Physics Cheat Sheet

Kinematics

Position $\neq$ Displacement
$\vec{d_1} = 20m[E]$
$\Delta\vec{d} = \vec{d}_{final} - \vec{d}_{initial}$
$\Delta\vec{d}_{total} = \Delta\vec{d}_1 + \Delta\vec{d}_2$
$\Delta\vec{d} = \vec{v} \times \Delta t$
$\vec{a} = \frac{\Delta\vec{v}}{\Delta\vec{t}} = \frac{\vec{v}_f - \vec{v}_i}{t_2 - t_1}$
$\vec{v}_f = \vec{v}_i + \vec{a} \times \Delta t$

Five Key Equations

$$\vec{a} = \frac{\vec{v}_f - \vec{v}_i}{\Delta t} \qquad \Delta\vec{d}$$

$$\Delta\vec{d} = \frac{\vec{v}_f + \vec{v}_i}{2}\Delta t \qquad \vec{a}$$

$$\Delta\vec{d} = \vec{v}_1\Delta t + \frac{1}{2}\vec{a}\Delta t^2 \qquad \vec{v}_2$$

$$\Delta\vec{d} = \vec{v}_2\Delta t - \frac{1}{2}\vec{a}\Delta t^2 \qquad \vec{v}_1$$

$$\vec{v}_2^2 = \vec{v}_1^2 + 2\vec{a}\Delta\vec{d} \qquad \Delta t$$

$g = -9.8\ m/s^2$

Adding Vectors

$\Delta\vec{d} = n\ \mathrm{m}[E\theta^\circ N]$
$\Delta\vec{d}_x = n\cos\theta$
$\Delta\vec{d}_y = n\sin\theta$
$\Delta\vec{d}_T^2 = \Delta\vec{d}_1 + \Delta\vec{d}_2$
$\Delta\vec{d}_{T_x} = \Delta\vec{d}_{1_x} + \Delta\vec{d}_{2_x}$
$\Delta\vec{d}_{T_y} = \Delta\vec{d}_{1_y} + \Delta\vec{d}_{2_y}$
$|\Delta\vec{d}_T| = \sqrt{(\Delta\vec{d}_{1_x} - \Delta\vec{d}_{2_x})^2 + (\Delta\vec{d}_{1_y} - \Delta\vec{d}_{2_y})^2}$
$\theta = \tan(\frac{\Delta\vec{d}_y}{\Delta\vec{d}_x})$

Acceleration in Two Dimensions

$\vec{v}_{og} = \vec{v}_{om} + \vec{v}_{mg}$
$1\ \mathrm{N} = 1\ \mathrm{kg}\frac{m}{s^2}$
$\vec{F}_g = m\vec{g}$
$\vec{F}_f \propto F_N$
$\mu = \frac{F_f}{F_N}$

Newtons Laws

$F_{net_y} = F_N - F_g$
$F_{net_x} = F_a - F_f$
$\vec{F}_{net} = m \times \vec{a}$
$|\vec{a}| = \frac{|\vec{F}_{net}|}{m}$
$\overrightarrow{F_{Action}} = -\overrightarrow{F_{Reaction}}$

Work and Energy

$1\ \mathrm{J} = 1\ \mathrm{kg}\frac{m^2}{s^2} = 1\ \mathrm{N}\times m$
$W = \overrightarrow{F_{app}} \times \Delta\vec{d}$
$W = F_a\cos\theta \times \Delta d$
$W = \frac{F_{max}\times\Delta d}{2}$
$W = F_{av} \times \Delta d$
$E_k = \frac{mv^2}{2}$
$W = \Delta E_k$
$E_g = mgh$
$E_{T_1} = E_{T_2}$
$E_T = E_k + E_g$
$E_{k_1} + E_{g_1} = E_{k_2} + E_{g_2}$
$E_{T_1} + W_{done} = E_{T_2}$
$W_{done} = \Delta E_T$
$P = \frac{W_{net}}{\Delta t}$
Efficiency $= \frac{\text{useful Output Energy}}{\text{Total input energy}} \times 100\%$
$E = \frac{E_{output}}{E_{input}} \times 100\%$

Waves and Sound

period $= \frac{\text{total time}}{\text{number of cycles}}$
frequency $= \frac{\text{number of cycles}}{\text{total time}}$
$v = \frac{d}{t}$
$v = \lambda \times \frac{1}{T}$
$v = \lambda \times f$
$v = 331.4 + 0.606T$
$\mu = \frac{m}{L}$
$v = \sqrt{\frac{F_T}{\mu}}$
$M = \frac{\text{Speed of object}}{\text{Speed of sound in air}} = \frac{v_o}{v_s}$
$I = \frac{P}{A}$
$\frac{I_1}{I_2} = \frac{r_2^2}{r_1^2}$
$\beta = 10\log(\frac{I_2}{I_1})$
$I_1 = 10^{-12}$
$\frac{I_2}{I_1} = (10)^{\frac{\beta_2 - \beta_1}{10}}$
$\lambda_2 = \lambda_1 - v_oT$
$f_2 = f_1(\frac{v_s}{v_s - v_o})$
$f_3 = f_1(\frac{v_s}{v_s + v_o})$

Wave Interactions

$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2}$
$L = \frac{n\lambda}{2}$
$f_n = nf_1$
$L = \frac{(2n-1)\lambda}{4}$
$f_n = (2n-1)f_1$
$L_2 - L_1 = \frac{\lambda}{2}$
$\frac{f_1}{f_2} = \frac{L_2}{L_1} = \frac{\sqrt{T_1}}{\sqrt{T_2}} = \frac{d_2}{d_1} = \frac{\sqrt{P_2}}{\sqrt{P_1}}$
$f_B = |f_2 - f_1|$

Electricity

$e^- = -1.6 \times 10^{-19}C$
$Q = N \times e$
$I = \frac{Q}{t}$
$V = \frac{E}{Q}$
$E = VIt$
$R = \frac{V}{I}$
$R_T = R_1 + R_2 + R_3 + \ldots$
$V_T = V_1 + V - 2 + V_3 + \ldots$
$I_T = I_1 = I_2 = I_3 = \ldots$
$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$
$I_T = I_1 + I_2 + I_3 + \ldots$
$V_T = V_1 = V_2 = V_3 = \ldots$
$P = I^2R$
$P = \frac{V^2}{R}$
$P = I \times V$

Magnetism

$P_p = P_s$
$V_pI_p = V_sI_s$
$\frac{V_p}{V_s} = \frac{I_s}{I_p}$
$V \propto N$
$\frac{V_p}{V_s} = \frac{I_s}{I_p} = \frac{N_p}{N_s}$
$P_{lost} = I^2R$