PHYSICS FORMULAS

SCIENTIFIC NOTATION

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Power of ten</th>
<th>E notation</th>
<th>Decimal form</th>
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<tbody>
<tr>
<td>tera</td>
<td>T</td>
<td>10^12</td>
<td>E + 12</td>
<td>1,000,000,000,000</td>
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<tr>
<td>giga</td>
<td>G</td>
<td>10^9</td>
<td>E + 09</td>
<td>1,000,000,000</td>
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<tr>
<td>mega</td>
<td>M</td>
<td>10^6</td>
<td>E + 06</td>
<td>1,000,000</td>
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<tr>
<td>kilo</td>
<td>k</td>
<td>10^3</td>
<td>E + 03</td>
<td>1,000</td>
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<tr>
<td>hecto</td>
<td>h</td>
<td>10^2</td>
<td>E + 02</td>
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<td>deka</td>
<td>da</td>
<td>10</td>
<td>E + 01</td>
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<td>deci</td>
<td>d</td>
<td>10^-1</td>
<td>E – 01</td>
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<td>centi</td>
<td>c</td>
<td>10^-2</td>
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<td>mili</td>
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<td>E – 03</td>
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<tr>
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<td>µ</td>
<td>10^-6</td>
<td>E – 06</td>
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<tr>
<td>atto</td>
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<td>E – 18</td>
<td>0.000000000000001</td>
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KINEMATIC FORMULAS

Magnitude: \[ ||\mathbf{R}|| = \sqrt{(Rx^2 + Ry^2)} \]

Direction: \[ \tan \theta = \frac{Ry}{Rx} \]

\[ V_0 \theta = (V_0 \cos \theta, V_0 \sin \theta) \]

Velocity:

\[ V_{av} = \left( \frac{d}{t} \right) \]

: \( d \) = distance, \( t \) = elapsed time

\[ V_{BA} = V_{BE} - V_{AE} \]

: relative velocity

\[ V_{av} = \left( \frac{\Delta x}{\Delta T} \right) = \left( \frac{x-x_0}{T-T_0} \right) \]

: Velocity average

\[ V = \left( \frac{dx}{dt} \right) \]

: Instantaneous velocity

Acceleration:

\[ A_{av} = \left( \frac{\Delta V}{\Delta T} \right) \]

: \( V = \) velocity, \( t = \) elapsed time

\[ A_{av} = \left( \frac{\Delta v}{\Delta T} \right) = \left( \frac{V-V_0}{T-T_0} \right) \]

: Acceleration average

\[ A = \left( \frac{dv}{dt} \right) \]

: Instantaneous acceleration

Constant acceleration:

\[ x = \frac{1}{2}a_ot^2 + v_o t + x_o \rightarrow \theta = \frac{1}{2}at^2 + \omega_o t + \theta_o \]

\[ v = a_0 t + v_o \rightarrow \omega = at + \omega_o \]

\[ v^2 - v_o^2 = 2a(\Delta x) \rightarrow \omega^2 - \omega_o^2 = 2a(\Delta \theta) \]
PHYSICS FORMULAS

Newton 2nd law:  \[ \sum F = ma \rightarrow \sum T = I\alpha \]  
: \( F \) = force, \( m \) = mass, \( a \) = acceleration  
: \( T \) = torque, \( I \) = moment of inertia, \( \alpha \) = rotational acceleration

Work:  
\[ W = F \cdot \Delta x \]  
: \( w \) = work, \( F \) = force, \( \Delta x \) = distance

Universal Gravitation:  
\[ F = G \frac{m_1 \cdot m_2}{r^2} \]  
: \( F \) = force of attraction, \( m_1 \cdot m_2 \) = product of masses  
\( G \) = grav const \( r \) = radial distance between 2 masses

Centripetal Force:  
\[ F = \frac{m \cdot v^2}{r} \]  
: \( F \) = centripetal force, \( m \) = mass, \( v \) = velocity, \( r \) = radius

Pendulum:  
\[ T = 2\pi\sqrt{\frac{l}{g}} \]  
: \( T \) = period, \( l \) = length, \( g \) = acceleration of gravity

Mechanical heat:  
\[ W = J \cdot Q \]  
: \( W \) = work, \( Q \) = heat, \( J \) = mech equiv of heat

ENERGY RELATIONSHIPS

Kinetic Energy  
\[ KE = \frac{1}{2}m \cdot v^2 \]  
: \( KE \) = kinetic energy, \( m \) = mass, \( v \) = velocity

Potential Energy  
\[ U = m \cdot g \cdot \Delta y \]  
: \( U \) = potential energy, \( m \) = mass, \( g \) = acceleration of gravity

Conservation of energy  
\[ \sum E_{in} = \sum E_{out} \]  
: \( E_{in} \) = energy in, \( E_{out} \) = energy out

OPTICAL RELATIONSHIPS

Wave formula:  
\[ v = f \cdot \lambda \]  
: \( v \) = wave speed, \( f \) = frequency, \( \lambda \) = wave length

Images:  
\[ \frac{S_o}{S_i} = \frac{D_o}{D_i} \]  
: \( S_o \) = object size, \( S_i \) = image size, \( D_o \) = object

Focal length:  
\[ \frac{1}{f} = \frac{1}{D_o} + \frac{1}{D_i} \]  
: \( f \) = focal length, \( D_o \) = object, \( D_i \) = image distance

Snells law:  
\[ n_1 \sin \theta_1 = n_2 \sin \theta_2 \]  
: \( n_1 \) = refractive index, \( \theta \) = angle between ray to surface

ELECTRICITY AND MAGNETISM

Electric current:  
\[ I = \frac{q}{t} \]  
: \( I \) = current, \( q \) = charge, \( t \) = time

Coulombs law:  
\[ F = k \frac{q_1 q_2}{d^2} \]  
: \( F \) = force, \( k \) = coulombs constant, \( q \) = charge, \( d \) = dist

Capacitance:  
\[ C = \frac{q}{V} \]  
: \( C \) = capacitance, \( V \) = potential difference, \( q \) = charge

Ohms law:  
\[ E = I \cdot R \]  
: \( E \) = emf of source, \( I \) = Current, \( R \) = resistance

Induced EMF:  
\[ E = -N \frac{d\phi}{dt} \]  
: \( N \) = number of turns, \( \frac{d\phi}{dt} \) = change in flux

Induced EMF:  
\[ E = B \cdot L \cdot V \]  
: \( E \) = induced emf, \( L \) = length, \( V \) = velocity

Instantaneous voltage:  
\[ e = E_{max} \sin \theta \]  
: \( e \) = instantaneous voltage, \( E_{max} \) = max voltage

Instantaneous current:  
\[ i = I_{max} \sin \theta \]  
: \( i \) = instantaneous current, \( I_{max} \) = max current