**Work and Kinetic Energy**

**Work** (definition):Work is the product of the force on an object and the distance through which an object is moved; measured in Joules (J)

* The work done by a force is **POSITIVE** if the force points in the direction of motion
* The work done by a force is **NEGATIVE** if the force points in the opposite direction of motion
* The work done by a force is **ZERO** if the force points perpendicular to the direction of motion

**W = FD**

1 Joule of work is required to move an object weighing 1N through a distance of 1m;1J = 1N·m

**Example 1** Find the work done by the force of gravity if a 10 kg object moves (a) 1m downward, (b) 2m upward, (c) 10m right

**Example 2** A sky diver of mass 70kg falls a distance of 50m. During this time, he feels a downward force of gravity and an upward force of air resistance. The force of air resistance is 30N. What is the total work done by both forces as he falls?

**Kinetic Energy** (definition):The energy\* of a moving object; measured in Joules (J)

\*Energy, in general, is defined as the capacity to do work.

**K = (1/2)mv2**

**Example 1** What is the kinetic energy of an object of mass 30kg when it is moving at a speed of (a) 20m/s, (b) 100m/s, (c) 0m/s.

**Work - Kinetic Energy Theorem** (definition):The work done on an object is equal to the kinetic energy gained by the object.

**W = Kf – Ki**

**Example 1** You pull a 150kg sled across a frictionless surface. Over a distance of 20m, you speed up the sled from 2m/s to 4m/s. (a) How much work was done on the sled? (b) How much force did you apply to the sled? (c) Now assume that friction is present, and the ground exerts a frictional force of 10N on the sled as you are dragging it. How much force would you have to apply to the sled to achieve the same change in velocity (from 2m/s to 4 m/s)?

**Example 2** A 30,000kg train is coasting at a constant velocity of 100m/s. Superman applies an opposing force to the train, causing it to slow down and come to rest in a distance of 50m. How much force did Superman apply? Ignore the effects of friction.