Mechanical Advantage

***Mechanical Advantage is a measure of how much help a machine gives you.**

Two (2) Types of Mechanical Advantage

1. **Actual MA=takes friction into account (uses forces).**
2. **Ideal MA=does NOT take friction into account (uses distances).**

Equation:

$$\text{Mechanical Advantage (MA)} = \frac{\text{output force}}{\text{input force}}$$

EX: What is the mechanical advantage of a lever that requires an input force of 20 N and lifts an object that weighs 60 N?

$$\text{Mechanical Advantage (MA)} = \frac{\text{output force } 60\text{ N}}{\text{input force } 20\text{ N}} \quad \text{MA} = 3$$

Mechanical Efficiency

****Mechanical Efficiency* is a measure of how well a machine converts input energy, work, and power into output energy, work, and power.**

The efficiency of an ideal machine is 100% because the input work =the output work.

Real machines do not achieve efficiency of 100% because heat may be lost from the system due to the friction between the moving parts.

Improve efficiency by reducing friction.
Ex. A pulley with a rope running over a wheel is more efficient than a pulley where the rope only runs over a bar. The pulley with the spinning wheel makes the machine more efficient.
Equation:

$$\text{Mechanical Efficiency (ME)} = \frac{\text{output work (J)}}{\text{input work (J)}} \times 100\% = \text{ME (J)}$$

EX: What is the mechanical efficiency of a pulley that requires an input work of 10 J and an output work of 9 J?

$$\text{Mechanical Efficiency (ME)} = \frac{\text{output work 9 J}}{\text{input work 10 J}} \quad \text{ME} = .90 \times 100\% = .90 \text{ J}$$