**Simple Machines**

Simple machines have been known since ancient times, having been described as early as the 3rd century BC by Archimedes. Later studies of simple machines in Renaissance times by Leonardo Da Vinci, Galileo, and others, had a significant influence on the development of classical mechanics, including the definitions of force and work/energy.

A simple machine is a mechanical device that changes the direction or magnitude of a force (or a torque in the case of rotational machines). In general, they can be defined as the simplest mechanisms that use the principle of MECHANICAL ADVANTAGE to multiply force (or torque). A simple machine allows a user to apply a much greater (or smaller) force (or torque) than they would be able to apply without the machine.

A simple machine uses a single applied force (or torque) to do work on a single object. Ignoring friction, the work done by the machine on the object is equal to the work done by the person to the machine; that is to say that the machine itself does not produce work or energy, it merely transfers the energy from the user to the object being moved.

The term usually refers to the following classical machines: the lever, the inclined plane, the wedge, the pulley, the wheel, and the screw. The first four machines each produce a mechanical advantage for an applied force. The last two machines produce mechanical advantages for applied torques, and in the case of the screw can be used to convert a torque into a linear force.

We will now examine the lever. A diagram of a lever is shown below:

The distance between the applied force and the fulcrum is D1, and the distance between the object to be lifted and the fulcrum is D2. Conservation of energy requires that:

Work in = F1 × D1 = Work out = F2 × D2

Thus we have: F2 = (D1/D2) F1 and the Mechanical Advantage the lever is defined as:

Mechanical Advantage = Force out / Force in = F2/F1 = D1/D2.