DERIVATION OF KINETIC ENERGY AS = 1/2 mV^2

The following equations for motion of an object in *one direction* were previously derived; where "**V**" represents velocity, "**a**" represents a constant acceleration, "**delta D**" represents the total displacement, "**delta t**" represents the change in time, subscript "**f**" represents the associated final parameter and subscript "**i**" represents the associated initial parameter, subscript "$_{avg}$" represent the average of that parameter – all in that *one direction*.

$$V_{avg} = [V_f + V_i] / 2$$

$$V_{avg} = \Delta D / \Delta t$$

$$V_f = V_i + (a)(\Delta t)$$

$$\Delta D = V_i(\Delta t) + (1/2)(a)(\Delta t)^2$$

$$V_f^2 = V_i^2 + 2(a)(\Delta D)$$

The last equation of the above listing can be rearranged as follows:

$$[V_f^2 - V_i^2]/2 = (a)(\Delta D)$$

Multiplying both sides of the equation by the mass "m" of the object in question we have:

$$(m)[V_f^2 - V_i^2]/2 = (m)(a)(\Delta D)$$

Notice that we can replace (m)(a) with F = the force on the object, such that we have:

$$(m)[V_f^2 - V_i^2]/2 = (F)(\Delta D)$$

But as (F)(ΔD) (Force x Distance) is the work done on the object, or energy put into the object, we can rewrite the equation as:

$$(m)[V_f^2 - V_i^2]/2 = \text{Energy}$$

Assuming we're looking at the change of energy of an object due to the work done on it based on an initial velocity of zero and since we're talking about energy of motion here, by definition "Kinetic Energy", we have:

$$KE = 1/2(m)V^2$$