Physics I & II Formulas

**Kinematics**

\[ v_{av} = \frac{\Delta d}{\Delta t} = \frac{v_i + v_f}{2} \]
\[ a_{av} = \frac{v_f - v_i}{\Delta t} \]
\[ \Delta d = \frac{(v_i + v_f)\Delta t}{2} \]
\[ \Delta d = v_f \Delta t - \frac{1}{2} a \Delta t^2 \]
\[ v_f = v_i + a \Delta t \]
\[ \Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2 \]
\[ v_f^2 = v_i^2 + 2a \Delta d \]

**Dynamics**

\[ F_{oc} = ma \]
\[ F_g = mg \]
\[ F_a = \frac{Gm_m}{\Delta d^2} \]
\[ F_f = \mu F_N \]
\[ F = kx \]
\[ a_c = \frac{v^2}{r} \]
\[ F_c = ma_c = \frac{mv^2}{r} \]
\[ a_c = \frac{4\pi^2 r}{T^2} = 4\pi^2 rf^2 \]
\[ F_1 = m_1 \left( \frac{d_2}{d_1} \right)^2 \]
\[ g = \frac{GM}{R^2} \]
\[ v_{ex} = \sqrt{\frac{2GM}{r}} \]
\[ r^3 = \frac{GM}{4\pi^2} \]
\[ v^2 = \frac{Gm_k}{r} \]

**Energy, Momentum & Power**

\[ W = F\Delta d \cos \theta \]
\[ E_g = mgh = \frac{Gm}{r} \]
\[ E_k = \frac{1}{2} mv^2 \]
\[ E_{eh} = F_f \Delta d \]
\[ E_{elastic} = \frac{1}{2} Kx^2 \]
\[ T = 2\pi \sqrt{\frac{m}{k}} \]
\[ P = \frac{W}{\Delta t} = \frac{F\Delta d}{\Delta t} = Fv_{av} \]
\[ p = mv \]
\[ p = p' \]
\[ J = F\Delta t = m\Delta v = \Delta p \]
\[ \text{efficiency} = \frac{W_{\text{output}}}{W_{\text{input}}} \times 100\% \]

**Important**

*NO displacement, NO work*

*When work is done ON the system, work is POSITIVE*

*When work is done BY the system, work is NEGATIVE*

The information for this handout was compiled from the following sources:
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Waves
\[ v = A f \]
\[ L = \frac{n\lambda}{2} \]
\[ L = \frac{(2n-1)\lambda}{4} \]
\[ n_1 \sin \theta = n_2 \sin \theta \]
\[ \sin \theta = \frac{1}{n} \]
\[ n\lambda = d \sin \theta \]

Where \( v \) is also \( v = \sqrt{\frac{f}{\mu}} \)

\( \nu \) Wave speed \( [\nu] = \text{m/s} \)

\( \lambda \) Wavelength \( [\lambda] = \text{m} \)

\( A \) Amplitude \( [A] = \text{m} \)

\( f \) Frequency \( [f] = \text{Hz} \)

\( T \) Period \( [T] = \text{s} \)

Electricity and Magnetism Equations (Also suitable for AP Physics Exam) from PhysicsLand.com

\[ F = \frac{kq_1 q_2}{r^2} \]

\[ E = \frac{F}{q} \]

\[ U_e = qV = \frac{kq_1 q_2}{r} \]

\[ I_{avg} = \frac{\Delta Q}{\Delta t} \]

\[ R = \frac{E}{I} \]

\[ \nu = I \]

\[ P = IV \]

\[ V = \frac{C}{Q} \]

\[ C = \frac{\epsilon_0 A^2}{d} \]

\( \eta_{av} = -\frac{\Delta H}{\Delta t} \)

\( E = \frac{B}{c} \)

Where:

\( A \) area

\( B \) magnetic field

\( C \) capacitance

\( d \) distance

\( E \) electric field

\( F \) force

\( l \) length

\( P \) power

\( Q \) charge

\( q \) point charge

\( R \) resistance

\( \theta \) angle

\( \rho \) resistivity

\( \theta \) angle

\( \phi_m \) magnetic flux

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