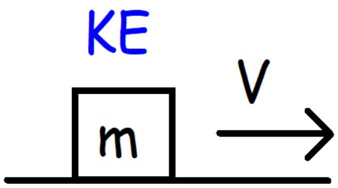
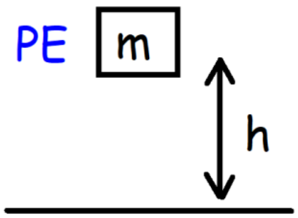
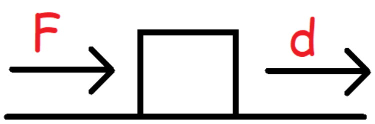
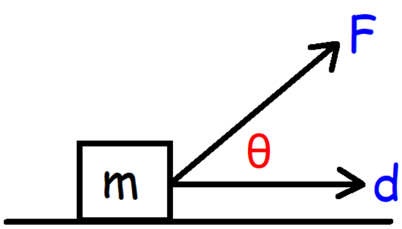
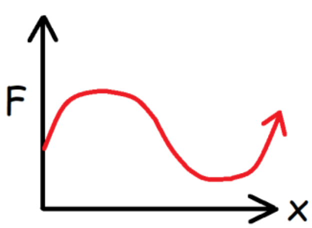
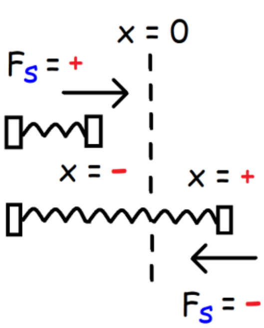
Work, Energy, and Power – Formula Sheet:

	**Kinetic Energy:** $$KE = \frac{1}{2}mv^2$$ Note: Objects in motion have kinetic energy.
	**Potential Energy:** $PE = U_G$ $$PE = mgh \qquad U_G = mgy$$ Note: Objects that have the ability to fall under the influence of gravity has potential energy.
	**Work Done by a Constant Force:** $$W = Fd$$
	**Work Done by a Constant Force at an Angle:** $$W = Fd\cos\theta$$ $$W = \vec{F}\cdot\vec{d}$$ $$W = F_x d_x + F_y d_y$$
	**Work Done by a Varying Force:** $$W = \int_a^b F(x)dx$$ $$W = Area\ under\ the\ curve$$
<u>Simple Definition of Energy:</u> The ability to do work. **<u>Definition of Work:</u>** The transfer of energy that occurs by means of a force.	**Work-Energy Theorem:** $$W_{net} = \Delta KE$$ $$W_{net} = \frac{1}{2}m[v_F^2 - v_0^2]$$ $$W_{net} = W_c + W_{nc}$$

Conservation Forces: 1. Gravitational force 2. Electric force 3. Elastic force	**Work Done by a Conservative Force:** $$W_c = -\Delta U = -\Delta PE$$ **Work Done by Gravity:** $$W_G = -\Delta U_G = -mg(y_2 - y_1)$$ **Work Done by the Elastic Spring Force:** $$W_S = -\Delta U_S = -\frac{1}{2}k[{x_F}^2 - {x_0}^2]$$ **Work Done by the Electric Force:** $$W_E = -\Delta U_E = -q\Delta V = -q[V_F - V_0]$$
Nonconservative Forces: 1. Applied Force 2. Tension Force 3. Frictional Force	**Work Done by a Nonconservative Force:** $$W_{nc} = \Delta ME$$
Conservation of *ME*: Mechanical energy is conserved when only conservative forces are present in the system.	**Conservation of Energy:** $$ME = KE + PE$$ $$W_{nc} = W_{net} - W_c$$ $$W_{nc} = \Delta ME \qquad W_{net} = \Delta KE \qquad W_c = -\Delta PE$$
Derivatives: $$F_x = -\frac{d}{dx}[U(x)]$$	**Force – Potential Energy Integral Relationship:** $$U(x) = -\int F(x)dx \qquad \Delta U = -\int_a^b F(x)dx$$
 	**Restoring Force of a Spring:** $$F_s = -kx$$ **Elastic Potential Energy of a Spring:** $$U_s = \frac{1}{2}kx^2$$ $$U(x) = -\int F(x)\,dx = -\int -kx\,dx = \frac{1}{2}kx^2 + C$$

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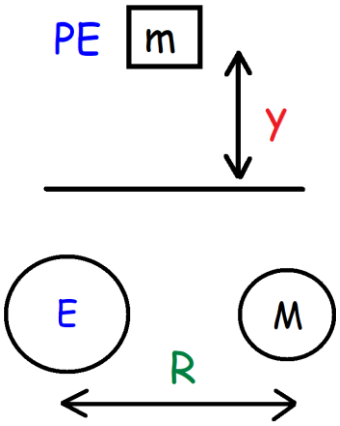
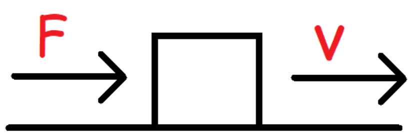
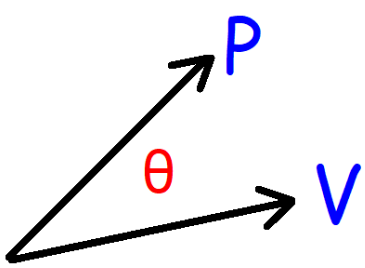
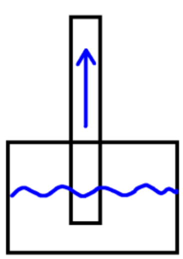
 	**Gravitational Potential Energy:** **GPE for objects near the surface of Earth:** $$\boldsymbol{U_G} = mgy$$ **GPE between two large planetary masses:** $$\boldsymbol{U_G} = \frac{GM_1M_2}{R}$$
Definition: Power is the rate at which energy is transferred.	**Power:** $$\boldsymbol{P} = \frac{Work}{Time}$$
 	**Power – With Constant Velocity:** $$\boldsymbol{P} = FV$$ **Average Power – With Constant Acceleration:** $$\overline{\boldsymbol{P}} = \frac{1}{2}F(v_o + v_f)$$
 	**Power – Dot Product Formula:** $$\boldsymbol{P} = \vec{F} \cdot \vec{v}$$ $$\boldsymbol{P} = Fv\cos\theta$$ $$\boldsymbol{P} = F_x v_x + F_y v_y$$
	**Power of a Water Pump:** $$\boldsymbol{P} = \left(\frac{m}{t}\right)gh$$ Note: The quantity ***m/t*** is the mass flow rate in kg/s.