AP Physics Formulas (Kinematic) Cheat Sheet

by ReSummit via cheatography.com/52223/cs/14186/

Kinematics 2D Motion

$V = V_0 + at$	V_0 = Initial velocity of object V = Final velocity of object a = Acceleration of object t = Time
$V^2 = V_0^2 + 2a\Delta x$	V_0 = Initial velocity of object V = Final velocity of object a = Acceleration of object Δx / Δy = Change in position
$\Delta x = V_0 t + \frac{1}{2}at^2$	Δx / Δy = Change in position V_0 = Initial velocity t = Time a = Acceleration
$F = ma$	F = Force from object m = Mass of object a = Acceleration of object
$F_f = \mu N$	F_f = Force of friction μ = Coefficient of friction N = Normal force

Note: Some formulas may involve BOTH the x and y directions, as well as incorporate other formulas outside kinematics.

Momentum

$F\Delta t = \Delta p = mV - mV_0$	$F\Delta t = \Delta p$ = Impulse mV = Final momentum mV_0 = Initial momentum

$mV_{before} - mV_{0before} = mV_{after} - mV_{0after}$

Note: Momentum is ALWAYS conserved. You may need to note that the momentum before is equal to the momentum after.

Energy

$W = Fd$	W = Work done F = Force applied d = Distance travelled

Energy (cont)

$W = \Delta KE = \frac{1}{2}mV^2 - \frac{1}{2}mV_0^2$	W = Work done m = Mass of object V = Final velocity V_0 = Initial velocity
$U_g = mgh$	U_g = Work done by gravity m = Mass g = Gravity h / d = Height or distance traveled
$F_S = kx$	F_S = Force of spring (Restored Force) k = Spring coefficient x = Distance from equilibrium
$W_S = U_S = \frac{1}{2}kx^2$	W_S = Work done by spring k = Spring coefficient x = Distance from equilibrium
$KE = \frac{1}{2}mV^2$	KE = Kinetic Energy m = Mass v = Velocity of object
$KE + U_g + U_S =$ $KE + U_g + U_S + W$	KE = Kinetic Energy (is the object moving?) U_g = Work done by gravity (is the object above where you set x = 0?) U_S = Work done by spring (is a spring involved?) W = Friction (did energy go to friction?)

Note: Energy is **SOMETIMES** conserved depending on the situation. **Inelastic** collisions cannot apply the conservation of energy because of the loss of energy. However, you can apply the conservation of energy for **elastic** collisions.

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Rotational Motion

$\omega = \omega_0 + \alpha t$	ω_0 = Angular initial velocity ω = Angular final velocity α = Angular acceleration t = Time
$\omega^2 = \omega_0{}^2 + 2\alpha\theta$	ω_0 = Angular initial velocity ω = Angular final velocity α = Angular acceleration θ = Angular change in position
$\theta = \omega_0 t + ½\alpha t^2$	θ = Angular change in position ω_0 = Angular initial velocity t = Time α = Angular acceleration
$V_T = r\omega$	V_T = Tangential (Linear) velocity r = Radius ω = Angular final velocity
$a_T = r\alpha$	a_T = Tangential (Linear) acceleration r = Radius α = Angular acceleration
$a_C = V_T{}^2 / r$	a_C = Centripetal acceleration V_T = Tangential (Linear) velocity r = Radius
$a_r = r\omega^2$	a_r = Radial Acceleration r = Radius ω = Angular velocity

Rotational Motion (cont)

$\tau = F_\perp d$	τ = Torque $F_\perp$ = Perpendicular Forces d= Distance from Pivot Point
I = Σmr^2	I = Moment of Inertia (Rotational Moment / Rotational Intertia) Σmr^2 = Total of each Mass x Radius Squared
$KE_C = 1/2(I)\omega^2$	KE_C = Kinetic Circular Energy I = Moment of Inertia (Rotational Moment / Rotational Intertia) ω = Angular velocity
$\tau = I\alpha$	τ = Torque I = Moment of Inertia (Rotational Moment / Rotational Intertia) α = Angular acceleration
$KE_R = 1/2\ I_P\omega^2 = 1/2(I_{COM} + mh^h)\omega^2 =1/2(m(V_{COM})^2) + 1/2I\omega^2$	KE_R = Kinetic Rolling Energy $1/2(m(V_{COM})^2)$ = Sliding Equation $1/2I\omega^2$ = Rotation Equation
$l = mr\omega$	l = Momentum of a particle
$L = I\omega$	L = Momentum of a rigid body (not a particle)

NOTE:
- You may need to consider that $\omega = d\theta / dt$ and $\alpha = d\omega / dt$.
- Account for all objects rotating the pivot point when calculating I.
- Momentum is **ALWAYS** conserved.