SPH3U Formula Sheet

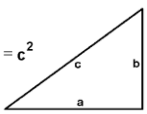
Kinematics

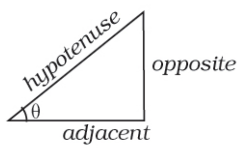
$v_{av} = \frac{\Delta d}{\Delta t}$ $\quad \vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t}$ $\quad \vec{a}_{av} = \frac{\Delta \vec{v}}{\Delta t}$

$\Delta \vec{d} = \left(\frac{\vec{v}_f + \vec{v}_i}{2}\right)\Delta t$ $\quad \vec{v}_f = \vec{v}_i + \vec{a}_{av}\Delta t$ $\quad \Delta \vec{d} = \vec{v}_i \Delta t + \frac{1}{2}\vec{a}_{av}\Delta t^2$

$\vec{v}_f^2 = \vec{v}_i^2 + 2\vec{a}_{av}\Delta \vec{d}$ $\quad \Delta \vec{d} = \vec{v}_f \Delta t - \frac{1}{2}\vec{a}_{av}\Delta t^2$ $\quad \vec{g} = -9.8 m/s^2$

$a^2 + b^2 = c^2$





$\sin\theta = \frac{o}{h}$

$\cos\theta = \frac{a}{h}$

$\tan\theta = \frac{o}{a}$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Forces

$\vec{F}_{Net} = m\vec{a}$ $\quad \vec{F}_g = m\vec{g}$ $\quad \mu_S = \frac{\vec{F}_S}{\vec{F}_N}$ $\quad \mu_K = \frac{\vec{F}_K}{\vec{F}_N}$

Energy

$W = \vec{F}\Delta\vec{d}$ $\quad W = \vec{F}cos\theta\Delta\vec{d}$ $\quad E_k = \frac{mv^2}{2}$ $\quad E_p = mgh$

$W_{net} = \frac{mv_2^2}{2} - \frac{mv_1^2}{2}$ $\quad W_{net} = \Delta E_k$ $\quad E_m = E_p + E_K$ $\quad \text{efficiency} = \frac{E_{out}}{E_{in}} \times 100\%$

$P = \frac{\Delta E}{\Delta t}$ $\quad P = \frac{W_{net}}{\Delta t}$ $\quad T_K = T_C + 273$ $\quad q = mc\Delta T$

$q_{released} + q_{absorbed} = 0$ $\quad q = mL_x$

$A = A_o\left(\frac{1}{2}\right)^{t/h}$ $\quad E = mc^2$

Table 1 Specific Latent Heats for Various Substances

Substance	Specific latent heat of fusion (L_f) (J/kg)	Melting point (°C)	Specific latent heat of vaporization (L_v) (J/kg)	Boiling point (°C)
aluminum	6.6×10^5	2519	4.0×10^5	10 900
ethyl alcohol	1.1×10^5	−114	8.6×10^5	78.3
carbon dioxide	1.8×10^5	−78	5.7×10^5	−57
gold	1.1×10^6	1064	6.4×10^4	2 856
lead	2.5×10^4	327.5	8.7×10^5	1 750
water	3.4×10^5	0	2.3×10^6	100

Table 1 Specific Heat Capacities of Common Substances

Substance	Specific heat capacity (J/(kg·°C))
water	4.18×10^3
ethyl alcohol	2.46×10^3
ice	2.1×10^3
aluminum	9.2×10^2
glass	8.4×10^2
iron	4.5×10^2
copper	3.8×10^2
silver	2.4×10^2
lead	1.3×10^2

Waves & Sound

$f = \frac{1}{T}$ $\quad v = \frac{\lambda(m)}{T(s)}$ $\quad v = f\lambda$ $\quad \mu = \frac{m}{L}$ $\quad v = \sqrt{\frac{F_T}{\mu}}$

$v = 331.4\frac{m}{s} + (0.606\frac{m}{s} / °C)T$ $\quad M = \frac{air\ speed\ of\ object}{local\ speed\ of\ sound}$ $\quad p = \frac{F}{A}$

$L_n = \frac{n\lambda}{2}$ for n = 1, 2, 3 ... fixed or free ends $\quad L_n = \frac{(2n-1)}{4}\lambda$ for n = 1, 2, 3 ... a fixed and a free end

$f_{obs} = \left(\frac{v_{sound}+v_{detector}}{v_{sound}+v_{source}}\right)f_0$ $\quad f_1L_1 = f_2L_2$

Electricity & Magnetism

$P = \frac{\Delta E}{\Delta t}$ $\quad V = \frac{\Delta E}{Q}$ $\quad I = \frac{Q}{\Delta t}$ $\quad V_{series} = V_1 + V_2 + \cdots$ $\quad V_{parallel} = V_1 = V_2 = \cdots$

$I_{series} = I_1 = I_2 = \cdots$ $\quad I_{parallel} = I_1 + I_2 = \cdots$ $\quad R = \frac{V}{I}$ $\quad R_{series} = R_1 + R_2 = \cdots$

$R_{parallel} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$ $\quad \frac{V_p}{V_s} = \frac{N_p}{N_s}$ $\quad \frac{I_s}{I_p} = \frac{N_p}{N_s}$ $\quad \frac{I_s}{I_p} = \frac{V_p}{V_s}$