General Physics I - Equation Sheet

-Linear Motion Equations -Projectile Motion Equations

$V=V\_{0}+at \leftarrow $ **no x** $V\_{0x}=V\_{0}cosθ$ ; $V\_{0y}=V\_{0}sinθ$

$x=x\_{0}+\frac{1}{2}\left(V\_{0}+V\right)t$ $\leftarrow $ **no a** $V\_{y}=V\_{0y}-gt$ (where $g=9.80\frac{m}{s^{2}}$)

$x=x\_{0}+V\_{0}t+\frac{1}{2}at^{2}$ $\leftarrow $ **no V** $x=x\_{0}+V\_{0x}t$

$V^{2}=V\_{0}^{2}+2a(x-x\_{0})$ $\leftarrow $ **no t** $y=y\_{0}+V\_{0y}t-\frac{1}{2}gt^{2}$

-Force Equations -Energy Equations

$F\_{net}=ma$ (Newton’s 2nd Law) $W=Fd$ (Work)

$W=F\_{N}=mg$ (Weight) $KE=\frac{1}{2}mV^{2}$ (Kinetic Energy)

$F\_{sp}=-kx$ (Hooke’s Law) $PE=U=mgh$ (Potential Energy)

$F\_{cir}=\frac{mV^{2}}{r}$ (Circular Motion) $E\_{sp}=\frac{1}{2}kx^{2}$ (Spring Energy)

$f\_{s}\leq μ\_{s}F\_{N}$ (Static Friction) $Q=mc∆T$ (Thermal Energy)

$f\_{k}=μ\_{k}F\_{N}$ (Kinetic Friction)

-Gravitation Equations -Momentum Equations

$F=\frac{Gm\_{1}m\_{2}}{r^{2}}$ (Gravitational Force) $P=mV$

$F=\frac{mV^{2}}{r}$ ; $=\frac{GM}{r^{2}}$ ; $V=\frac{2πr}{T}$ $m\_{1}V\_{1i}+m\_{2}V\_{2i}=(m\_{1}+m\_{2})V\_{f}$ (Inelastic)

$V=\sqrt{\frac{GM}{r}}$ (Circular Orbit) $m\_{1}V\_{1i}+m\_{2}V\_{2i}=m\_{1}V\_{1f}+m\_{2}V\_{2f}$ (Elastic)

$V\_{esc}=\sqrt{\frac{2GM}{r}}$ (Escape Velocity)

$U=-\frac{GMm}{r}$ (Gravitational Potential Energy)

-Rotational Motion Equations -Torque Equations

$\overbar{ω}=\frac{1}{2}(ω\_{0}+ω)$ ; $V=ωr$ ; $a=αr$ $τ=\left|r\right|\left|F\right|sinθ$

$ω=ω\_{0}+αt$ $\leftarrow $ **no** $θ$ $τ=Iα$ (for I-values look at p.163)

$θ=θ\_{0}+ω\_{0}t+\frac{1}{2}αt^{2}$ $\leftarrow $ **no** $ω$$KE\_{rot}=\frac{1}{2}Iω^{2}$ (Rotational Kinetic Energy)

$ω^{2}=ω\_{0}^{2}+2α(θ-θ\_{0})$ $\leftarrow $ **no t**

-Oscillatory Motion Equations -Thermodynamics Equations

$f=\frac{1}{T}$ ; $=2πf=\frac{2π}{T}$ ; $ω=\sqrt{\frac{k}{m}}$ $Q=mc∆T$ (for more info look at p.268)

$x\left(t\right)=Acos(ωt+ϕ)$ (Simple Harmonic Motion) $T\_{C}=T\_{K}-273.15$ (Kelvin to Celsius)

$V\left(t\right)=-ωAsin(ωt)$ $T\_{F}=\frac{9}{5}T\_{C}+32$ (Celsius to Fahrenheit)

$ω=\sqrt{\frac{g}{L}}$ (Simple Pendulum) $PV=nRT=NkT$ (Ideal Gas Law)

 $Q=mL$ (Heat of Transform.)

-Fluid Motion Equations -Wave Motion Equations

$P=\frac{F}{A}$ (Pressure) $V=λf=\frac{λ}{T}$ ; $V=\frac{ω}{k}$

$P=P\_{0}+ρgh$ $k=\frac{2π}{λ}$ (Wave Number)

$P\_{1}+\frac{1}{2}ρV\_{1}^{2}+ρgy\_{1}=P\_{2}+\frac{1}{2}ρV\_{2}^{2}+ρgy\_{2}$ $y\left(x,t\right)=Acos(kx\pm ωt)$ (Sinusoidal Wave)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Constant | Symbol | Value | Units | Alternative |
| Speed of Light | c | 3.00x108 | $$\frac{m}{s}$$ | -------------- |
| Gravitational Constant | G | 6.67x10-11 | $$\frac{N∙m^{2}}{kg^{2}}$$ | -------------- |
| Earth’s Mass | M | 5.97x1024 | kg | -------------- |
| Earth’s Radius | R | 6.37x106 | m | -------------- |
| Boltzmann’s Constant | k | 1.38x10-23 | $$\frac{J}{K}$$ | -------------- |
| Ideal Gas Constant | R | 8.314 | $$\frac{J}{K∙mol}$$ | 0.0821 $\frac{L∙atm}{K∙mol}$ |
| Avogadro’s Number | NA | 6.02x1023 | $$\frac{1}{mol}$$ | -------------- |

- Conversion Factors

**Length Time Mass Energy**

1 mi = 5280 ft 1 d = 24 hr 1 metric ton = 1000 kg 1 Cal = 1000 cal

1 ft = 12 in 1 hr = 60 min 1 lb = 0.454 kg 1 cal = 4.184 J

1 in = 2.54 cm 1 min = 60 sec 1 kg = 1000 g

**Chemistry Pressure**

1 mol = 6.02x1023 molecules 1 atm = 101.3 kPa = 101,300 Pa = 760 mmHg = 760 torr

1 g = 6.02x1023 amu