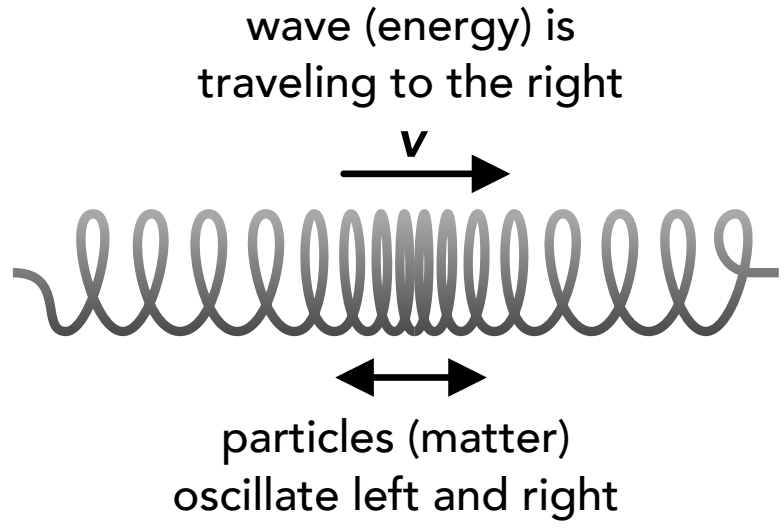
- There are many different types of waves which behave in different ways, but they all share similar characteristics.
- All waves carry or transport energy, and some waves also carry matter.
- **Transverse waves** are waves where the physical material moves **perpendicular** to the direction of the wave. If the wave is traveling to the right, the particles in the medium move up and down. Examples include water waves and waves traveling in a string.
- **Longitudinal waves** are waves where the physical material moves **parallel** to the direction of the wave. The particles in the medium do not travel with the wave, they just oscillate back forth within a small distance. Examples include sound waves and longitudinal waves traveling in a spring.

Variables		SI Unit
λ	wavelength	m
T	period	s
f	frequency	$\text{Hz} = \frac{\text{cycles}}{\text{s}}$
A	amplitude	m, ...
v	velocity	$\frac{\text{m}}{\text{s}}$

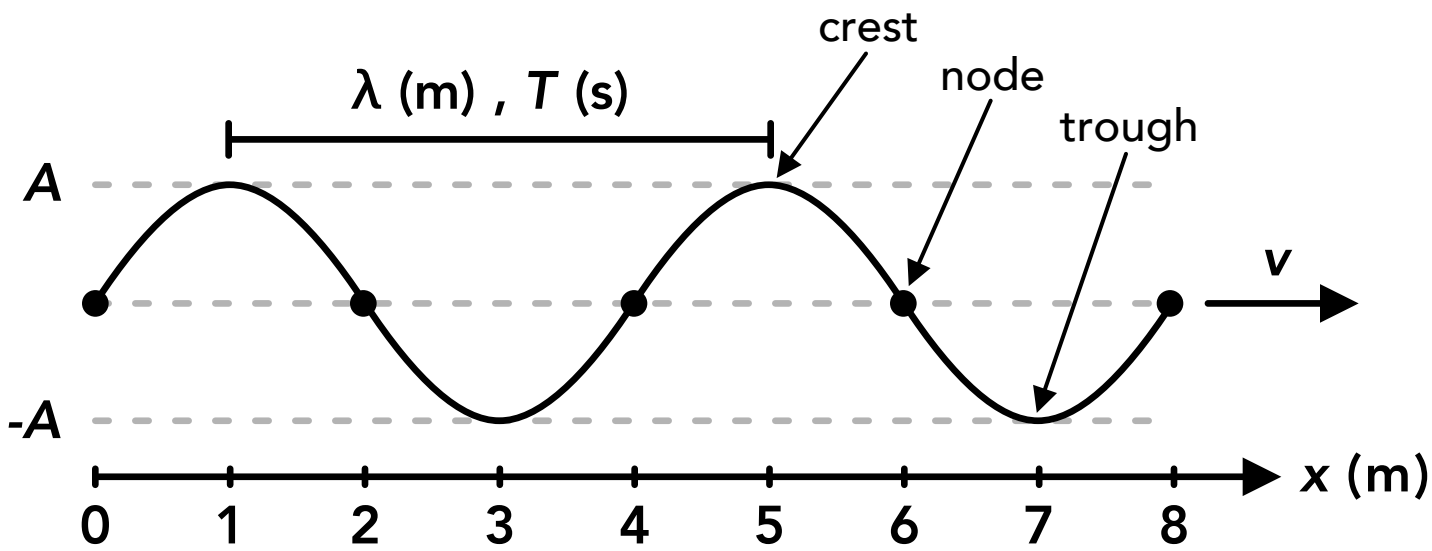
Transverse wave



Longitudinal wave

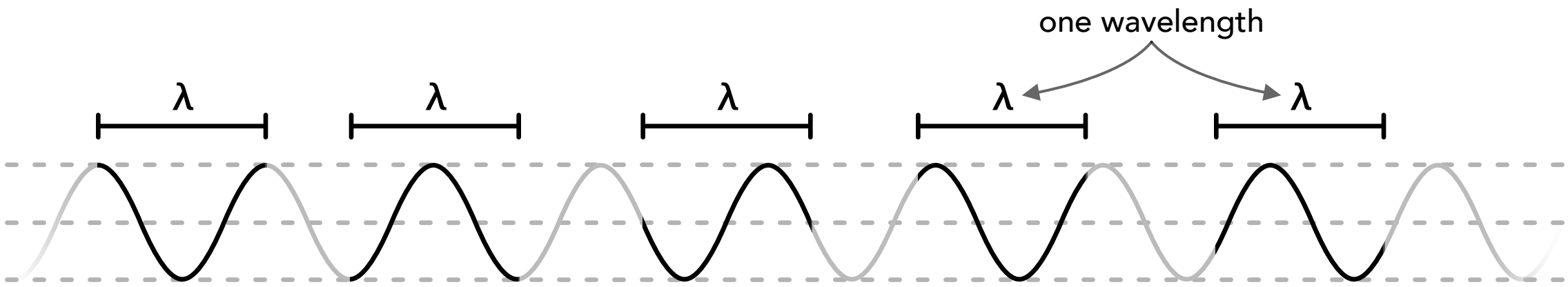


- A **crest** is the upper amplitude of a visual wave or graph of a wave. This is also an antinode.
- A **trough** is the lower amplitude of a visual wave or graph of a wave. This is also an antinode.
- A **node** is a point where the wave is at the center or equilibrium position.
- The **wavelength** is the length of a section that repeats and is easiest to measure as the distance between crests, the distance between troughs, or 3 nodes across.
- The **period** is the amount of time it takes the wave to travel one wavelength.
- The **wave speed** is the speed that the wave (energy) travels and is equal to the wavelength divided by the period.

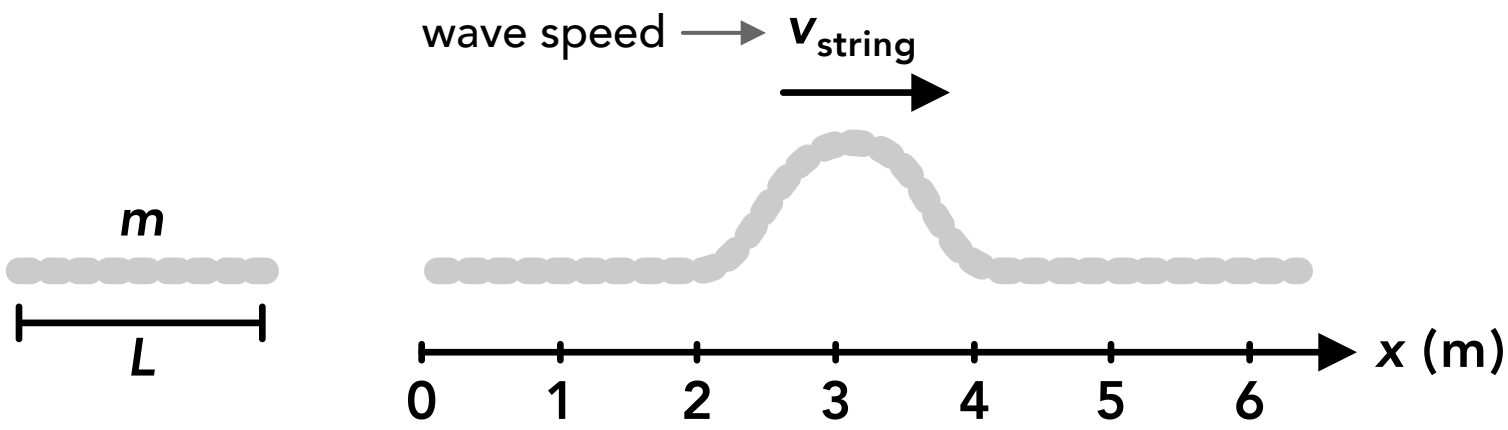


Wave speed

$$v = \lambda f = \frac{\lambda}{T}$$



- If a wave is traveling on a string, the wave speed depends on the tension in the string and the linear mass density of the string (the mass per unit length).



Linear density

$$\mu = \frac{m}{L}$$

Speed of a wave in a string

$$v_{string} = \sqrt{\frac{T_s}{\mu}}$$

Variables		SI Unit
μ	linear density	$\frac{kg}{m}$
m	mass	kg
L	length	m
T_s	string tension	N
v	velocity	$\frac{m}{s}$