

Sound & Light (1)

1.1 Miscellaneous

% error = (observed - theoretical) / theoretical \* 100%

1.2 Kinematics

x = (a/2)(Δt)^2 + v\_0Δt + x\_0      v = v\_0 + aΔt

v^2 = v\_0^2 + 2aΔx      Δx = (v\_0 + v) / 2 \* Δt

1.3 Simple Harmonic Motion

x = A cos(ωt + φ)      v = -ωA sin(ωt + φ)      a = -ω^2 A cos(ωt + φ)

x\_max = A      v\_max = ωA      a\_max = ω^2 A      F\_max = mω^2 A

1.3.1 Springs and Slinkies

F\_s = kx      F\_s\_max = kx\_0 = mg

f = (1/2π)√(k/m)      T = 2π√(m/k)      ω = 2πf = √(m/k)

SPE = (1/2)kx^2      KE = (1/2)mv^2

TME = (1/2)kx^2 + (1/2)mv^2 = (1/2)kA^2 = (1/2)mv\_max^2

1.3.2 Pendulums

f = (1/2π)√(g/L)      T = 2π√(L/g)

1.4 Waves

T = 1/f      v = λf      v = Δx/Δt

1.4.1 Slinkies and strings with fixed ends

F\_T = F\_s = kx      μ = m/L      v = √(F\_T/μ)

Given mass m\_T hanging below a pulley, F\_T = m\_Tg.

1.5 Standing waves

1.5.1 Open-open, closed-closed

n is the number of antinodes, or the n^th harmonic.

f\_n = f\_1 n = (nv) / (2L)      f\_1 = v / (2L)      λ\_n = 2L / n

f\_n = f\_1 n = (nv) / (4L)      f\_1 = v / (4L)      λ\_n = 2L / n

1.6 Sound

1.6.1 Speed of sound

v = 331√((T\_c + 273) / 273)      v ≈ 331 + 0.59T

1.6.2 Sound intensity

I = (Power (W)) / (Area) = (Power (W)) / (4πr^2)

I\_dB = 10 log\_10(I / (10^-12))      I = 10^(I\_dB / 10 - 12)

1.6.3 Doppler effect

[S] → [O]      f\_o = f\_s \* (v / (v - v\_s))      [O] [S] →      f\_o = f\_s \* (v / (v + v\_s))

[S] → ← [O]      f\_o = f\_s \* ((v + v\_o) / (v - v\_s))      [O] → [S] →      f\_o = f\_s \* ((v + v\_o) / (v + v\_s))

[S] → [O] →      f\_o = f\_s \* ((v - v\_o) / (v - v\_s))      ← [O] [S] →      f\_o = f\_s \* ((v - v\_o) / (v + v\_s))