Translational motion	$x = x_o + v_o t + 1/2at^2$ | $(V_f)^2 = (V_o)^2 + 2ax$	$V_f = V_o + at$
Frictional force	$f_{max} = \mu N$	$\mu_k < \mu_s$ always
Uniform circular motion	$F_c = ma_c = mv^2/r$	$a_c = v^2/r$
Momentum, Impulse	$I = F\Delta t = \Delta M$	$M = mv$
Work, Power	$W = F d \cos\theta$	$P = \Delta W/\Delta t$
Energy (conservation)	$E_T = E_k + E_p$	$E = mc^2$
Spring Force, Work	$F = -kx$	$W = kx^2/2$
Continuity (fluids)	$A v = const.$	$\rho Av = const.$
Current and Resistance	$I = Q/t$	$R = \rho l/A$
Resistors (series, par.)	$R_{eq} = R_1 + R_2 \dots$	$1/R_{eq} = 1/R_1 + 1/R_2$
Sound	$dB = 10 \log_{10}(I/I_0)$	beats = Δf
Kirchoff's Laws	$\Sigma i = 0$ at a junction	$\Sigma\Delta V = 0$ in a loop
Thermodynamics	$Q = mc\,\Delta T$ (MCAT !)	$Q = mL$
Torque forces	$L_1 = F_1 \times r_1$ (CCW + ve)	$L_2 = F_2 \times r_2$ (CW -ve)
Torque force at EQ	$\Sigma F_x = 0$ and $\Sigma F_y = 0$	$\Sigma L = 0$
Refraction	$(\sin\theta_1)/(\sin\theta_2) = v_1/v_2 = n_2/n_1 = \lambda_1/\lambda_2$	$n = c/v$

MCAT Physics Equations to memorize as pairs

F = ma	F = qE	Similar Form
$F = K_G (m_1 m_2 / r^2)$	$F = k (q_1 q_2 / r^2)$	
V = IR	P = IV	Paired Use
$v_{av} = \Delta d / \Delta t$	$a_{av} = \Delta v / \Delta t$	*(avg vel, acc)*
$v = \lambda f$	$E = hf$	*(f = 1/T)*
$E_k = 1/2\, mv^2$	$E_p = mgh$	*(kin, pot E)*
$P = F/A$	$\Delta P = \rho g \Delta h$	*(pressure P)*
SG = ρ substance / ρ water	$\rho = 1\ g/cm^3 = 10^3\ kg/m^3$	*(Spec Grav)*
$\rho = mass / volume$	$F_b = V\rho g = mg$	*(buoyant F)*
$I_{rms} = I_{max} / \sqrt{2}$	$V_{rms} = V_{max} / \sqrt{2}$	Root Mean Sq
$1/i + 1/o = 1/f = 2/r = Power$	$M = magnification = - i/o$	*Optics*

Note: Specific gravity (SG) is equivalent to the fraction of the *height* of a buoyant object below the surface of the fluid.

Don't Memorize, Know How to Use...

$P + \rho gh + 1/2\ \rho v^2 = constant$	Bernouilli's Equation	Fluids in Motion
$L = L_0\,(1 + \alpha\Delta\ T\,)$	Linear Expansion	Solids, Temp Δ
$A = A_0(1 + \gamma\Delta\ T\,)$	Area Expansion	
$V = V_0(1 + \beta\Delta\ T\,)$	Volume Expansion	$\beta = 3\ \alpha$
$f_o = f_s\ (V \pm v_o\,)/(\,V \pm v_s\,)$	Doppler Effect: when d is *decreasing* use + v_o and -v_s	
$V = Ed$ for a parallel plate capacitor	d = the distance between the plates	
$dF = dq\ v(B \sin \alpha) = I\ dl(B\ sin\ \alpha)$	Laplace's Law	RH rule
$1/\ C_{eq} = 1/\ C_1 + 1/\ C_2 + 1/\ C_3\ . . .$	Capacitors in Ser. and Par.	$C_{eq} = C_1 + C_2\ . . .$
Potential Energy (PE) = W = 1/2QV	*Work in Electricity*	$W = 1/2\ CV^2$
$\Delta G = \Delta H - T\Delta S$	Gibbs Free Energy	$\Delta G° = -RT\ln K_{eq}$

Atomic Physics

1) alpha (α) particle = ${}_2He^4$ (helium nucleus);

2) beta (β) particle = ${}_{-1}e^0$ (an electron);

3) a positron ${}_{+1}e^0$ (same mass as an electron but opposite charge);

4) gamma (γ) ray = no mass, no charge, just electromagnetic energy;

5) $\Delta m / \Delta t$ = rate of decay where Δm = change in mass, Δt = change in time.

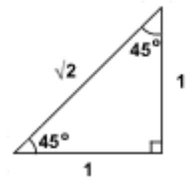
6) If the number of half-lifes *n* are known we can calculate the percentage of a pure radioactive sample left after undergoing decay since the fraction remaining = $(1/2)^n$.

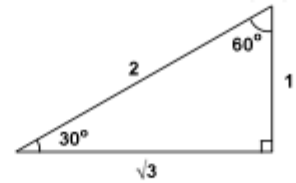
$N_{\text{electrons}} = 2n^2$, where $N_{\text{electrons}}$ designates the number of electrons in shell *n* .

The state of each electron is determined by the four quantum numbers:

- *principal quantum number n* determines the number of shells, possible values are: 1 (K), 2 (L), 3 (M), etc...
- *angular momentum quantum number l,* determines the subshell, possible values are: 0 (s), 1 (p), 2 (d), 3 (f), n-1, etc...
- *magnetic momentum quantum number* m_l , possible values are: $\pm l$, ... , 0
- *spin quantum number* m_s ,determines the direction of rotation of the electron, possible values are: ±1/2.

The Basics





sin θ = opp/hyp *cos θ = adj/hyp* *tan θ =opp/adj*

$\theta = \sin^{-1} x$ $\text{arcsec}\ \theta = \sec^{-1}\theta$ $r^2 = x^2 + y^2$

- angle θ may be given in radians (R) where 1 revolution = $2\pi^R$ = 360°
- estimate square root 3 as 1.7 and root 2 as 1.4
- cross-sectional area of a tube = area of a circle = πr^2 where π can be estimated as 3.14 and *r* is the radius of the circle; circumference = 2πr

Some Units to Memorize

- Both work and energy are measured in joules where 1 *joule (J)* = 1 *N* × 1 *m* . {Imperial units: the *foot-pound* , CGS units: the *dyne-centimeter* or *erg* }
- The SI unit for power is the *watt* (W) which equals one *joule per second* (J/s) = *volts* × *amperes* .
- Current is measured in *amperes* = *coulombs/sec.* The units of resistance are ohms, symbolized by Ω (omega), where 1 ohm = 1 volt/ampere.
- The SI unit for pressure is the *pascal* (1 Pa = 1 N/m^2). Other units are: 1.00 atm = 1.01 × 10^5 Pa = 1.01 bar = 760 mmHg = 760 torr.
- The SI unit for the magnetic induction vector *B* is the tesla where 1 T = 1 N/(A)(m) = 10^4 gauss.