Science Olympiad -- Physics Lab Notes -- 2008

Concept	Definition	Basic Equation	
Work			
Linear Work	The act of exerting a force through a distance in the direction of the force (constant)	$W = F \Delta x \cos \theta$	(F = Force, Δx = Displacement, θ = angle w.r.t. Force)
Rotational Work	The act of exerting a torque through an angular displacement (fixed Axis)	$W = T \Delta\theta$	(T = Torque, $\Delta\theta$ = angular Displacement)
Work done by Pressure	The act of maintaining a pressure through a volume change (Constant Pressure)	$W = P \Delta V$	(W = Work, P = Pressure Δ V = change of Volume)
Work done by an Electric Field	The act of moving an electric charge within an electric field. (Constant field)	$W = E q \Delta x$	(E = Electric Field Strength, q = electric charge, Δx = Displacement)
Energy			
Linear Kinetic Energy	The ability to do work because of linear motion.	$KE = 0.5 m v^2$	(v = linear velocity, m = mass)
Rotational Kinetic Energy	The ability to do work because of rotational motion. (fixed axis)	$KE_{rot} = 0.5 I \omega^2$	(ω = angular velocity, I = moment of Inertia)
Potential Energy	The ability to do work because of position within a force field		
Gravitational Potential Energy	The ability to do work because of position within the gravitational force field	$PE = mgh$	(h = height w.r.t. reference)
Spring Potential Energy	The ability to do work because of elongation or compression of a spring	$U_s = 0.5 k \Delta s^2$	(k = spring constant)
Elect. Capacitor Potential Energy	The ability to do work because of electric charges stored in an Electric force field.	$U_q = 0.5 q^2/C$	(q = charge, C = Capacitance)
Pressure	Potential Energy per unit volume within a fluid (liquid and / or gas / vapor)	$P = F / A$	(P = pressure, F = force, A = area)

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Ideal Gas Law	Relationship between energy stored in Ideal gas and it's temperature	**$PV = nRT$** (P = pressure, V = volume, n = number of moles, R = energy to change the temp. of one mole by one degree Kelvin, T = temperature in degrees Kelvin)
	Power	
Power	The rate at which work is done or energy is transformed (used or generated)	**$P = W/\Delta t$** (P = power, W = work, Δt = time to do work)
Linear Power	The rate at which work is done during linear motion	**$P = Fv$** (P = power, F = force, v = velocity)
Rotational Power	The rate at which work is done during rotational motion (fixed Axis)	**$P = T\omega$** (P = power, T = torque, ω = angular velocity)
Electrical Power	The rate at which electrical energy is generated or transformed to other energy	**$P = Vi$** (P = Power, V = Voltage, I = current)
Ohmic Heating	The rate at which electrical energy is transformed to heat	**$P = i^2R$** (P = power, I = electric current, R = electrical resistance)
Fluid Power	The rate at which a liquid fluid does work (hydraulic)	**P = Pressure x Volume flow rate** (P = power)
	Efficiency	
Efficiency	The ratio of useable energy resulting from an energy conversion to the total energy supplied for the conversion	
Efficiency of Work		**$e = W_{out} / W_{in}$** (Wout = useful work out, Win = Total work input)
Efficiency of Power		**$e = P_{out} / P_{in}$** (P_{out} = useful power out, P_{in} = Total power input)
Efficiency of Energy Conversion		**$e = E_{out} / E_{in}$** (E_{out} = Useful Energy out, E_{in} = Total Energy input)