CP Physics - Student Formula Sheet

Formula	**Formula in Words**
$a^2 + b^2 = c^2$	(Pythagorean Theorem)
Sine θ = $\frac{\text{Opposite}}{\text{Hypotenuse}}$	Sin θ = $\frac{O}{H}$
Cosine θ = $\frac{\text{Adjacent}}{\text{Hypotenuse}}$	Cos θ = $\frac{A}{H}$
Tangent θ = $\frac{\text{Opposite}}{\text{Adjacent}}$	Tan θ = $\frac{O}{A}$
$\text{Sine}^{-1}\left(\frac{\text{Opposite}}{\text{Hypotenuse}}\right) = \theta$	$\text{Sin}^{-1}\left(\frac{O}{H}\right) = \theta$
$\text{Cosine}^{-1}\left(\frac{\text{Adjacent}}{\text{Hypotenuse}}\right) = \theta$	$\text{Cos}^{-1}\left(\frac{A}{H}\right) = \theta$
$\text{Tangent}^{-1}\left(\frac{\text{Opposite}}{\text{Adjacent}}\right) = \theta$	$\text{Tan}^{-1}\left(\frac{O}{A}\right) = \theta$
$v = \frac{\Delta d}{t} = \frac{df - di}{t}$	Velocity = $\frac{\text{change in displacment}}{\text{time}} = \frac{\text{Final Displacement} - \text{Initial Displacment}}{\text{time}}$
$a = \frac{\Delta v}{t} = \frac{vf - vi}{t}$	Acceleration = $\frac{\text{change in velocity}}{\text{time}} = \frac{\text{Final Velocity} - \text{Initial Velocity}}{\text{time}}$
$v = a \cdot t$	Instantaneous Velocity = Acceleration · Time
$d = (v_i \cdot t) + (½ \cdot a \cdot t^2)$	Displacement = (Initial Velocity · Time) + (½ · Acceleration · Time^2)
$v_f = v_i + a \cdot t$	Final Velocity = Initial Velocity + Acceleration · Time
$d = \frac{vi + vf}{2} \cdot t$	Displacement = $\frac{\text{Initial Velocity} + \text{Final Velocity}}{2}$ · Time
$v_f^2 = v_i^2 + 2 \cdot a \cdot d$	Final Velocity^2 = Initial Velocity^2 + 2 · Acceleration · Displacement
$a_c = v^2 / r$	Centripetal Acceleration = Velocity^2 / Radius of Curve
Free Fall: $v = g \cdot t$	Velocity of a Falling Object = Acceleration due to Gravity · Time
$v_f = v_i - g \cdot t$	Final Velocity = Initial Velocity - Acceleration due to Gravity · Time
$d = (v_i \cdot t) - (½ \cdot g \cdot t^2)$	Displacement = (Initial Velocity · Time) - (½ · Acceleration due to Gravity· Time^2)
Hang Time: $t_{up} = t_{down}$	Time Spent Going Upwards = Time Spent Going Downwards
$t_{total} = 2 \cdot t_{up}$	Total Time Spent Going Up and Down = 2 · Time Spent Going Upwards
$♠_y = ♠ \cdot \sin(\theta)$	Y-Component of ♠ = ♠ · Sine (θ) Note: ♠ is a placeholder for velocity, force, etc.
$♠_x = ♠ \cdot \cos(\theta)$	X-Component of ♠ = ♠ · Cosine (θ) Note: ♠ is a placeholder for velocity, force, etc.
$F = m \cdot a$	Force = mass · acceleration (Newton's 2nd Law)
$W_t = m \cdot g$	Weight of an Object (Force of Gravity) = mass · acceleration due to gravity
$F_N = m \cdot g$	Normal Force = mass · acceleration due to gravity (only true in CP Physics)
$F_1 = F_2$	The Force on Object 1 = The Force on Object 2 (Newton's 3rd Law)
$m_1 \cdot a_1 = m_2 \cdot a_2$	Mass of Object 1 · Acceleration of Object 2 = Mass of Object 2 · Acceleration Object 2

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$F_f = \mu \cdot F_N$	Force of Friction = Coefficient of Friction (Static or Kinetic) · Normal Force
$F = k \cdot \Delta x$	Force on a Spring = Spring Constant · Change in Spring Length (Hooke's Law)
$W = F \cdot d$	Work = Force Applied · Displacement
$PE = m \cdot g \cdot h$	Potential Energy = mass · acceleration due to gravity · height
$KE = \frac{1}{2} \cdot m \cdot v^2$	Kinetic Energy = ½ · mass · velocity^2
$P = \frac{W}{t}$	Power = $\frac{\text{Work}}{\text{time}}$ Note: You can use Work, PE, or KE in the numerator in this formula
$p = m \cdot v$	Momentum = mass · velocity
$I = F \cdot \Delta t$	Impulse = Force · Time Interval
$I = m \cdot (v_f - v_i)$	Impulse = Change in Momentum [mass · (final velocity – initial velocity)]
$F \cdot \Delta t = m \cdot (v_f - v_i)$	Force · Time Interval = mass · (final velocity – initial velocity)
$p_{initial} = p_{final}$	Momentum Before an Interaction = Momentum After an Interaction
$p_{1i} + p_{2i} = p_{1f} + p_{2f}$	Momentum of Objects Before Interaction = Momentum of Objects After Interaction
$(m_{1i} \cdot v_{1i}) + (m_{2i} \cdot v_{2i}) = (m_{1i} \cdot v_{1i}) + (m_{2i} \cdot v_{2i})$	Formula for an Elastic Collision
$(m_{1i} \cdot v_{1i}) + (m_{2i} \cdot v_{2i}) = (m_1 + m_2) \cdot v_f$	Formula for an Inelastic Collision

Quantity	**Standard Unit (Abbreviation)**	**Standard Unit (Word)**
Displacement / Distance	m	meter
Velocity / Speed	m/s	meters / second
Acceleration	m/s^2	meters / second^2
Mass	kg	kilogram
Force	N	Newton
Weight	N	Newton
Coefficient of Friction (Static and Kinetic)	[unitless]	[unitless]
Spring Constant	N/m	Newtons / meter
Work	J	Joule
Potential Energy	J	Joule
Kinetic Energy	J	Joule
Power	W	Watt
Momentum	kg · m/s	kilogram · meter / second
Impulse	N · s	Newton · seconds