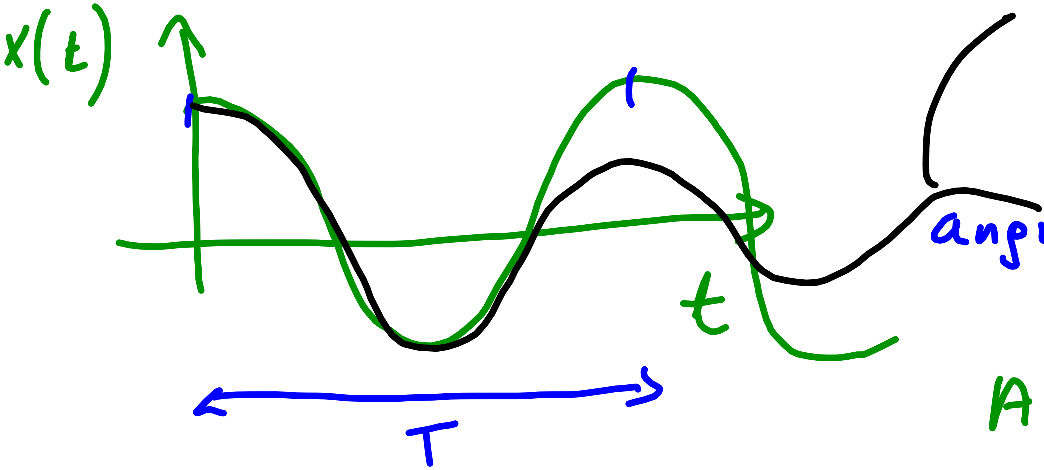
Overview of oscillatory motion

- if you displace a system from the equilibrium, it will try to reach it back; while it's trying it is osaillating
    - swing
    - spring
    - bungie jumping

Simple harmonic motion (SHM)



$x(t) = A \cos \omega t$

angular frequency $\omega = \frac{2\pi}{T}$

A amplitude of oscill.

T period

f frequency (number of oscillations per unit time) $f = \frac{1}{T}$

- forced oscillations

If a system is driven at a frequency near its natural oscillation => resonance

- bridge
- meteotsunami

WAVES

- disturbances that propagate through space

But what propagates?

In oscillatory motion an object oscillated / propagate

Is that the same for the wave?

NO

Energy or information propagates!

The particles oscillate as in SHM, do not travel with the wave.

- slinky
- stadim wave
  - boat rocking / wave crest moving } different speed

Formal classification for the waves

- mechanical - require a medium such as air, water, inner earth ...
- electromagnetic - share many properties with mechanical waves but don't require a medium
  - visible
  - infrared
  - radio waves
  - x-rays
  - light

Waves – longitudinal – the particles oscillate in the same direction as the wave (sound, slinky)

– transverse – the particles oscillate $\perp$ to the wave (spring)

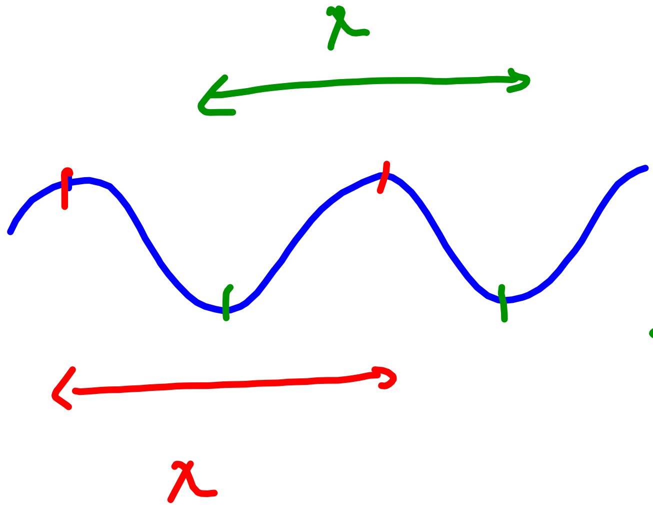
– mix

As with oscillatory motion waves have:

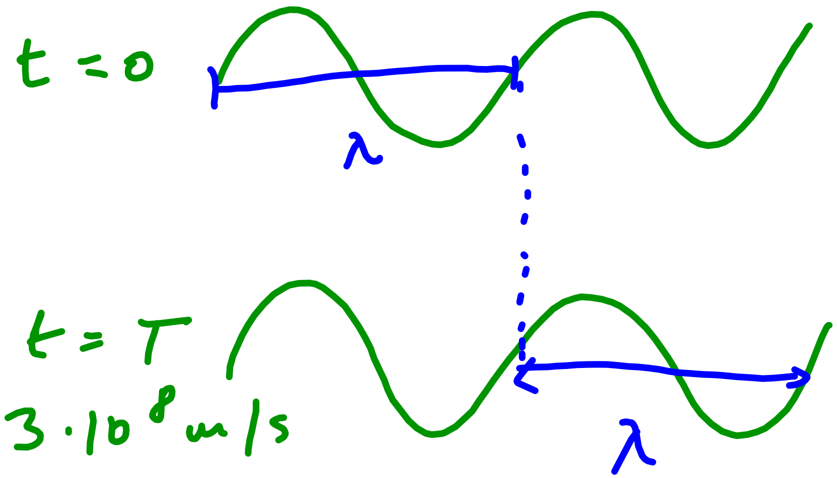
- amplitude A (for wave crest it is the crest, for sound it is max pressure)

- shape - waves come in many shapes that we call wavefronts

- wavelength λ the distance over which the wave pattern repeats



period T time for one cycle



Particle has its speed

Wave speed v

- light $3 \cdot 10^8$ m/s
- Sound 340 m/s
- earthquake waves ~ 2 km/s

v, λ, T are related in a similar way as in Phys 121

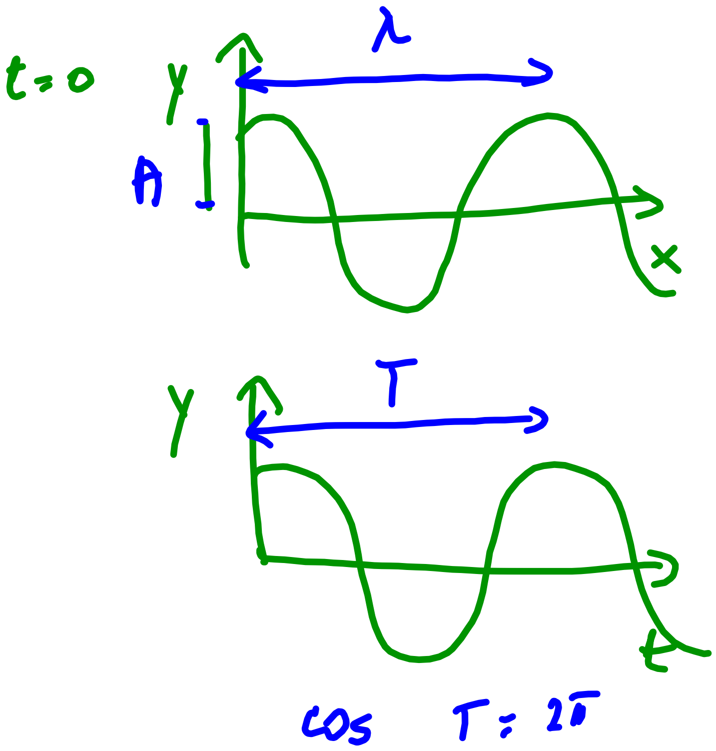
$v = \frac{s}{t}$ car 140 km/h

wave $\boxed{v = \frac{\lambda}{T}}$

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

$v = \lambda \cdot f$

Simple harmonic wave



We chose coordinates so that at $x = 0$ there is a maximum of the wave cos

$$y(x, t=0) = A\cos(kx)$$

A amplitude

y wave displacement

k wave number

$kx = 0$ when $x = 0$ $y = A$

2π

$kx = 2\pi$ when $x = \lambda$

$k\lambda = 2\pi$

$k = \frac{2\pi}{\lambda}$ wavenumber