Fluids: $P = P_0 + \rho gh$, $\rho vA = constant$ or $A_1v_1 = A_2v_2$ $F_B = \rho_F V_F g$

$P + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$ $Q = \pi R^4(P_1 - P_2)/(8\eta L)$ $M_{apparent} = V(\rho - \rho_F)$

Harmonic Motion: F = - kx (k = spring constant) PE = ½ k x^2 KE = ½ mv^2

$x(t) = A\cos(\omega t + \phi)$ $v(t) = -A\omega\sin(\omega t + \phi)$ $a(t) = -A\omega^2\cos(\omega t + \phi) = -\omega^2 x(t)$

$\omega = \sqrt{\frac{g}{l}}$ (Pendulum); $E = \frac{1}{2}kA^2 = \frac{1}{2}mv_{max}^2$; A(t) = A(0)exp(-bt/2m) ; $\omega = (k/m)^{1/2}$

Travelling Waves: $k = \frac{2\pi}{\lambda}$ $\omega = \frac{2\pi}{T} = 2\pi f$ $v = \lambda f$ $v = \sqrt{\frac{F_T}{\mu}}$

Harmonic Waves: y(x, t) = A sin(kx + ωt + ϕ) or y(x, t) = A sin(kx - ωt + ϕ)

$v_y(x, t) = \omega A\cos(kx + \omega t + \phi)$ or $v_y(x, t) = -\omega A\cos(kx - \omega t + \phi)$

Standing waves: y = 2A sin kx cos ωt

Sound: *Intensity = Power/Area*

$\beta(dB) = 10\log_{10}\left(\frac{I}{I_0}\right)$ $I_0 = 10^{-12}\frac{W}{m^2}$ spherical wave $I = \frac{P}{4\pi r^2}$ $f' = f\left(\frac{v \pm v_o}{v \mp v_s}\right)$

Interference : Index of refraction : $n = \frac{c}{v}$ $\lambda_n = \frac{\lambda}{n}$

Phase difference upon reflection = π (hard, $n_2 > n_1$) or = 0 (soft, $n_2 < n_1$)

Optical path length = *nd* phase difference = $\frac{2\pi}{\lambda}(path\ \ difference)$

N-slit interference: d sin θ = mλ (constructive),

Diffraction: First single-slit diffraction minimum: a sin θ = λ circular aperture: $\theta_{min} = 1.22\frac{\lambda}{D}$

Heat: $L = L_0(1 + \alpha(T - T_0))$ $Q = mc\Delta T$ $Q = mL$

$dQ/dt = k A \Delta T / L$ $dQ/dt = e\sigma AT^4$ $\sigma = 5.67 \times 10^{-8}$ W/m^{2}K^4 0°C = 273 K

$L_{water\text{-}fusion} = 3.33 \times 10^5$ J/kg or 80.0 cals/gram; $L_{water\text{-}vap.} = 22.6 \times 10^5$ J/kg or 539 cals/gram ;

c_{ice} = 2100 J/kg.°C or 0.5 cal/gram°C, c_{water} = 4186 J/kg.°C or 1.0 cal/gram°C

c_{steam} = 2010 J/kg.°C or 0.48 cal/gram°C

Constants: $P_{atmosphere} = 1.013\times10^5$ Pa, ρ (fresh water) = 1000 kg/m^3, ρ (He) = 0.18 kg/m^3

ρ (air)= 1.29 kg/m^3, ρ (ice) = 917 kg/m^3 $\eta_{water} = 1.0\times10^{-3}$ Pa.sec.

Velocity of sound in air = 343 m/s, 1 cal. = 4.186 J, g = 9.81 m / s^2, Vel. of light, c = 3 x 10^8 m/s