$F = -kx$ $U = ½ k x^2$ $E = ½ mv^2 + ½ kx^2 = ½ k A^2$

$v_{max} = \omega A$ $a_{max} = \omega^2 A$ where $\omega^2 = k/m$ $\omega = 2\pi f$ $f = 1/T$

$T = 2\pi (m/k)^{1/2}$ $x = A \cos \omega t$ $v = - \omega A \sin \omega t$ $a = -\omega^2 x$

Simple pendulum: $\omega^2 = g/L$ Compound pendulum $\omega^2 = mgd/I$

Isotropic wave: $I = P/4\pi r^2$ String: $v^2 = F/\mu$ where $\mu = m/L$

Traveling wave: $v = f \lambda = \lambda/T$ $y = A \cos (\omega t-kx)$ where $k = 2\pi/\lambda$

Intensity is proportional to the square of the amplitude.

Standing waves: $n\lambda = 2L$, $f = nv/2L$

$v_{sound} = 331$ m/s $(T/273 K)^{1/2}$ $\beta = (10 dB) \log (I/I_o)$ where $I_o = 10^{-12}$ W/m^2

open or closed at both ends: $\lambda = 2L/n$, $f = nv/2L$ $n = 1,2,3…$
open at one end only: $\lambda = 4L/n$, $f = nv/4L$ $n = 1,3,5$

$f_{beat} = f_1 – f_2$
moving source: $f_{observer} = f_{source} /(1 – v_{obs}/v)$
moving observer: $f_{observer} = (1 – v_{obs}/v) f_{source}$
(in both, $v_{obs} >0$ if observer moving in the direction of the wave).