Earth and Meteor Encounters

The 600 Horsepower Paperclip

This lecture supports the California Content Standards

Physics, Grades 9-12, item 1: Newton's laws predict the motion of most objects.

a. The relationship between the universal law of gravitation and the effect of gravity on an object at the surface of the Earth.

b. Applying a force to an object perpendicular to the direction of its motion causes the object to change direction but not sppeed (for example, the Earth's gravitational force causes a satellite in a circular orbit to change direction but not speed).

Newton's Laws of Motion:

First Law of Motion
Every body continues in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it.

Second Law of Motion
The acceleration of a body is directly proportional to the net force acting on the body and inversely proportional to the mass of the body.

Third Law of Motion
To every action force there is always opposed an equal reaction force.

Basic definitions:

Force (F) = any influence that can cause a mass (**m**) to be accelerated (**a**). (note acceleration can be a positive or negative.) **F = ma**

Mass (m)= The quantity of matter in a body.

Volume = The quantity of space a body occupies.

Weight (Wt) = The force due to gravity on a body. (The same mass has different weight on the earth and the moon)

Work (W) = force (**F**) times distance (**d**) moved in the direction of the force **W = Fd**

Power = $\frac{\text{work}}{\text{time}}$

One horsepower = $\frac{\text{550 pounds lifted one foot}}{\text{1 second}}$

Joule = In the metric system power is measured in Joules per second, named after James Prescott Joule. One joule is equal to one Watt. One hp. is equal to 746 watts, or .746 kilowatts.

Newton = One newton of force will accelerate one kilogram of mass one meter/second^2

Kinetic energy = Kinetic energy of an object is equal to half its mass multiplied by its velocity (**v**) squared.

or

Kinetic energy = $\frac{1}{2}mv^2$

Gravitational constant (**G**) = Defined by $F = G\frac{mM}{d^2}$

The force which the Earth's mass (**M**) exerts on a mass of 1 kilogram at its surface is equal to 9.8 newtons.

The value of G was measured by Philipp von Jolly as

6.67×10^{-11} $m^3/kg \cdot s^2$