

Simple Machines

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1. Introduction

Simple Machines

- A machine is something that helps you use your energy more effectively.
- The different types of simple machines
 - Inclined plane
 - Lever
 - Wheel and axle
 - Pulleys
 - Wedge
- The lever and the inclined plane are the two basic machines. Other simple machines are mostly a modification of the lever and inclined plane.
- In all cases we have the relation , $W_{in} = W_{out}$
- The force that you input is also called the effort (E). This force is applied to overcome a force that is called the load or resistance (R)
- We can then write the above relation as

$$E \times de = R \times dr$$

, where de is the distance through which the effort acts and dr is the distance through which the load moves.

- The mechanical advantage of the machine is defined as the ratio of the resistance to the effort.

$$ME = \frac{R}{E}$$

which is also equal to

$$ME = \frac{de}{dr}$$

- The mechanical advantage of a machine has to be greater than 1 in order for it to reduce our effort.

Inclined plane

- It allows you to trade increased distance for decreased effort or force.
- Consider loading a heavy weight onto a truck by lifting it directly versus rolling it on an inclined plane. In the latter case the force acts over a longer distance so that the force required to push it is lesser. The force required changes depending on the steepness of the inclined plane.
- Examples of inclined planes in daily life:

Lever

- It is another kind of simple machine which consists of a bar resting on a fulcrum. It has two arms the effort arm and the resistance arm which balances two forces, the effort and the resistance.
- The principle of the lever was stated first by Archimedes. It states that, "The longer the arm of the lever to which force is applied, the less that force need be."
- Examples of levers in daily life:
 - Using a hammer to pull a nail out of a plank of wood.
 - A can or soda opener.
- Levers are of three different types. [refer to text.]

Mechanical advantage and friction

- The mechanical advantage of the inclined plane is in most cases less than that of the lever.
- This is because friction is involved to a greater extent when two objects are pushed against each other. In order to overcome the force of friction more effort has to be supplied and this reduces the mechanical advantage offered by the machine.
- With the lever however, the area of contact is greatly reduced and hence the role of friction is reduced to a great extent.

Screw

- A screw is a modified form of an inclined plane.
- It can be considered as an inclined plane wrapped around a cylinder.
- Example of screws in daily life are:

Wedge

- A wedge is also a modified form of the inclined plane.
- It consists of two inclined planes joined together.
- Example of the use of wedge in daily life are:

Pulleys

- A pulley consists of a wheel with a grooved rim which can rotate freely around an axle.
- The axle is supported by a framework called the block.
- A string or rope passes around the wheel

- The chief function of the pulley is to equalise the tension in the string on either side of the pulley.
- Pulleys can be classified into two types. Fixed pulleys and movable pulleys.
- Fixed pulleys are attached to a fixed support
- Movable pulleys are attached to the resistance and moves along with the resistance.
- Examples of pulleys in daily life are:

- 2. Uses of simple machines in health care and medical practice**
- 3. Different types of levers in the Human body**
- 4. Traction**