Module #8: Work and Energy

* The Definitions of Work and Energy
	+ Energy = the ability to do work
	+ Work = the product of the displacement of an object and the component of the applied force that is parallel to the displacement
		- In order for work to occur there must be displacement
		- Therefore, energy can be redefined as the ability to apply a force which results in a displacement that has a component parallel to the force
	+ In order for energy to exist in a situation, the application of the force and the displacement do not have to actually occur
* The Mathematical Definition of Work
	+ W = F∥ \* ∆x
		- W represents work
		- ∆x stands for the magnitude of the displacement vector
		- F∥ is used toindicate the magnitude of the component of the force vector that is parallel to the displacement vector
		- If the force is not constant, or if motion is not in a straight line, you cannot use this equation to calculate work
		- SI Unit = N\*m = Joule “J”
			* Any force unit multiplied by any distance unit is a valid energy unit
			* Standard English unit = ft\*lbs
	+ James Prescott Joule
		- Known for his studies of both electricity and energy
		- Developed a law that describes the heat produced in an electrical circuit
		- Studied the behavior of gases
		- Saw science as a means of understanding God
	+ Ex 8.1 p.254
	+ OYO #8.1 p.254
* Kinetic and Potential Energy
	+ Energy exists in a situation simply if there is an ability to do the work
	+ We make the distinction between the ability to do work and actually doing the work
	+ If energy exists in a situation but is not used to perform work it is called potential energy: energy that is stored, ready to do work
	+ If the work is actually being performed, then motion occurs. We call the energy associated with motion kinetic energy: energy in motion
	+ PE= mgh
		- PE: potential energy
		- H: height
		- G: acceleration due to gravity
		- M: mass
	+ KE= ½ mv2
		- KE: kinetic energy
		- M: mass
		- V: speed
	+ Potential energy is a relative quantity – it must be calculated in relation to something else
	+ Ex 8.2 p.256
	+ OYO p.257 #8.2
	+ Ex 8.3 p.257
	+ OYO p.257 #8.3
* The First Law of Thermodynamics
	+ The first law of thermodynamics = energy cannot be created or destroyed; it can only change form
	+ There is no way to add or subtract the amount of energy, from the time of creation the total amount of energy in the universe was fixed
	+ Energy can change form from potential energy into kinetic energy
	+ In order to follow the First Law of Thermodynamics, there must be a one-to-one relationship between the potential energy decrease and the kinetic energy increase
	+ There is a certain amount of energy in each situation
		- TE= PE + KE
		- Total energy
		- “conservation of energy equation”
	+ Ex 8.4 p.259-260
	+ Ex 8.5 p.261-263
	+ OYO #8.4-8.6 p.264
	+ Experiment 8.1: Energy in a Pendulum
* Friction, Work, and Energy
	+ Mechanical energy = energy associated with the movement (or potential movement) of objects
	+ Chemical energy = energy associated with the chemical bonds of a molecule
	+ Electrical energy = energy associated with the motion (or potential movement) of charged particles
	+ Heat = energy that is transferred from one object to another as a result of a difference in temperature
		- Must always be kinetic
	+ Friction removes mechanical kinetic energy from a moving object and transforms it into heat.
		- Every Joule of work that friction does removes a Joule of kinetic energy
	+ Ex 8.6 p.268
	+ Experiment 8.2 p.269
		- Read p.270-272 and complete the calculations outline there
	+ OYO p.272 #8.6
	+ Ex 8.7 p.272
	+ OYO p.273 #8.7
	+ Ex 8.8 p.273-274
	+ OYO p.274 #8.8-8.9
* Energy and Power
	+ The concept of power tells us how much energy is used during a certain time interval.
		- Power = the amount of energy expended per second
		- P= ∆W/ ∆t
			* ∆W is the work done within a certain time interval
			* ∆t is the time interval
		- Units of power are J/sec which is named the Watt
	+ Ex 8.9 p.276
	+ OYO p.276 #8.10