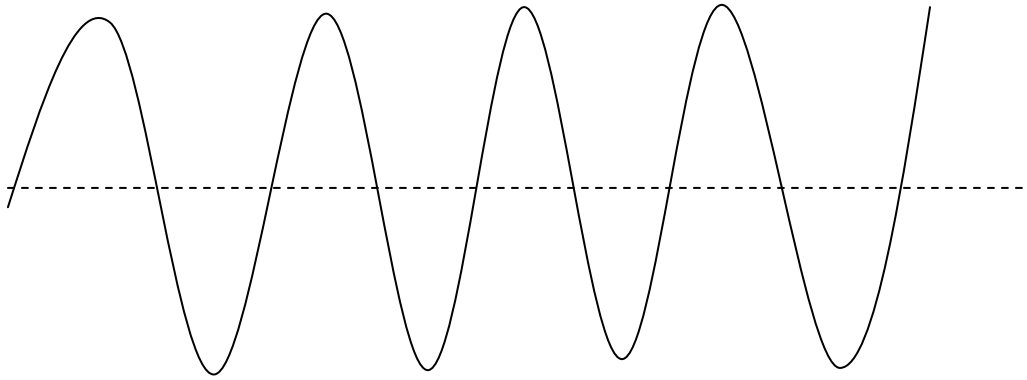
Wave Characteristics

Use your text to label this sketch of a wave. You need to include these labels: amplitude, wavelength (λ), crest, trough, equilibrium and phase shift.



Time based characteristics of waves

Period (T) is how long 1 wave (1 cycle, 1 repetition) takes. It is most often measured in seconds.

$$T = \frac{t}{N}$$

Where T = period (s)

t = time (s)

N = # cycles

$$F = \frac{N}{t}$$

Where f = frequency = 1/s

..or s^{-1}…or Hertz (Hz)

Did you notice that the 2 formulas are very similar? In fact, they are reciprocals. So we can also write

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

Homework: Do #3 page 387

Wave Speed

We know v = d/t. Let's just substitute in wave equivalent ideas. Instead of distance, let's use wavelength (distance of 1 wave!) and instead of time, let's use period (time for 1 wave!) . Thus we get…

$v = \frac{\lambda}{T}$ But..we know T = 1/f so let's sub 1/f in for T so we get rid of fraction!

Thus… $\boxed{v = f\lambda}$ This works for ***every*** wave and is thus known as 'universal wave equation'

Factors that Affect Speed of Wave

- We know speed wave in solid > speed of wave in liquid > speed of wave in air.

  This is because the forces between solid particles are the strongest.

- We know the more 'elastic' a medium is, the faster the wave travels.

- Guitar strings – specific example

  Strings have a density but instead of using mass/volume, we use mass/length! This makes sense for a string, a cable, a wire etc.

  Linear density (kg/m) = mass (kg) / length (m)

  $$\boxed{\mu = \frac{m}{L}}$$

  We use μ as the symbol for linear density. This is the same symbol (mu) we use for coefficient of friction so it's important you know the context. When taking about waves and strings, we are not talking about forces of friction.

  The tension (F_T) and the linear density (μ) of the string both affect the speed of the vibration (wave) along a string once it's plucked or strummed.

  $$\boxed{v = \sqrt{\frac{F_T}{\mu}}}$$

This means speed varies directly with tension.

So… more tension means faster wave (but we already knew that!)

This means the more dense the string, the slower the wave. (that makes sense don't you think!)

Slower waves are lower notes. Talk to a guitar player. The lower strings are thicker and denser. Also…tightening up a string makes it play a higher note!

Homework: p. 391 # 1,2,3,7