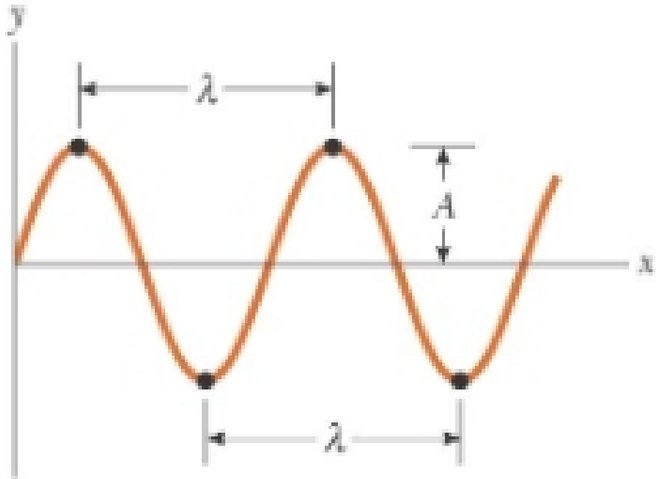
Physics 202, Lecture 21

Today's Topics

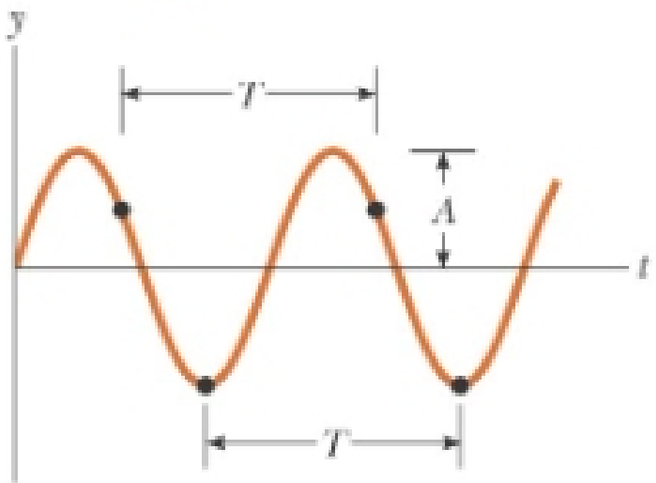
- More Wave Review
  - Standing waves
- Electromagnetic Waves (EM Waves)
  - The Hertz Experiment
  - Review of the Laws of Electromagnetism
  - Maxwell's equations
  - Propagation of **E** and **B**
    - The Linear Wave Equation

Parameters For A Sinusoidal Wave

- Snapshot with fixed t:
  wavevector = k
  wavelength $\lambda=2\pi/k$
- Snapshot with fixed x:
  angular frequency = ω
  frequency $f=\omega/2\pi$
  Period $T=1/f$
  Amplitude =A
- Wave Speed $v=\omega/k$
  → $v=\lambda f$, or
  → $v=\lambda/T$
- Phase angle difference between two positions
  $\Delta\phi=-k\Delta x$



Snapshot:Fixed t



Snapshot:Fixed x

Standing Waves

- When two waves of the same amplitude, same frequency but opposite direction meet standing waves occur.

$$y_1 = A\sin(kx - \omega t) \qquad y_2 = A\sin(kx + \omega t)$$

$$y = y_1 + y_2 = 2A\sin(kx)\cos(\omega t)$$

- Points of destructive interference (nodes)

$$kx = n\pi;\ \ x = \frac{n\pi}{k} = \frac{n\lambda}{2};\ n = 1,2,3\ldots$$

- Points of constructive interference (antinodes)

$$kx = (2n-1)\frac{\pi}{2};\ \ x = (2n-1)\frac{\lambda}{4};\ n = 1,2,3\ldots$$