Waves

Traveling energy

What is a wave?

A **wave** is a disturbance that carries energy through matter or space

Most waves are produced by **vibrating objects**

The more energy present the larger the wave

Waves travel isotropically…

All this means is that it travels in a spherical shape away from its origin point.

There are 2 types of waves: Electromagnetic and Mechanical

Mechanical Waves

Require a medium

Medium: a physical environment in which phenomena (like waves) occur; matter through which waves travel.

They can either travel as transverse waves or longitudinal waves

Examples: Sound

Water

Mechanical Waves

The medium matters for mechanical waves:

Sound will travel 3-4 times faster in water than air and

15-20 times faster in rock or metal than air

The particles of water and solids are more densely packed, allowing the sound waves to travel faster

Electromagnetic Waves

A wave consisting of changing electric and magnetic fields in space.

They do not require a medium

Travel in transverse waves

Examples: Visible Light

Radio waves

Wave Definitions

Crest: The highest attainable point of a wave

Trough: The lowest attainable point of a wave

Amplitude(A): The distance from the equilibrium of a wave (to the crest or trough)

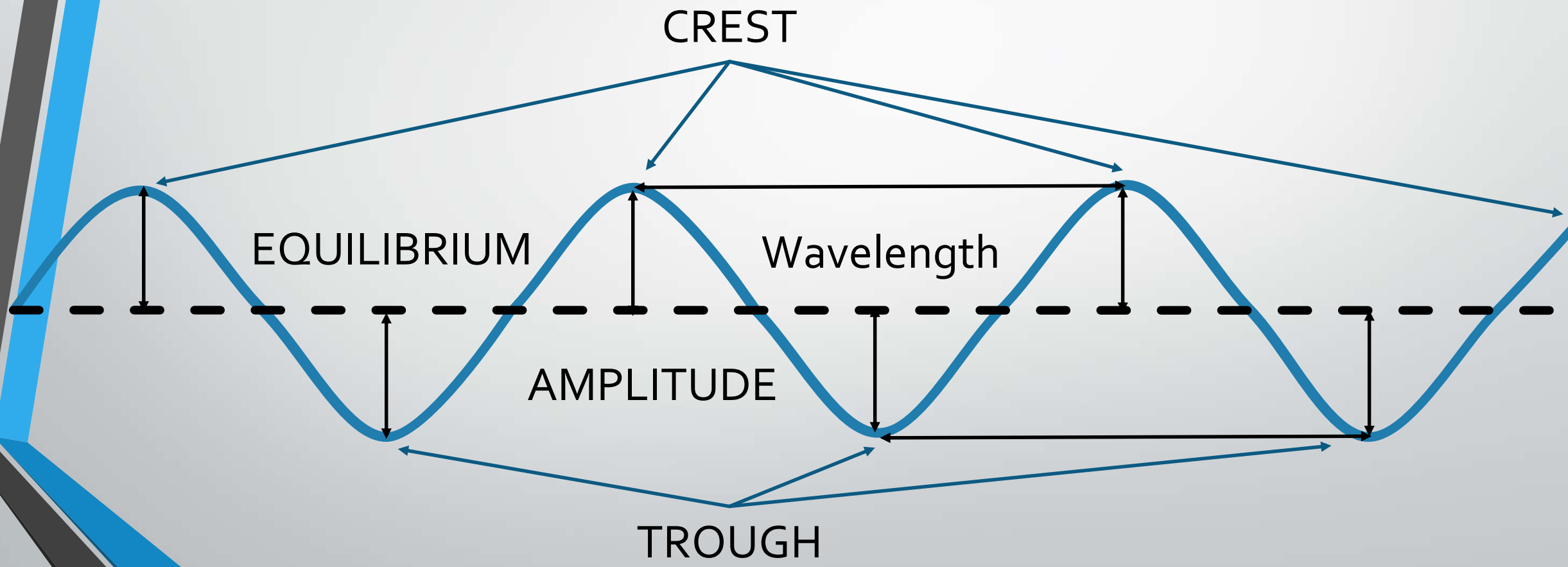
Wavelength(λ): The distance between 2 crests or troughs

Frequency(f): The number of waves or cycles per unit time

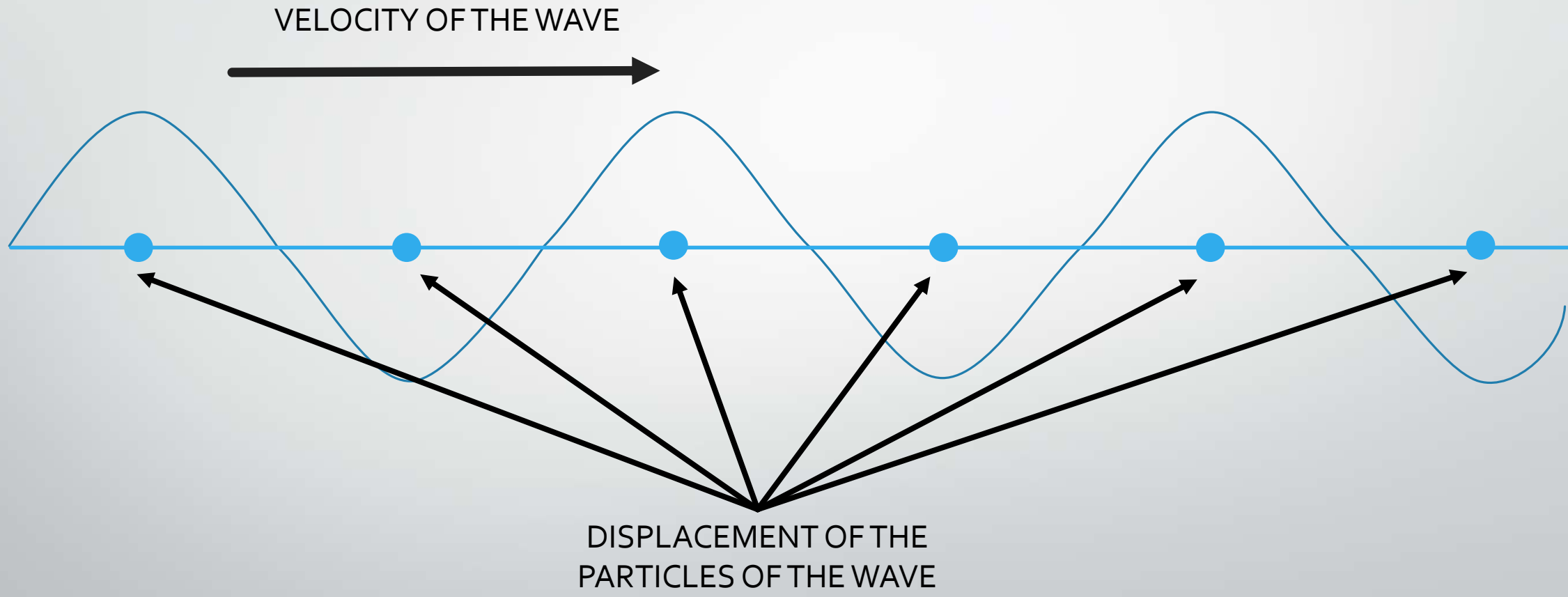
Period(T): the time required to complete one wave

Transverse Waves

The speed of the wave is perpendicular to the displacement of the particles

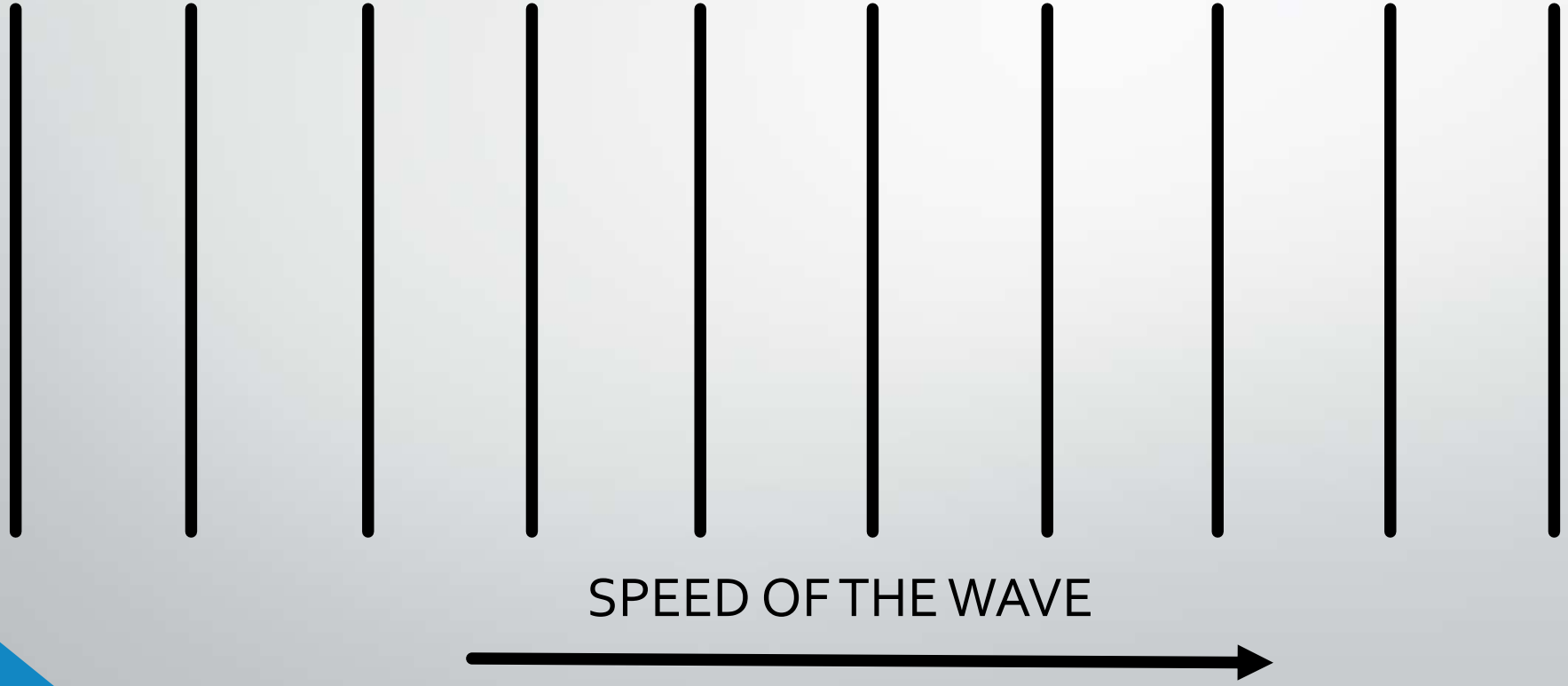


Transverse Waves

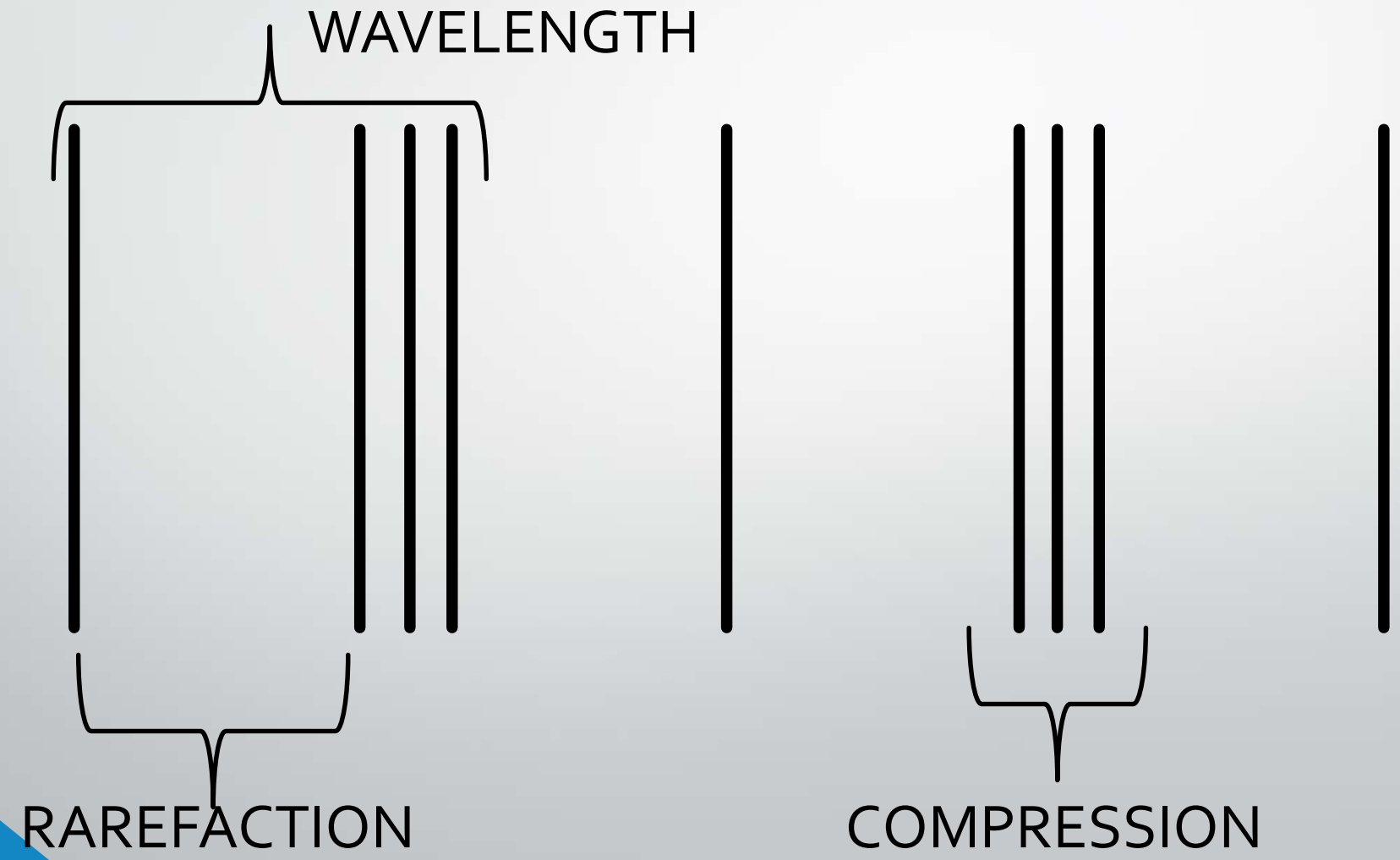


Longitudinal Waves

The speed of the wave is parallel to the displacement of the particles



Longitudinal waves are made up compressions and rarefactions. One wave length is from the beginning of a rarefaction to the end of a compression

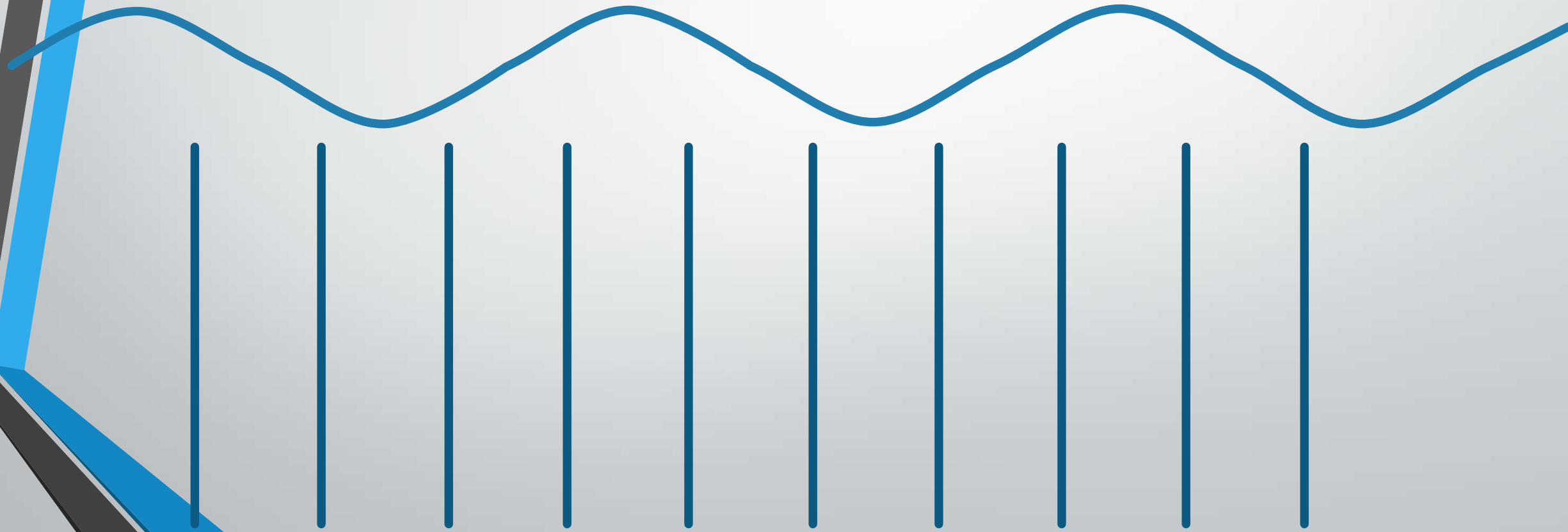


How does water travel?

The surface travels like a transverse wave, but the undercurrent is longitudinal

But remember: The individual drops are moving up and down on the surface

The transverse wave is called a surface wave



Speed and energy of a wave

The energy of a wave is directly related to it's wavelength:

- The shorter the wavelength the greater the energy
- The longer the wavelength the lesser the energy

The speed of a wave also has to do with the wavelength, but it also has to do with the frequency

Wave Equations

Velocity:

$v = f\lambda$ v = velocity(m/s); f = frequency(Hz); λ = wavelength (m)

Frequency to Period:

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

Period to Frequency:

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