

### 4.3 Intro to Wave Theory

**Wave** - the regular transportation of energy without the permanent displacement of matter

- waves are regular because the particles which make them up oscillate in Simple Harmonic Motion, returning to their equilibrium positions
- waves transport energy (ie. heat, energy in light, sound energy, energy in water waves, etc.)
- waves don't displace matter (as the particles eventually return to equilibrium)



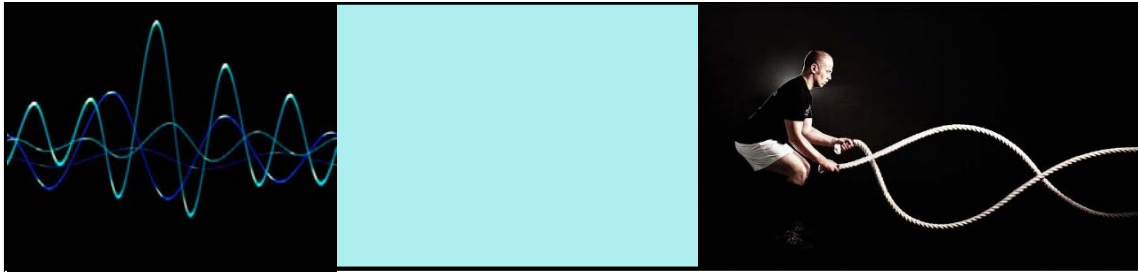
Two Main Types of Waves:

#### 1. **Mechanical Waves** (Physics 20)

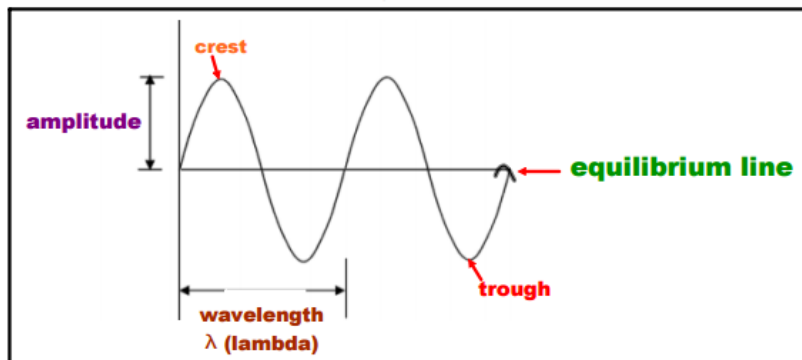
- water waves, sound waves, waves on springs/strings
- Mechanical waves **need a medium** to travel through like water, air, string, etc.

#### 2. **Electromagnetic Waves** (Physics 30)

- light, radio/tv/satellite rays, microwaves, UV waves
- **do not need a medium** to travel through (can go through the vacuum of space)



A Sinusoidal Curve is used to draw waves:

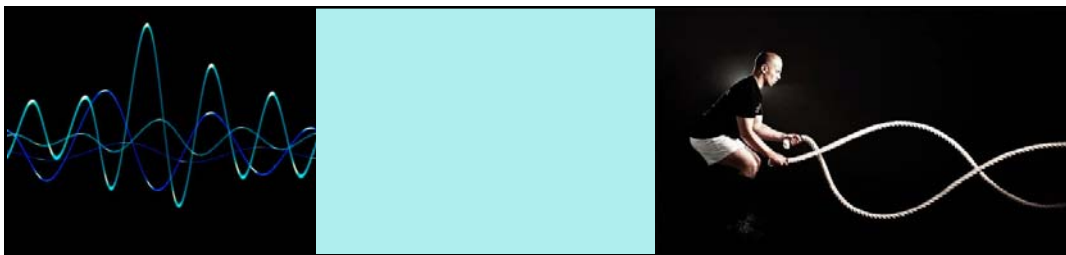


$\lambda$



Terminology:

- **equilibrium** - the initial position of the medium
- **crest** - the portion of the waves above equilibrium
- **trough** - the portion of the waves below equilibrium
- **amplitude** - the distance between the crest and equilibrium or between the trough and equilibrium (m)
- **wavelength** - the distance between two repeating parts of the wave, symbol  $\lambda$  - "lambda" (m)
- **pulses** - individual crests and troughs
- **wave train** - collection of pulses



We study two types of wave motion in Physics 20:

1. **Transverse Waves:** a wave where the particles vibrate in a direction perpendicular to the propagation of the wave.

2. **Longitudinal Waves:** a wave where particles vibrate in a direction parallel to the propagation of the wave.

Eg.) In transverse waves particles move up and down while the wave moves right to left (ie. waves in string, ripples on water, electromagnetic waves, "the wave").

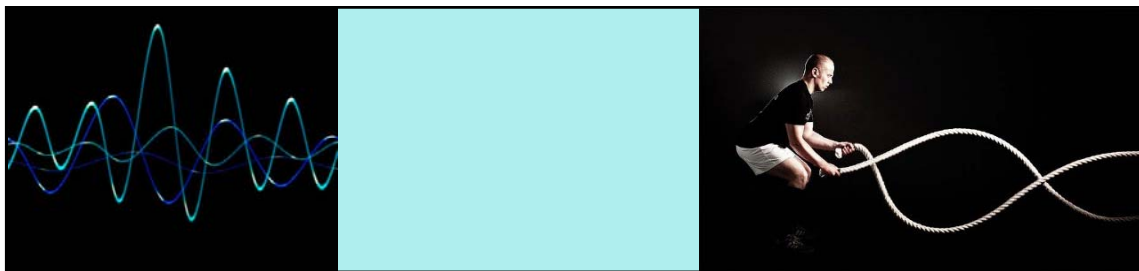
Eg.) In longitudinal waves particles move right and left while the wave moves right and left (ie. sound waves). Longitudinal waves are made up of areas of high particle density (compressions) and low particle density (rarefaction).



Sometimes we have both transverse and longitudinal waves...Earthquakes are an example of this.



[http://www.classzone.com/books/earth\\_science/terc/content/visualizations/es1002/es1002page01.cfm?chapter\\_no=visualization](http://www.classzone.com/books/earth_science/terc/content/visualizations/es1002/es1002page01.cfm?chapter_no=visualization)



Activity: Pulses in a String

Pg. 403 and ~~405~~

Read pg. 401-410.