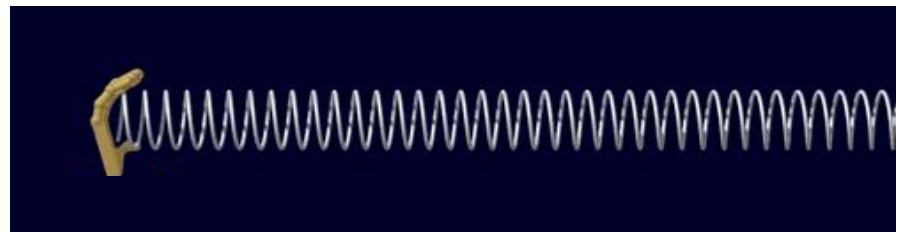


# Introduction to **WAVES**



A **wave** is a kind of **oscillation** (disturbance, vibration) that **transports energy** from place to place through space and matter.

# WAVES

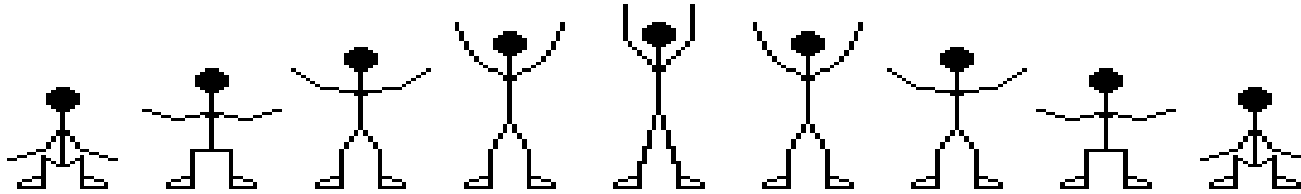
## MECHANICAL:

- oscillations of *matter*
- require a medium

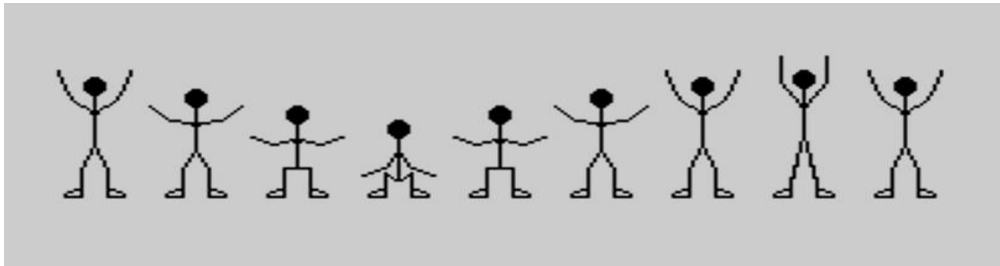
## ELECTROMAGNETIC:

- oscillations of *electric and magnetic field*
- require no medium

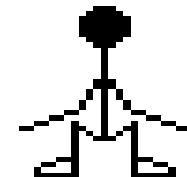
# How to describe a wave?



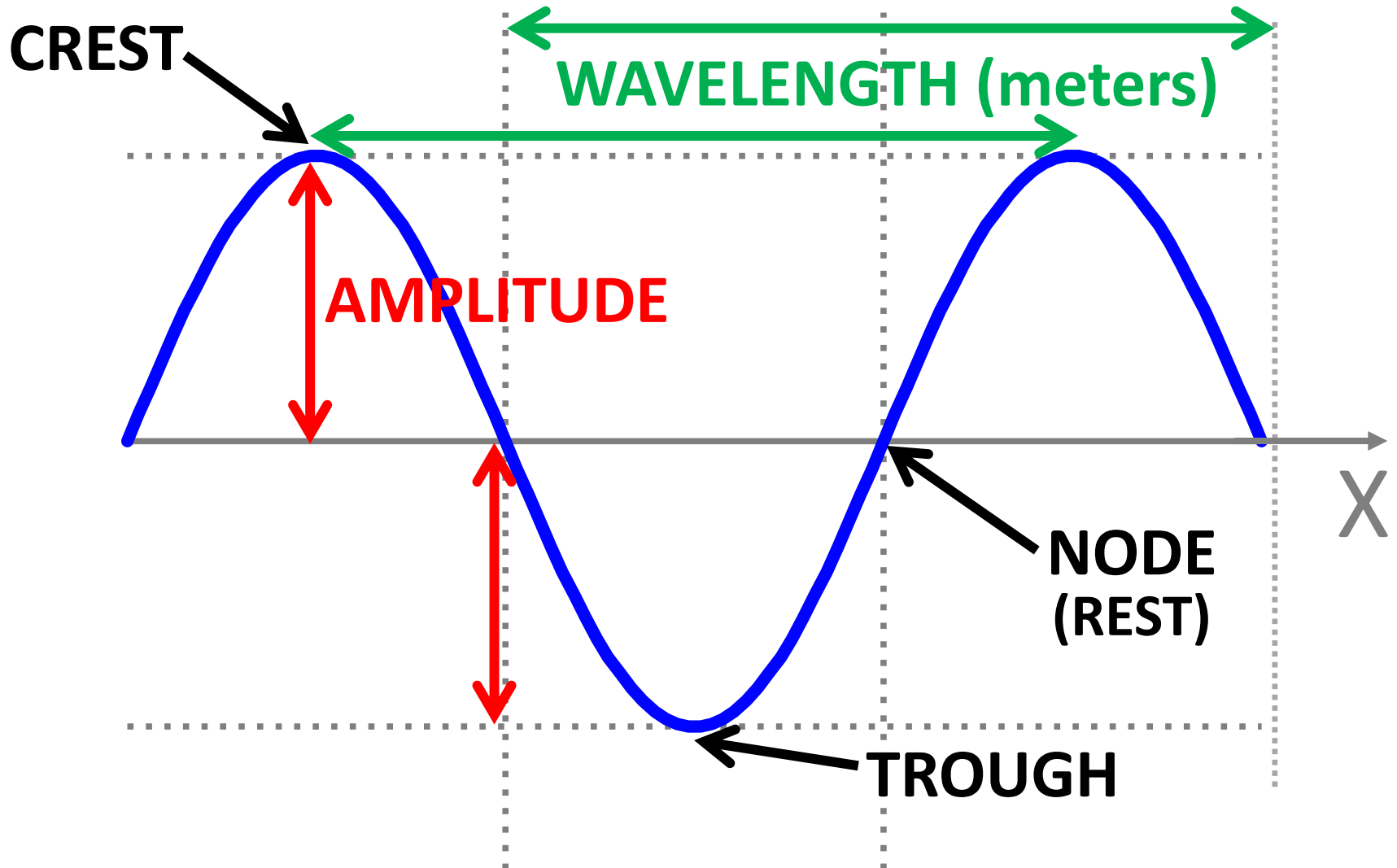
1. Take a “snapshot” – look at wave shape through space at a particular moment in time.



2. Watch a particular point over time.



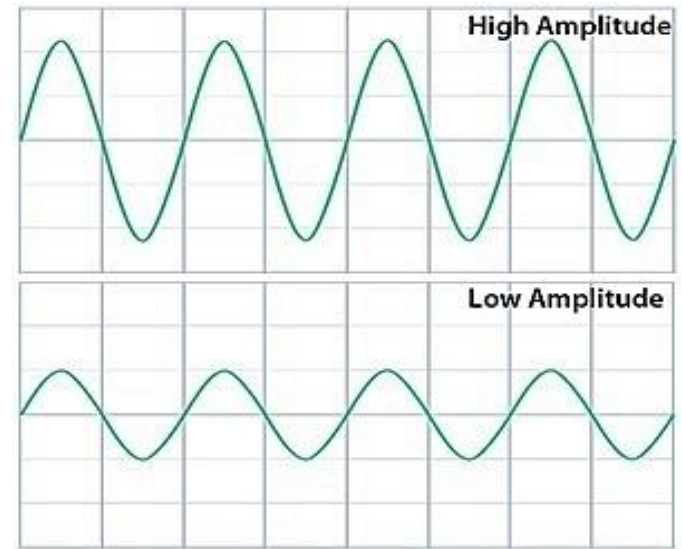
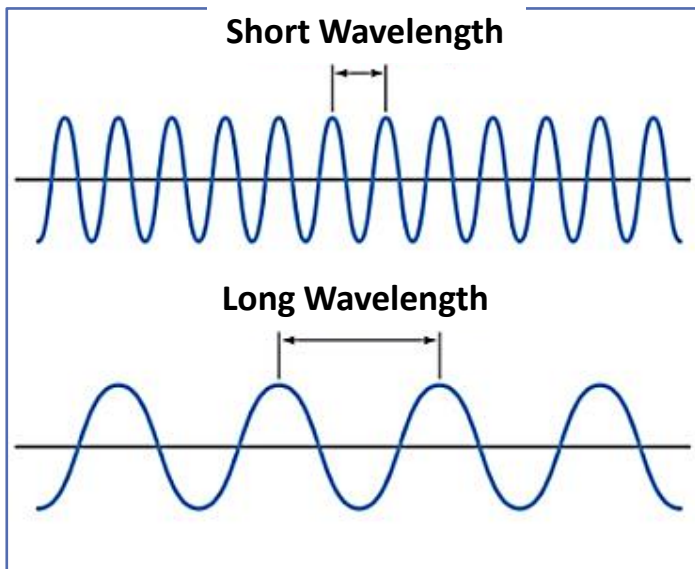
# How to describe a wave in space?



# Notations and Units

**AMPLITUDE ( $A$ ):** maximum amount of vibration measured from the rest position.

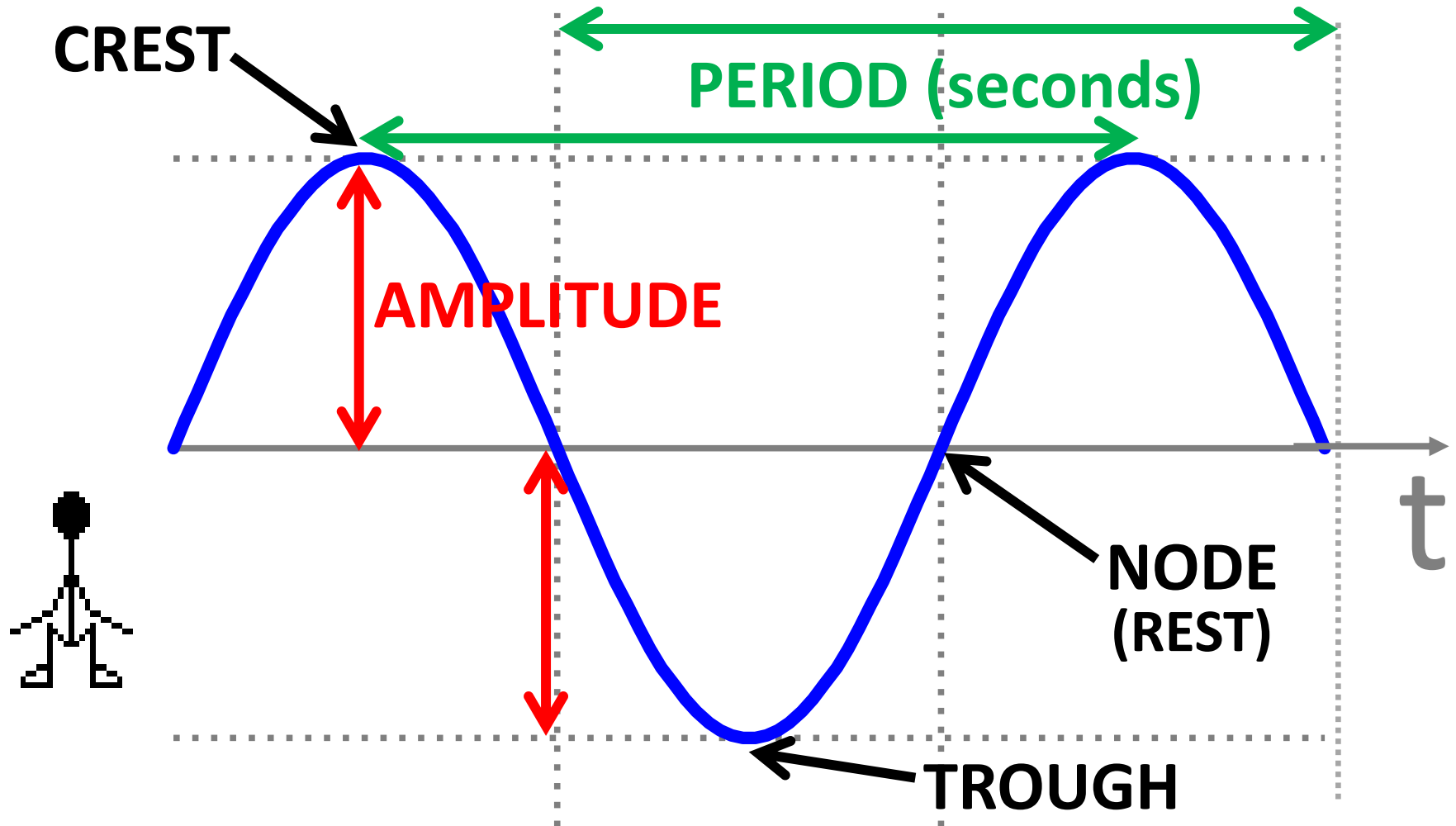
- Unit of measurement: depends on the physical quantity that is oscillating
- Examples: distance (meters), pressure (pascals), electric field strength (volts/meter)



**WAVELENGTH ( $\lambda$ ):** the distance over which the wave's shape repeats itself.

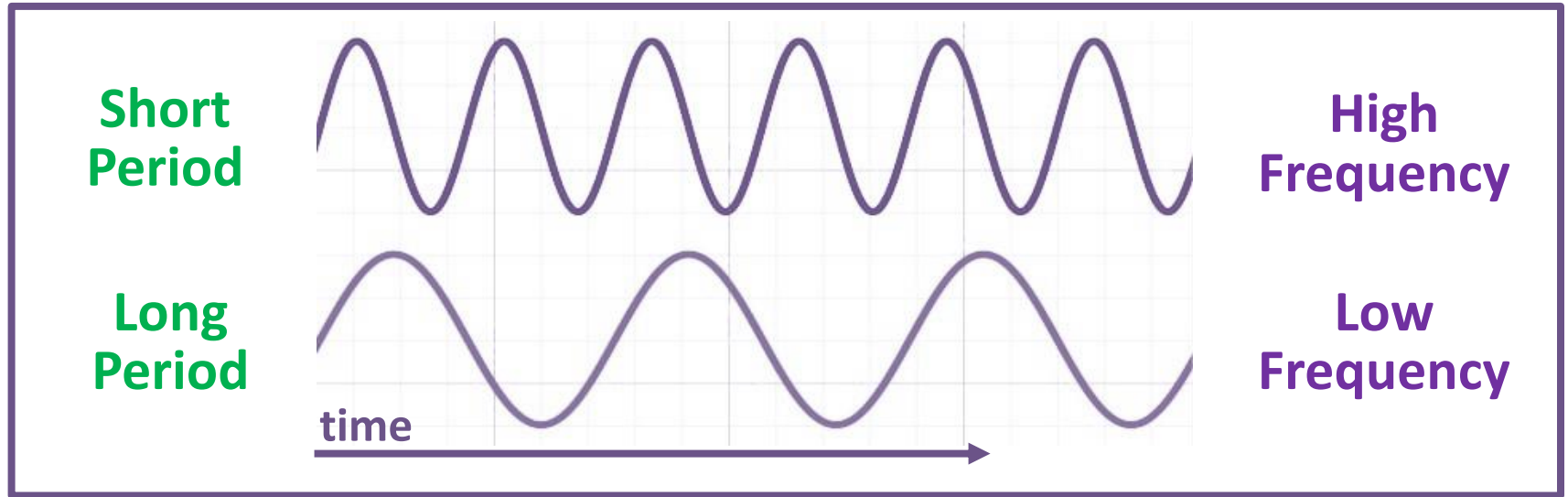
- Unit of measurement: meters
- Examples: the sounds of thunder are waves with wavelengths from few tenths to a few meters; the wavelengths of visible light are in the range of 400 to 750 *nanometers* (billionths of a meter)

# How to describe a wave in time?



**FREQUENCY: number of waves per second**

# Notations and Units



**PERIOD (T):** The time it takes to make one complete vibrational cycle.

➤ Unit of measurement: seconds

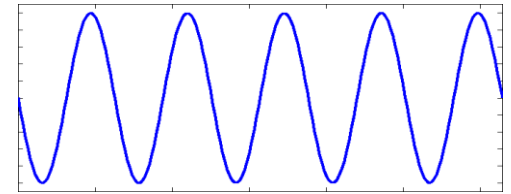
**FREQUENCY (f):** number of waves per second.

➤ Unit of measurement: hertz (Hz)

$$\text{FREQUENCY} = \frac{1}{\text{PERIOD}}$$

$$1\text{Hz} = \frac{1}{1\text{s}}$$

# Exercise: match wave parameters with descriptions.



| ANSWER   | PARAMETER   | DESCRIPTION <i>(in mixed order!)</i>                                                                  |
|----------|-------------|-------------------------------------------------------------------------------------------------------|
| <b>C</b> | CREST       | A. Maximum amount of vibration from the rest position; can be measured to the crest or to the trough. |
| <b>G</b> | THROUGH     | B. The <u>distance</u> over which the wave's shape repeats itself in space.                           |
| <b>F</b> | NODE (REST) | C. The highest (maximum) point of a wave.                                                             |
| <b>A</b> | AMPLITUDE   | D. Number of waves per second.                                                                        |
| <b>B</b> | WAVELENGTH  | E. The <u>time</u> it takes to make one complete vibrational cycle.                                   |
| <b>E</b> | PERIOD      | F. Equilibrium position of a wave.                                                                    |
| <b>D</b> | FREQUENCY   | G. The lowest (minimum) point of a wave.                                                              |

Can you identify **two**  
different kinds of  
mechanical **waves**  
that are created when  
someone plays a  
musical instrument?



***What*** vibrates  
***and where?***