

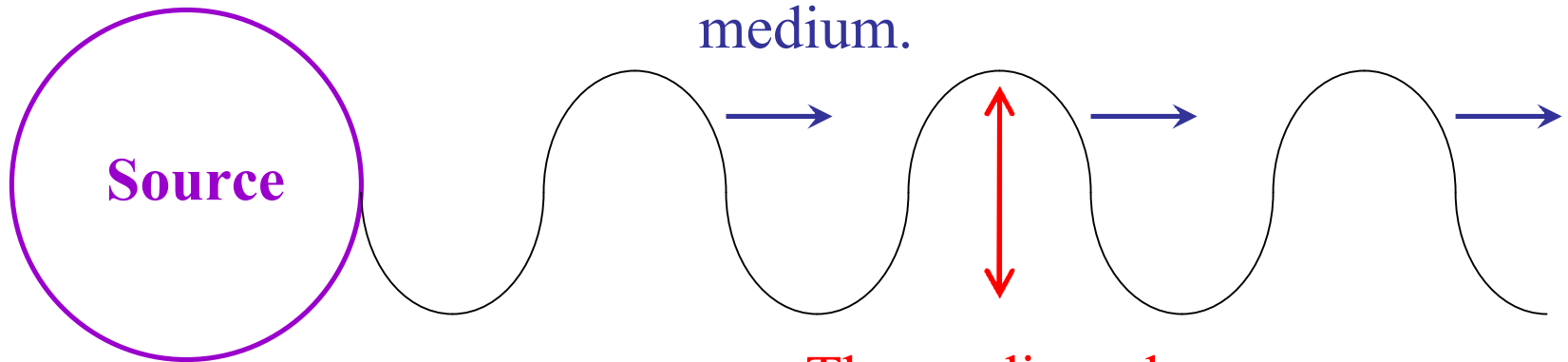
Waves

- I. Definitions and Types
- II. Parameters and Equations
- III. Sound
- IV. Light (EMR)
- V. Graphs of Waves

A **wave** is a disturbance propagating through a medium.

- Whatever it is that is being disturbed is called the **medium**.
- A **disturbance** is a change in the equilibrium state of the medium.
- **Propagation** implies that the wave is “self sustaining” and that the pattern of disturbance is reproduced at progressive points through the medium.
- All waves involve the transfer of energy and require a **source** that initiates the wave and supplies energy to the medium.

The source causes a disturbance in the medium.



The disturbance travels through the medium.

The source supplies energy to the medium. This energy is “transported” by the wave.

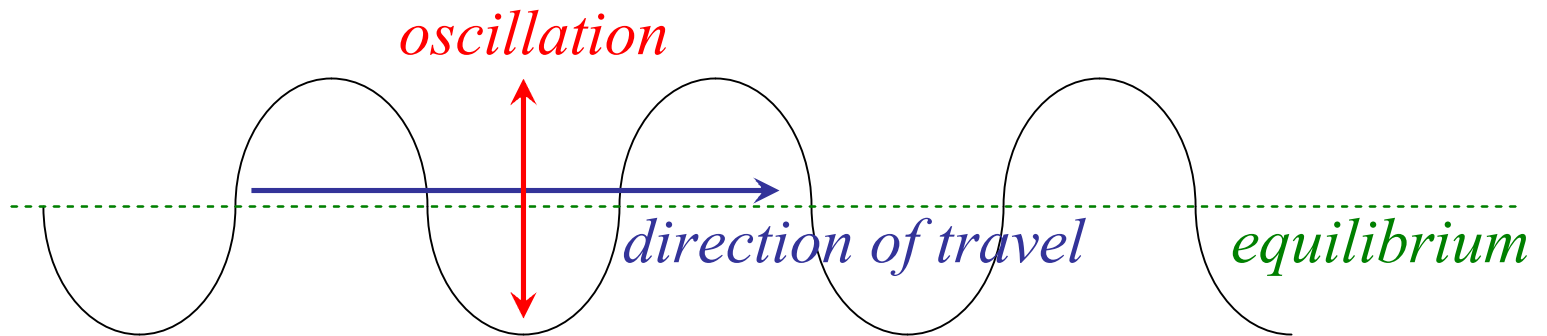
The medium does not travel with the wave but rather it oscillates about a fixed point.

Wave Types

- There are many different types of waves, characterized by the way in which the medium is disturbed from its equilibrium state.
- Three common types are: transverse waves, longitudinal waves, and surface waves.

Transverse Waves

In a **transverse wave** the oscillation of the medium is perpendicular to the direction the wave travels.

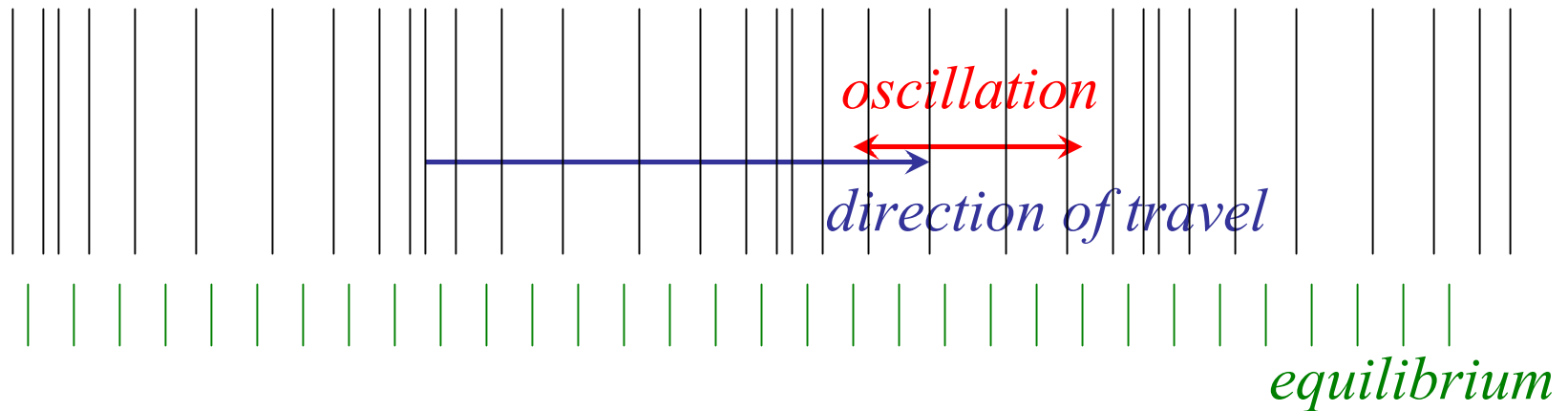


Crest = upward or positive displacement or change of the medium

Trough = downward or negative displacement or change of medium

Longitudinal Waves

In a **longitudinal wave** the oscillation of the medium is parallel to the direction the wave travels.

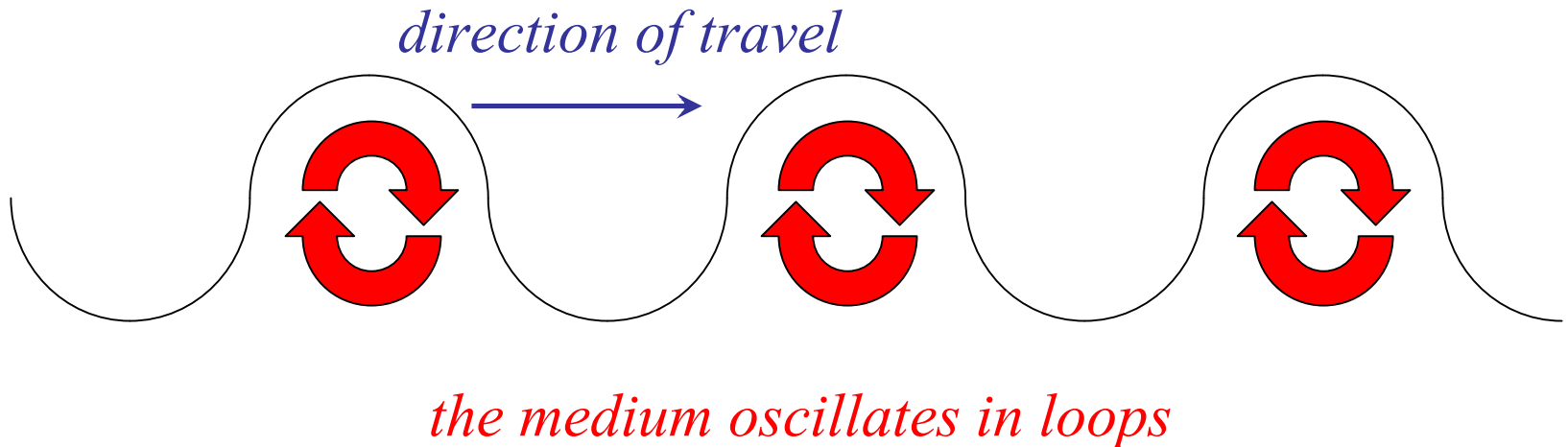


Compression = medium is more tightly spaced than normal

Rarefaction = medium is less tightly spaced than normal

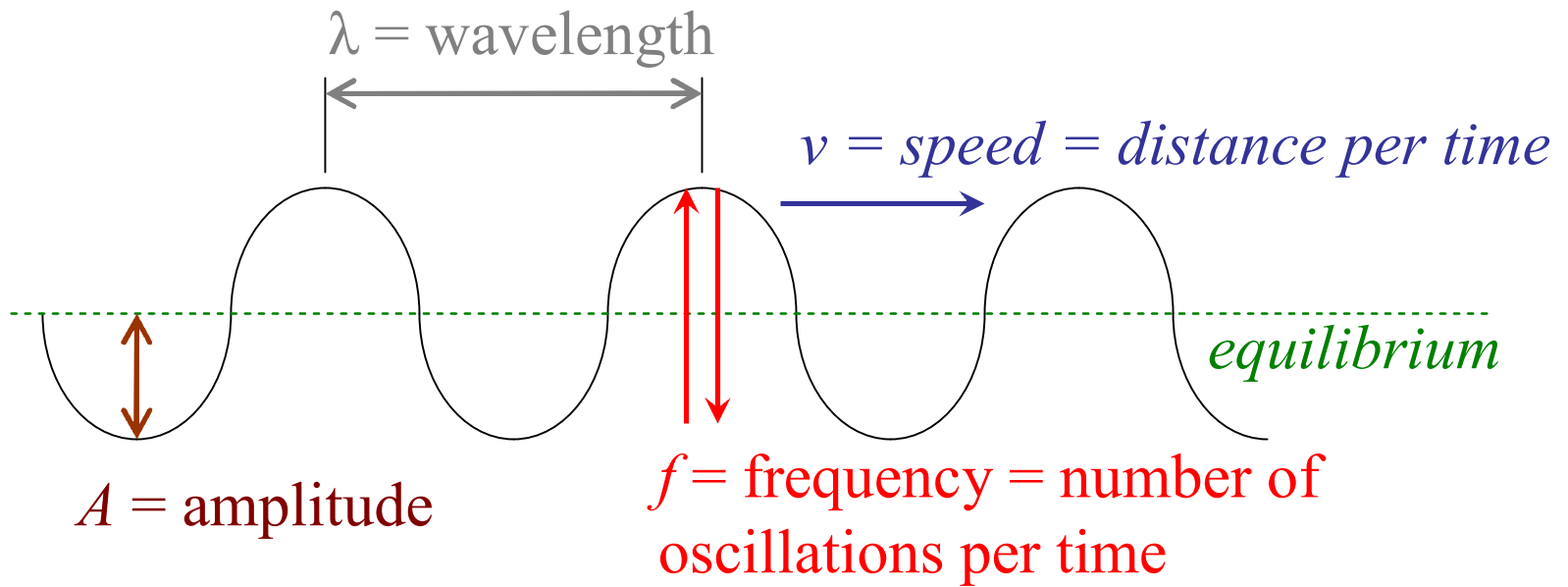
Surface Waves

A **surface wave** occurs along a surface (boundary) between two different mediums and involves both transverse and longitudinal actions.



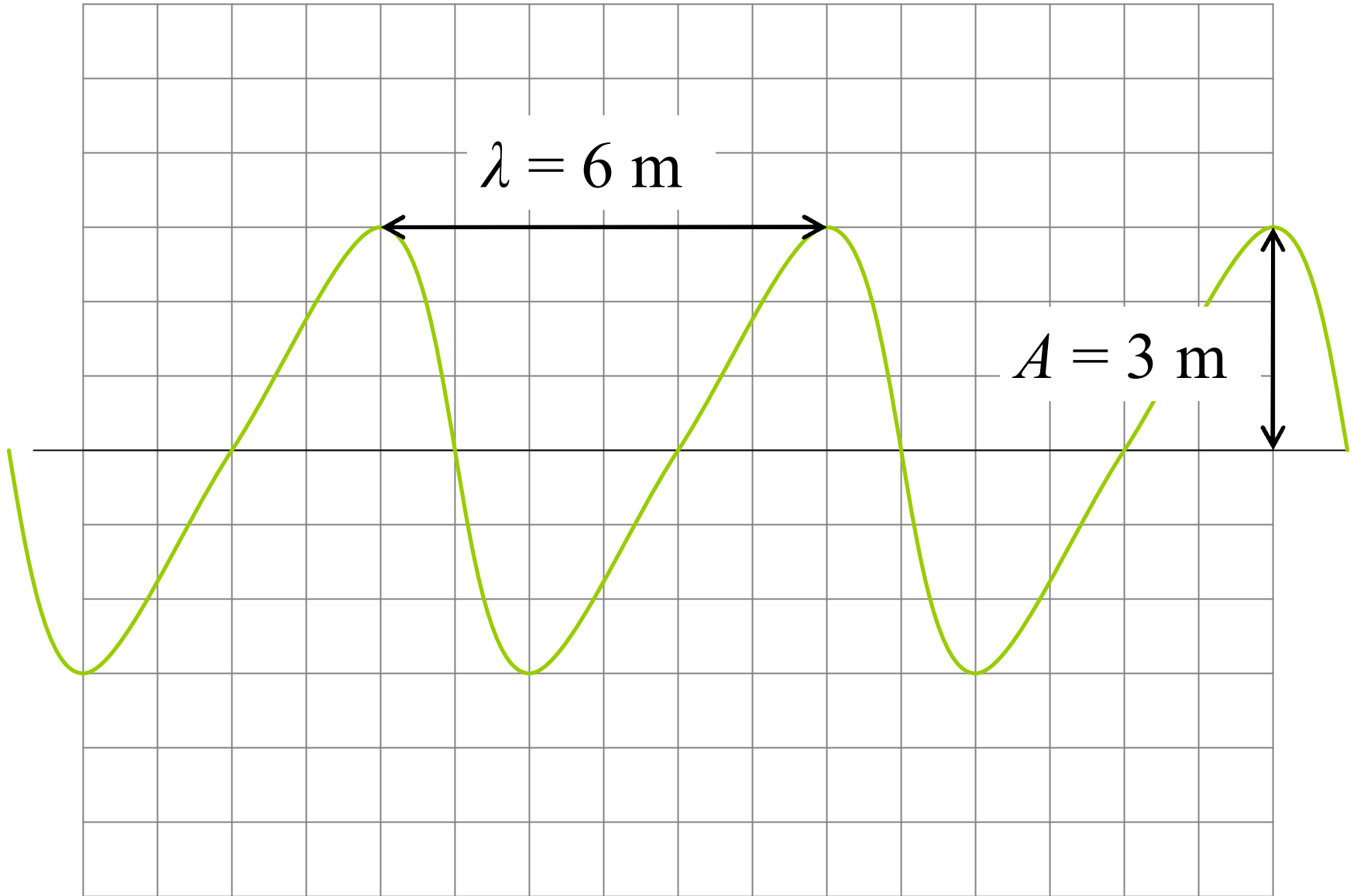
Wave Parameters

- The **speed** of a wave is the rate at which the disturbance travels through the medium.
- The **amplitude** is the maximum level of disturbance, measured from equilibrium.
- **Period** is the time for one complete cycle.
- **Frequency** is the number of cycles per unit time.
- **Wavelength** is the length of one complete cycle (measured along a line parallel to the direction of wave travel)



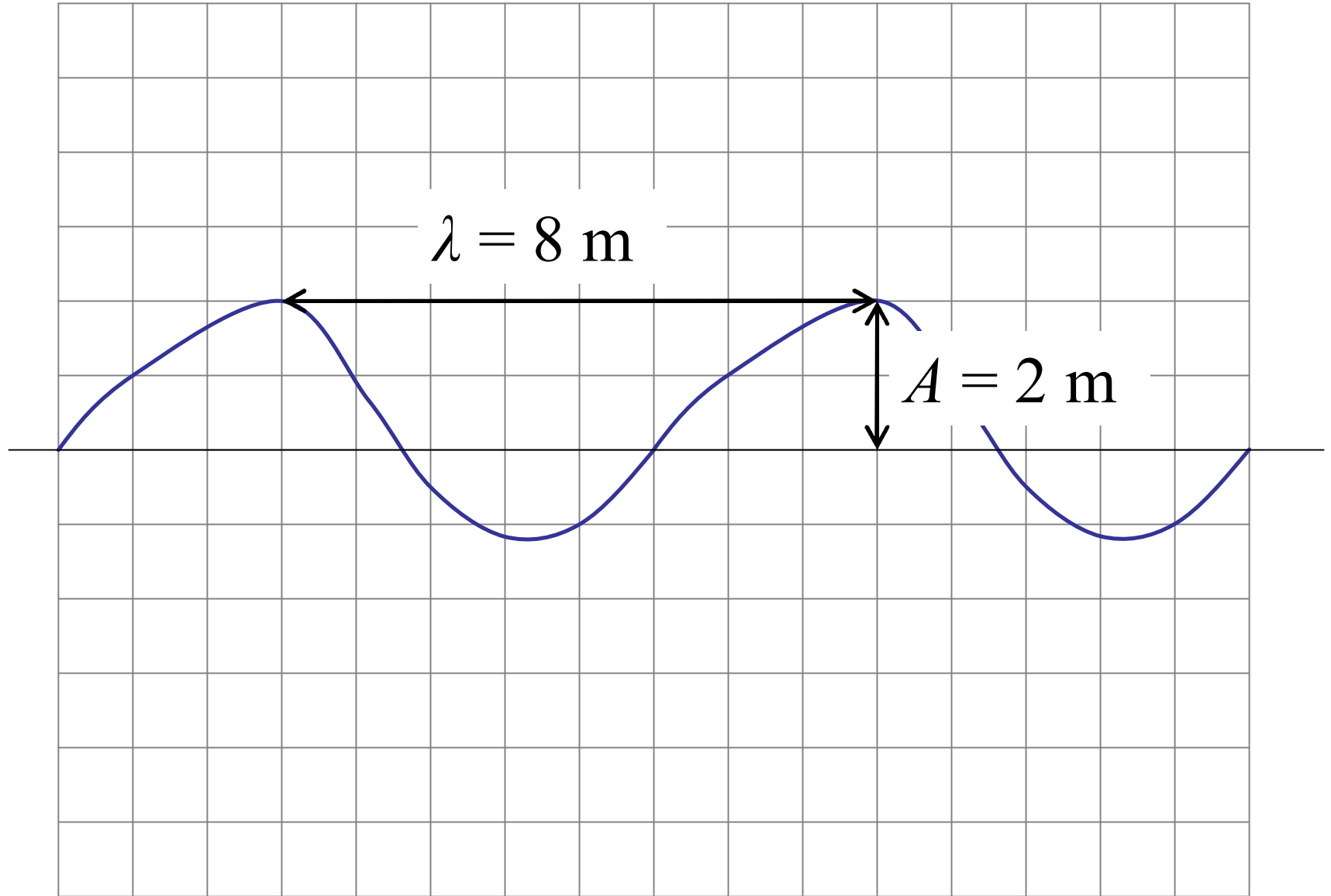
$$v = f \cdot \lambda$$

Find wavelength and amplitude.



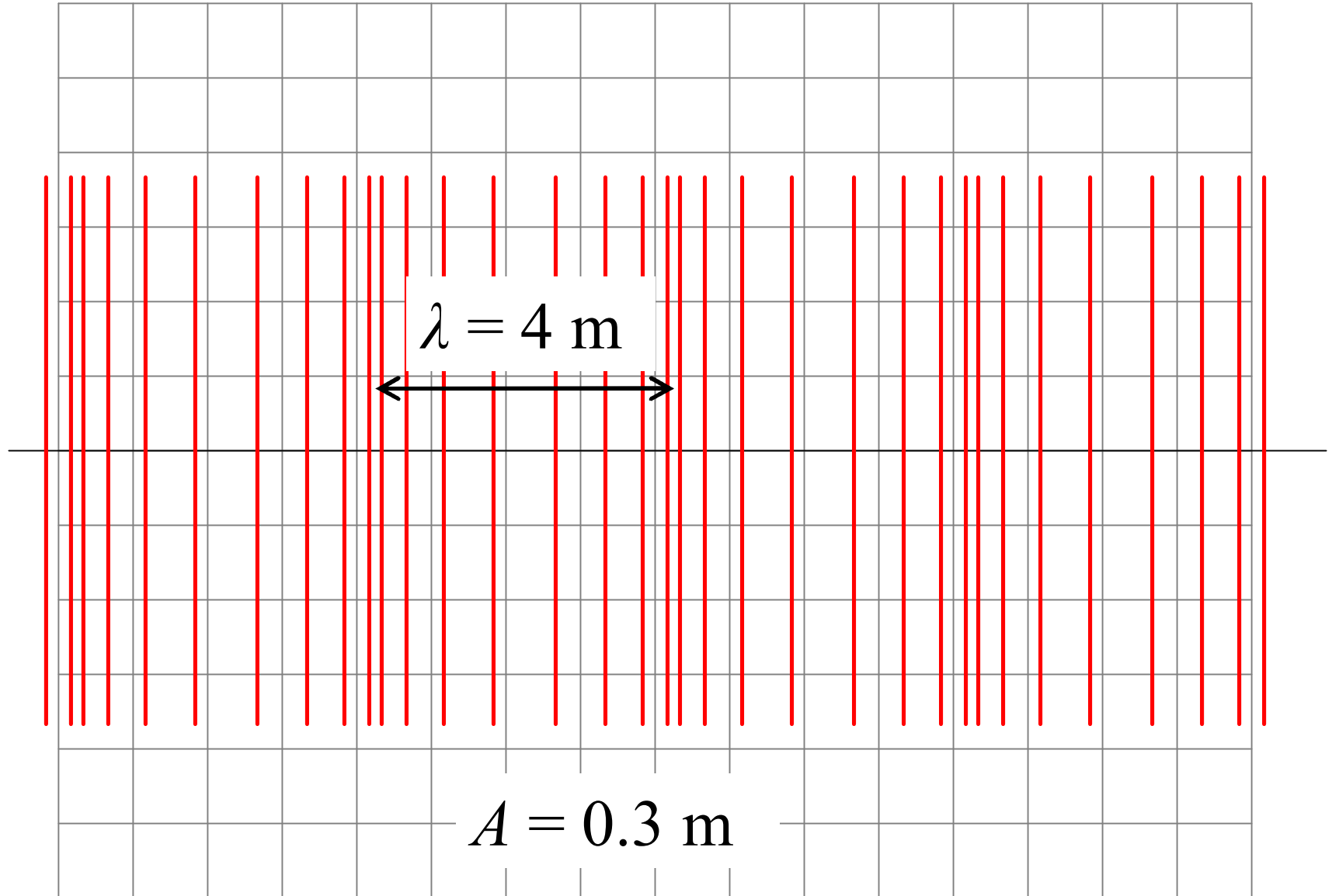
Scale: each square is 1 meter wide.

Find wavelength and amplitude.



Scale: each square is 1 meter wide.

Find wavelength and amplitude.



Scale: each square is 1 meter wide.

Source vs. Medium

- The source of a wave has no effect on the speed of the wave.
- The speed is determined by the properties of the medium.
- The medium of the wave has no effect on its frequency or period.
- The frequency and period of a wave are determined by (and equal) the frequency and period of the source.
- Wavelength is determined by speed (medium) and frequency (source) so that: $v = f \lambda$.