Physics in motion

Constant velocity: $V = \frac{\Delta x}{\Delta t}$

$x_f = x_i + V \cdot t$

Constant accelerat: $V_f = V_i + a \cdot t$

$V_{avg} = (V_i + V_f) \cdot \frac{1}{2}$

$x_f = x_i + \frac{1}{2}(V_i + V_f) \cdot t$

$x_f = x_i + V_i \cdot t + \frac{1}{2} a \cdot t^2$

$V_f^2 = V_i^2 + 2 \cdot a (x_f - x_i)$

Projectile motion: $V_{xf} = V_{xi} = \text{constant}$ } Horizontal

$x_f = x_i + V_{xi} \cdot t$ } Horizontal

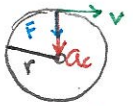
$V_{yf} = V_{yi} - g t$ } Vertical

$Y_f = Y_i + V_{yi} \cdot t - \frac{1}{2} g t^2$ } Vertical

Uniform circular: $a_c = V^2 \cdot \frac{1}{r}$

$T = 2\pi r \cdot \frac{1}{V}$

$\sum \vec{F} = m \cdot a_c = m \cdot \frac{V^2}{r}$



Newtons thoughts

$\sum F = ma$

$F = \frac{dP}{dt} = m \cdot \frac{dv}{dt} + v \cdot \frac{dm}{dt} = m \cdot a + V \cdot \frac{dm}{dt}$ ~~[kgm/s]~~

$\mu = f/N$:

$dw = F \cdot dr$, $W = \int F \cdot dr$

Hook spring

$F = -k \cdot x$

$W = \frac{1}{2} k a x^2$

$E_p = \frac{1}{2} k x^2$, $E_k = \frac{1}{2} m V^2$

$x(t) = A \cdot \cos(\omega t + \phi)$

Harmonic Waves

$Y(x,t) = A \cdot \sin(kx - \omega t + \phi)$

Utbr. hastighet: $V = \lambda f = \frac{\omega}{k}$

Partikelhastig: $V_p = \frac{dy}{dt} = -\omega A \cdot \cos(kx - \omega t)$

$k = \frac{2\pi}{\lambda}$, $\omega = 2\pi f = \frac{2\pi}{T}$

Transmisjonel: $V = \sqrt{T/\mu}$, $\mu = \frac{m}{L}$

Stående våg: Överton n: $\lambda = 2L \cdot \frac{1}{n+1}$, $n = 0, 1, 2 \ldots$

Grundton: $\lambda = 2L$

$Y(x,t) = A \cdot \sin(kx) \cdot \cos(\omega t)$

stängd i ena: $\lambda = 4L/(2n+1)$

Harmonisk: $Y_1 + Y_2 = 2A \cdot \cos(\frac{\phi}{2}) \cdot \sin(kx - \omega t + \frac{\phi}{2})$

Stående: Konst. int: $\frac{\phi}{2} = \pi m$

Dese. int: $\frac{\phi}{2} = (2m+1)\frac{\pi}{2}$

Thermodynamics

$PV = nRT = \frac{N}{N_A} \cdot R \cdot T$

$P = \frac{N}{V} \cdot \frac{R}{N_A} \cdot T = \frac{N}{V} \cdot k_B \cdot T$

$R = 8.31 \ J/(mol \cdot K)$

$N_A = 6.023 \cdot 10^{23}$

$k_B = 1.38 \cdot 10^{-23} \ \frac{J}{K}$

$1 \ atm = 1.013 \cdot 10^5 \ N/m^2$

Energy: 1atom: $E_{medel} = \frac{3}{2} k_B \cdot T$

2atom: $E_{medel} = \frac{5}{2} k_B \cdot T$

$E_{int} = n \cdot C_v \cdot \Delta T$

1atom: $C_v = \frac{3}{2} R$, $C_p = \frac{5}{2} R$

2:atom: $C_v = \frac{5}{2} R$, $C_p = \frac{7}{2} R$

Heat cap: $Q = c \cdot m \cdot \Delta T$

$Q = m \cdot L$

$C_{H_2O} = 4.18 \cdot 10^3$

$L_{H_2O} = 2260 \cdot 10^3$ ($\leftrightarrow$ gas)

$L_{H_2O} = 333 \cdot 10^3$ ($\leftrightarrow$ ice)

Expansion: $L = L_0(1 + \alpha \cdot \Delta T)$

$A = A_0(1 + \beta \cdot \Delta T)$, $\beta = 2\alpha$

$V = V_0(1 + \gamma \cdot \Delta T)$ $\gamma = 3\alpha$

Temp: $T(K) = t(C) + 273.15$

Light

$n = \frac{c}{v}$

$n_{glas} = 1.5$

$n_{vatten} = 1.33$

Optisk väg:

Brytningslag: $\sin\Theta_1 \cdot n_1 = \sin\Theta_2 \cdot \Theta_2$

Intensitet: $\frac{\text{Effekt}}{\text{Yta enhet}} = I \equiv A^2$

$I_{tot} = 4A^2 \cdot \cos^2(\frac{\phi}{2})$

Reflex: Mot tätare: 1 våg: Max $\equiv 2nd = (m + \frac{1}{2})\lambda$

Min $\equiv 2nd = m\lambda$

0 ll 2: Max $\equiv 2nd = m\lambda$

Min $\equiv 2nd = (m + \frac{1}{2})\lambda$

Koefficient: $R \equiv \frac{I_1}{I_0} = \left(\frac{n_2 - n_1}{n_2 + n_1}\right)^2$

Böining: $b \cdot \sin\Theta_{min} = \lambda$

Enkelspalt: $d \cdot \sin\Theta_{min} = m\lambda$

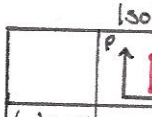
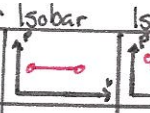
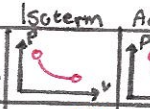
Dubbelspalt: $d \cdot \sin\Theta_{max} = m\lambda$: Gitter

Raleigh's: Slit: $\Theta_{min} = \frac{\lambda}{d}$

circle: $\Theta_{min} = 1.22 \frac{\lambda}{D}$

$\Theta_{min} = \frac{Y}{L}$

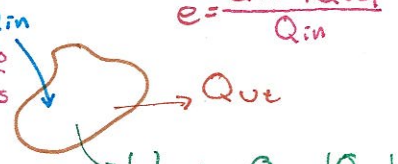
$Y = \frac{\lambda \cdot L \cdot m}{d}$

	Isokor	Isobar	Isoterm	Adiabat
				
W_{gas}	0	$P(V_f - V_i)$	$nRT\ln(\frac{V_f}{V_i})$	$-nC_v\Delta T$
Q	$n \cdot C_v \cdot \Delta T$	$n \cdot C_p \cdot \Delta T$	$nRT \cdot \ln(\frac{V_f}{V_i})$	0
ΔE_{int}	$n \cdot C_v \cdot \Delta T$	$n \cdot C_v \cdot \Delta T$	0	$nC_v\Delta T$

Thermal efficency

$e = \frac{\sum W_i}{\sum Q_{pos}} = \frac{\sum Q_i}{\sum Q_{pos}} = \frac{W_{netto}}{Q_{pos}}$

$e = \frac{Q_{in} - |Q_{ut}|}{Q_{in}}$



$Q = \Delta E_{int} + W_{gas}$

Heat transfer: $P = \frac{dQ}{dt} = k \cdot A \cdot \frac{T_h - T_c}{L} = k \cdot A \cdot grad(T) = -k \cdot A \cdot \frac{dT}{dx}$

Stela kroppar

$\Theta_f - \Theta_i = \omega_0 \cdot t + \frac{1}{2} \alpha \cdot t^2$

$\omega_f^2 - \omega_i^2 = 2\alpha \cdot \Delta\Theta$

$s = r\Theta$

$v = r\omega$

$a_t = r\alpha$

$a_c = r\omega^2$

$E_k = \frac{1}{2} I \omega^2$

$\tau = I\alpha = \frac{dL}{dt} = r \times F$ [Nm]

$L = I\omega = r \times p = m \cdot v \cdot r \cdot \sin\phi$ [$\frac{kgm^2}{s}$]

$I = \sum_i m_i r_i^2 = \int r^2 \cdot dm = \int \rho \cdot r^2 \cdot dV$ [kgm^2]

$\vec{a} \times \vec{b} = \begin{bmatrix} a_2b_3 - a_3b_2 \\ a_3b_1 - a_1b_3 \\ a_1b_2 - a_2b_1 \end{bmatrix}$

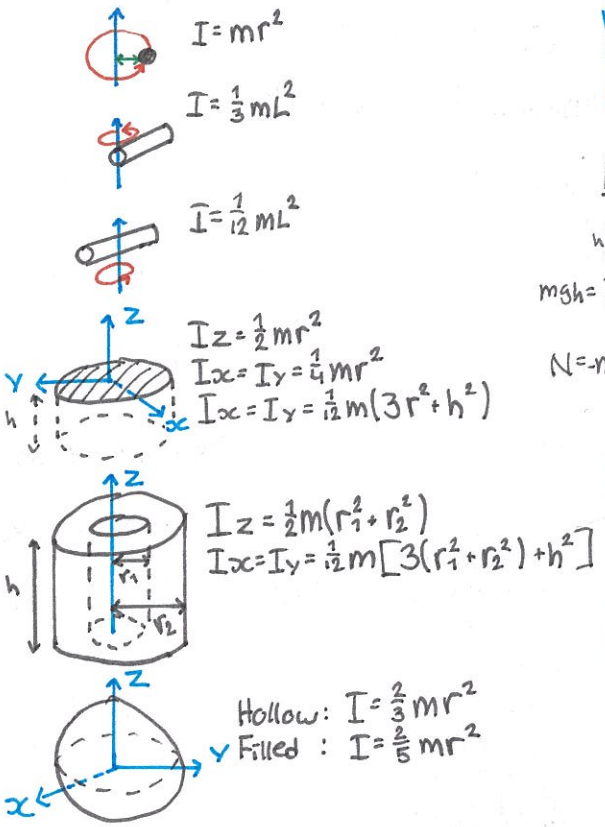
$\frac{rev}{min} \cdot \frac{2\pi}{60} = \frac{rad}{s}$

Parallellaxel: $I = I_{cm} + MD^2$

Tyngdp: $\frac{1}{M} \cdot \sum m_i \cdot r_i$ $(M = \sum m_i)$

Ljud i luft: 340 $\frac{m}{s}$

Inertia tabel



Projectile motion

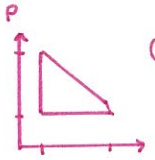
$x_f = x_i + v_{xi} \cdot t$

$v_{yf} = v_{yi} - gt$

$y_f = y_i + v_{yi} \cdot t - \frac{1}{2} g t^2$

$t = \frac{v_{yi}}{g} \pm \sqrt{\left(\frac{v_{yi}}{g}\right)^2 + \frac{2y_i}{g}}$

Wnetto



W_{netto} = triangelns yta = $\frac{1}{2}(P_h - P_l) \cdot \underbrace{1.031 \cdot 10^5}_{\text{om atm}} \cdot (V_h - V_l) \cdot \underbrace{10^{-3}}_{\text{om } l}$

Rulla kula

$mgh = \frac{I\omega^2}{2} + \frac{mv^2}{2} + 2Rgm$

$N = -mg + m\frac{v^2}{r} \Rightarrow mg = m\frac{v^2}{r}$

$\gamma = \frac{C_p}{C_v}$

Adiabatic: $PV^\gamma = konst$

$TV^{\gamma-1} = konst$

$P^{1-\gamma} \cdot T^\gamma = konst$

Carnot: $\left(\eta = 1 - \frac{T_h}{T_c}\right)$ $e = \frac{T_h - T_c}{T_h}$

Pendel

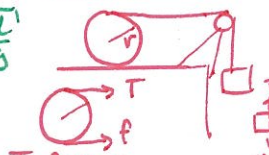
Matematisk: $\omega = \sqrt{\frac{g}{l}}$

$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{l}{g}}$

Densitet

$\rho = \frac{m}{V}$ $\left[\frac{kg}{m^3}\right]$

Rulla



Rull utan glid. Masslös tråsse?

$mg - T = ma$

$T + f = ma$

$Tr - fr = I\alpha$

Partiklar: Mekanisk energy bevaras: Se upp för: Deformation, Friktion

Rörelsemängden bevaras: Se upp för: Externa krafter

$F = ma$

Kropp: Mekanisk energi bevaras: Se upp för: Glidning

Rörelsemängdsmoment: Se upp för: Vridande moment

$T = I\alpha$, $F = a_{cm} \cdot M$