Waves

Waves are a form of energy transfer

- Water waves
- Sound waves
- Light
- Earth quakes

Waves are periodic oscillations that transfer energy from one point to another

- Consider sound, when someone is speaking, the air does not travel from their mouth to your ear, rather a “pulse” moves through the air from their voice box to your ear drums.

A better definition

- It makes more sense to think of a wave as a way that a form of energy travels. This will help with later comprehension.
  - In sound, the 'noise' travels from speaker to listener, but the air does not
  - In water, the crest (Ep and Ek) travel across a lake, but not the water
  - In light, magnetic and electric fields oscillate up and down (side to side), however it is the photon which travels forward.

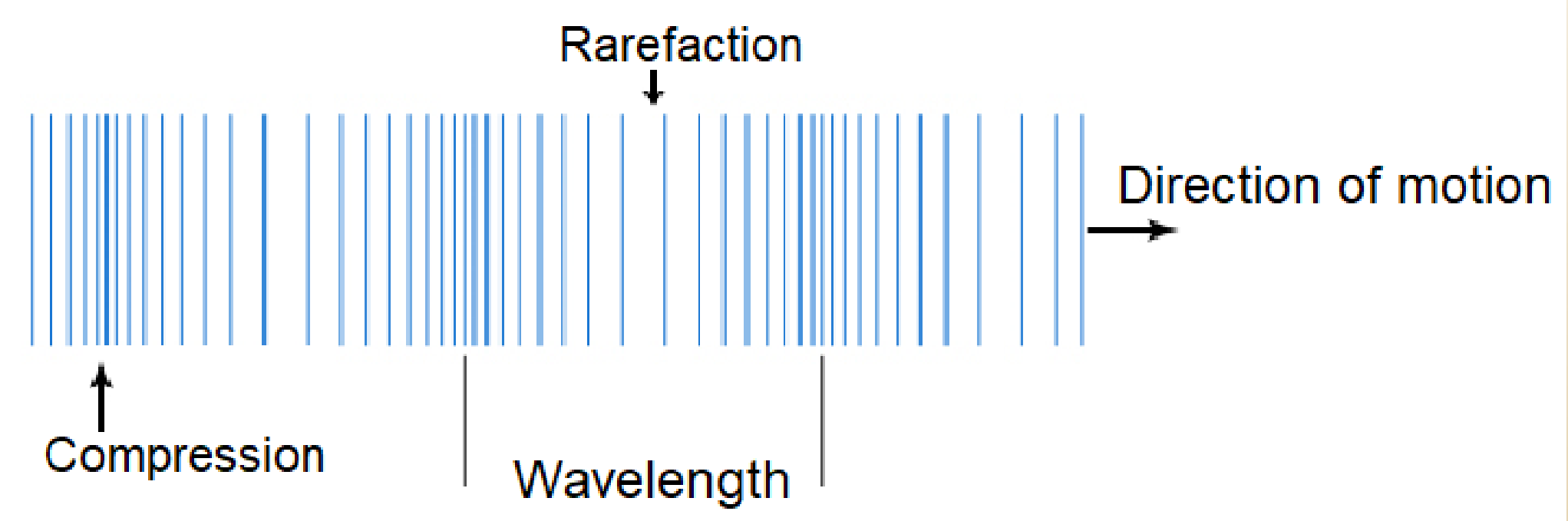
Know the basics

- Waves also have common properties and common structures and so it is important that we know (and remember the common structures).

- As a minimum you should be able to;
  - Draw
  - Describe
  - Label
- Both a transverse and a longitudinal wave.

longitudinal waves

- the direction of oscillation is parallel to the direction of travel of the wave.
- An example of a longitudinal wave is a sound wave.



Since sound is 3 dimensional, this is what a sound wave really looks like

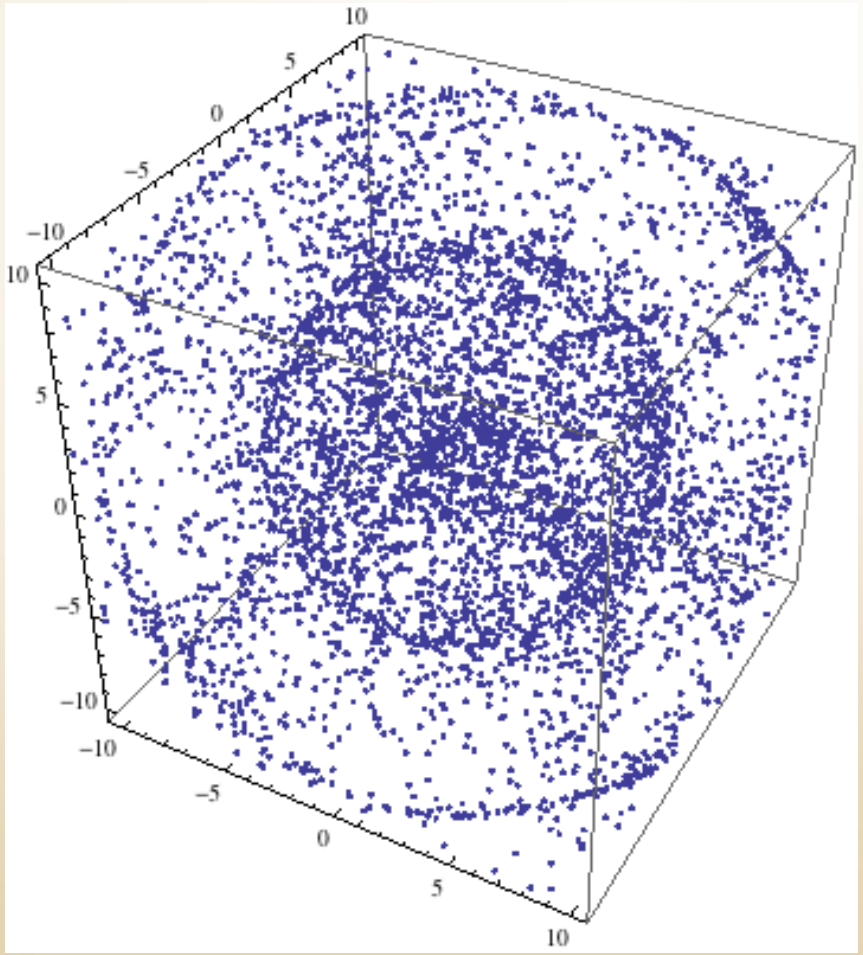


Image courtesy of
Ibrahim S. Souki

transverse waves

- the direction of oscillation is perpendicular to the direction of travel of the wave.
- Water waves are transverse waves

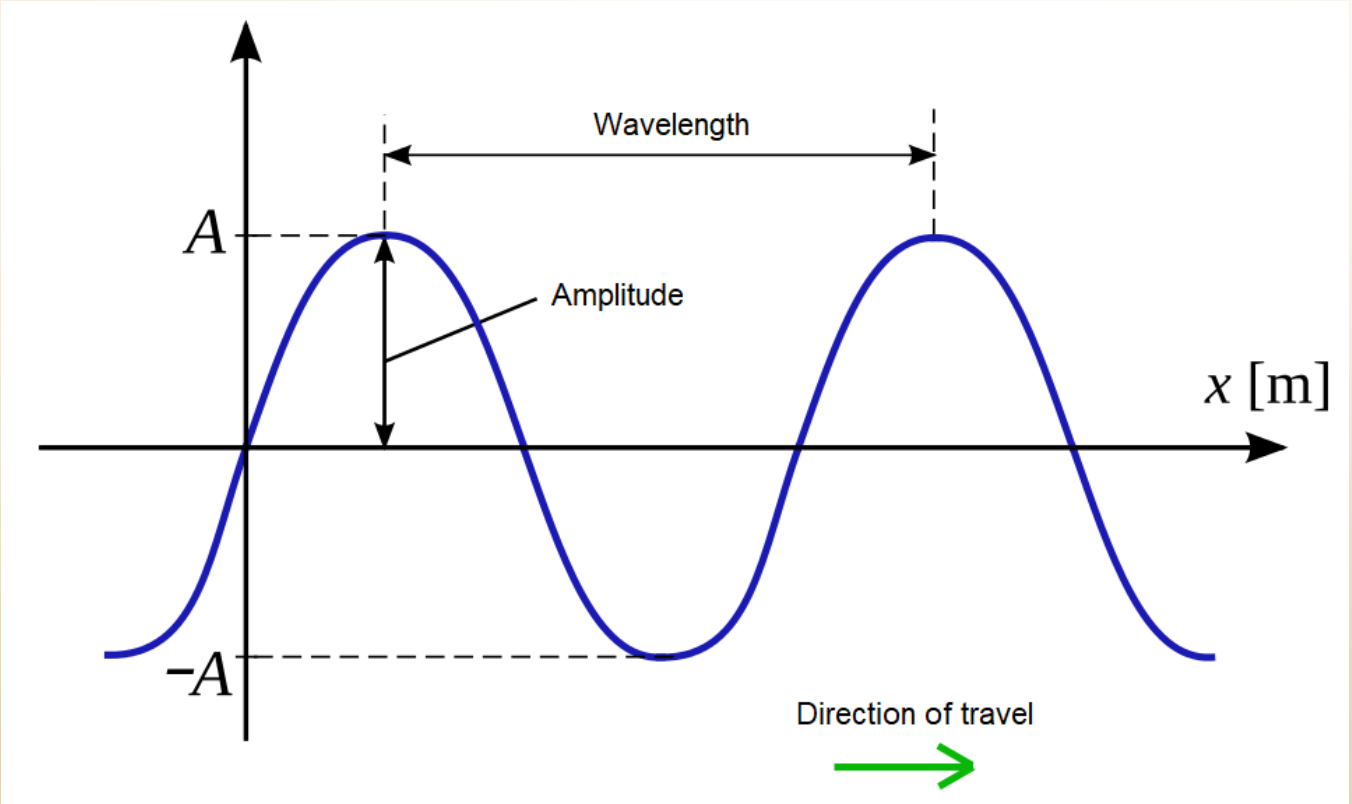


Image courtesy of すじにくシチュー

Terms you need to know

- Amplitude – displacement of crest from central (medium) position
- Wavelength – distance between two equal points along the wave
- Frequency – number of waves past a point each second
- Period – how long it takes one wavelength to pass a point
- Velocity – speed at which the wave "form" travels

Wave form

- We call the ‘shape’ of a wave the ‘wave form’ rather than the wave crest or ‘structure’ or other possible shape terms.

Wave equation

$$\boldsymbol{v = f\lambda}$$

$$velocity = frequency \times wavelength$$

- Good news/bad news; it is the equation you met back in earlier years, however it is now time for a new mindset. It only works for;
  - An instant in time (any instant)
  - It is actually only a description of a relationship between v, f, T
  - λ is the Greek letter lambda, it is used to describe wavelength

Algebraic versions

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

Video break

- Watch Crash' Course travelling waves video.
- It covers a lot of information, watch it slowly and carefully. Taking notes is highly recommended.
  - Traveling waves, Crash Course

Frequency and Period

- Frequency (f) is the number of waves past a point in a second
- Period (T) is how long an individual wave takes to pass a point

- As a result;

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

- And therefore

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

Talking waves

We need to mention

- Light is a wave (more on that later)
- Light travels at ‘c’ (the speed of light, $3 \times 10^8 ms^{-1}$)

- and …. ‘c’ is the speed of ‘causality’, no two things in the universe can communicate with each other faster than the speed of light.

To be continued

- Next topic – mechanical waves (waves that travel through a mechanical medium)

Chinatown after the San Francisco Earthquake of 1906