SCIENCE

NAME: PERIOD: DATE:

MECHANICAL ADVANTAGE NOTES

Work and **mechanical advantage** are related to each other through **machines**. When you do work on a machine, the machine does work on some other object, and the amount of work the machine does is the same as the amount of work you put into the machine.

$$\text{Work}_{(IN)} = \text{Work}_{(OUT)}$$

Since Work = force x distance, this means

$$\{\text{Force}_{(IN)} \times \text{Distance}_{(IN)}\} = \{\text{Force}_{(OUT)} \times \text{Distance}_{(OUT)}\}$$

The force you put in is called the **action force**, and the force the machine applies is the **resistance force**.

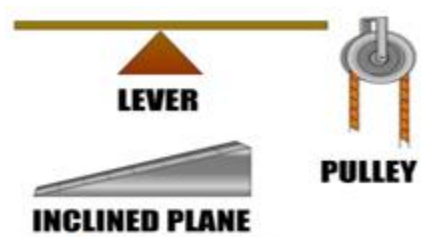
If you make a ratio of the **resistance force** and the **action force**, you can calculate the **mechanical advantage**.

$$\text{Mechanical Advantage} = \text{Force}_{(OUT)} \div \text{Force}_{(IN)}$$

or

Mechanical Advantage = Reaction force ÷ Action force

So if you put a force of 10 Newtons into a hammer, and the hammer hits with 50 Newtons of force, then the mechanical advantage is:



action force – 10 N **reaction force** – 50 N M

Mechanical Advantage = Reaction force ÷ Action force

MA = 50 N ÷ 10 N

MA = 5 A mechanical advantage of 5 means the machine multiplies your force by 5.

Whatever force you put into that machine, you will get 5x more force out of it.

You can also find the mechanical advantage by:

$$\text{Mechanical Advantage} = \text{Distance}_{(IN)} \div \text{Distance}_{(OUT)}$$

So if you down on a crowbar 1 m and the other end of the crowbar raises 0.1 m, then the mechanical advantage is:

Mechanical Advantage = distance (in) ÷ distance (out) MA = 1 ÷ 0.1 = 10 (10x the force)