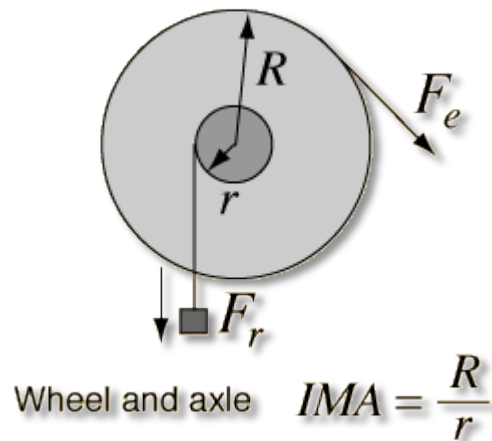


## MECHANICAL ADVANTAGE

### Wheel and axle:

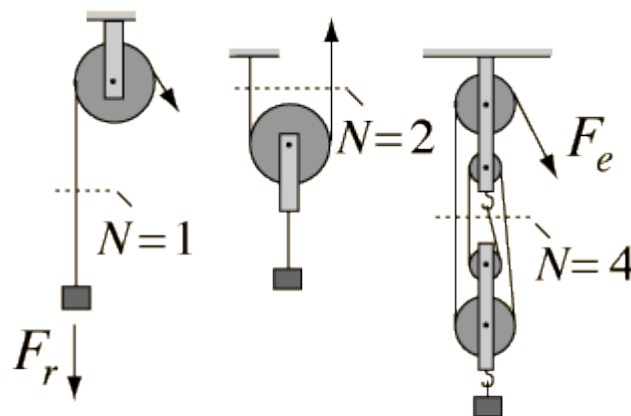
The wheel and axle is essentially a modified lever, but it can move a load farther than a lever can. The centre of the axle serves as a fulcrum.



The ideal mechanical advantage (IMA) of a wheel and axle is the ratio of the radii. If the effort is applied to the large radius, the mechanical advantage is  $R/r$  which will be more than one; if the effort is applied to the small radius, the mechanical advantage is still  $R/r$ , but it will be less than 1.

### Pulley:

A pulley is a wheel over which a rope or belt is passed. It is also a form of the wheel and axle. Pulleys are often interconnected in order to obtain considerable mechanical advantage.

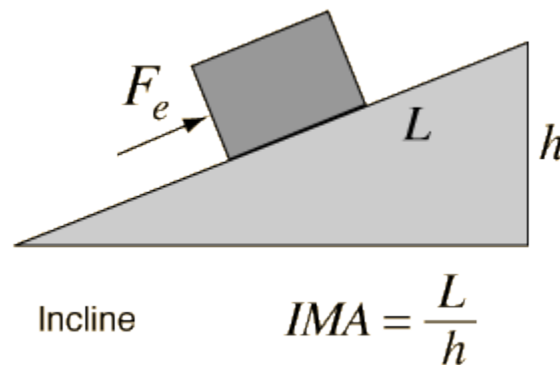


Pulley  $IMA = N$

The ideal mechanical advantage (IMA) of a pulley is directly dependent upon the number of support strings,  $N$ .

### Inclined plane:

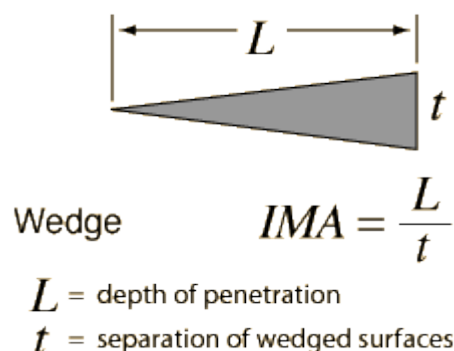
The inclined plane is a simple device that hardly looks like a machine at all. The mechanical advantage increases as the slope of the incline decreases. But the load will then have to be moved a greater distance.



The ideal mechanical advantage (IMA) of an inclined plane is the length of the incline divided by the vertical rise, the so-called run-to-rise ratio. The mechanical advantage increases as the slope of the incline decreases, but then the load will have to be moved a greater distance. Again, work in equals work out in an entirely efficient system. Friction will be large if objects are slide along the surface of the inclined plane. Efficiency can be increase by using rollers in conjunction with the inclined plane.

### Wedge:

The wedge is an adaptation of the inclined plane. It can be used to raise a heavy load over a short distance or to split a log.



The ideal mechanical advantage (IMA) of a wedge depends on the angle of the thin end. The smaller the angle, the less the force required to move the wedge a given distance through, say, a log. At the same time, the amount of splitting is decreased with smaller angles.