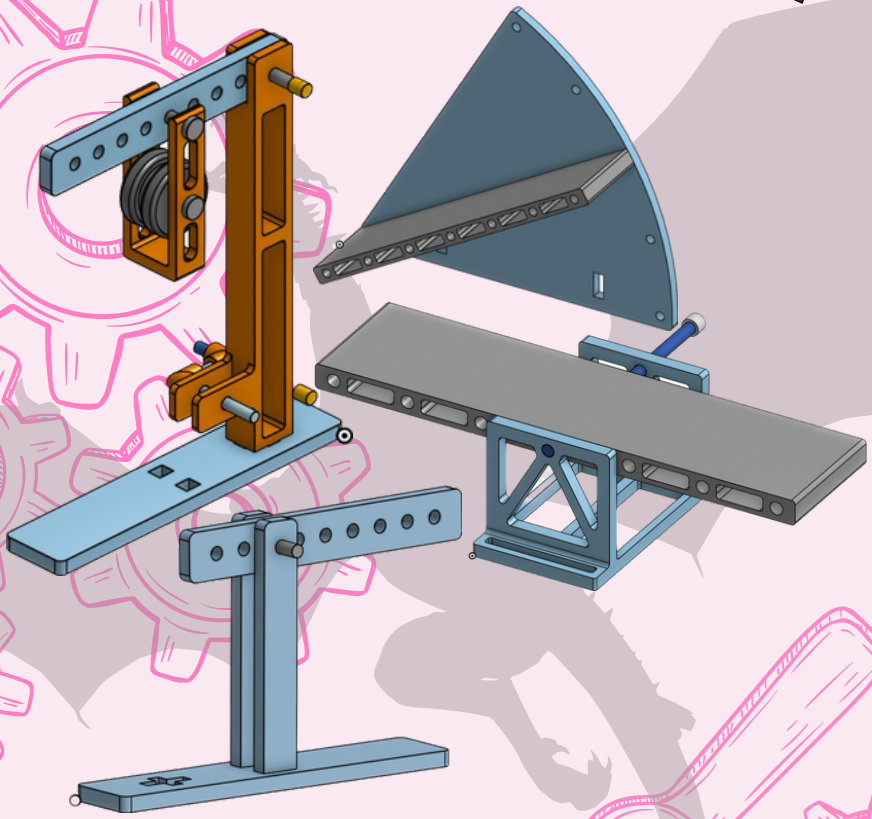
DRAGON KIT

SIMPLE MACHINES EDUCATION KIT

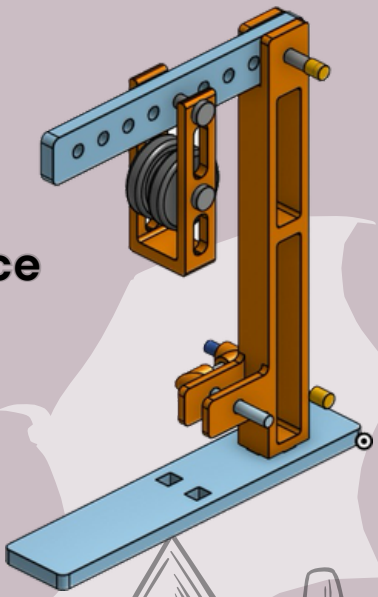


ARC 6014

DRAGON KIT

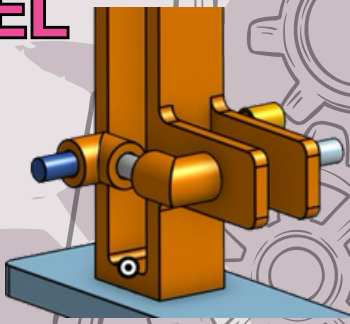
PULLEY SYSTEM

a. Bed support
b. Pulley
c. Vertical support surface
d. Base
e. Spinner
f. Perforated surface
g. Pulley holder



SPINNING WHEEL

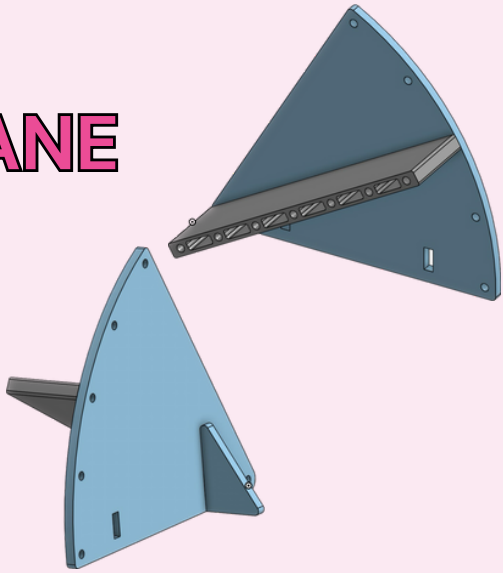
a. Support
b. Spinner



DRAGON KIT

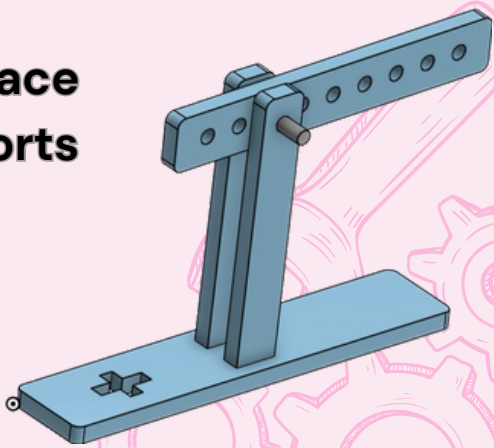
INCLINED PLANE

a. Scaled surface
b. Stand
c. Bed support



LEVER

a. Perforated surface
b. 2 vertical supports
c. Base
d. Screws



GENERAL PROPERTIES OF SIMPLE MACHINES

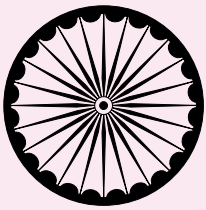
- Simple machines are tools that make it easier for us to do work in daily life.
- Thanks to simple machines:
  - The point of application of the force may change.
  - The direction of the force may change.
- There is no gain from work in any simple machine. There can be gain from force or from path.

WHEEL

- **A wheel can be thought of as a rotating disk in the middle of a circle.**
- **The aim is to facilitate the work by creating less friction on the surface to move objects more easily.**
- **Wheels have variables such as**
  - **center,**
  - **diameter,**
  - **circumference, and**
  - **number of rotations.**
- **To travel a distance of equal length, a wheel with a larger diameter takes fewer turns than a wheel with a smaller diameter.**
- Bicycle wheels, wheelchairs, and car wheels are examples of everyday use.

Longer Diameter/Radius

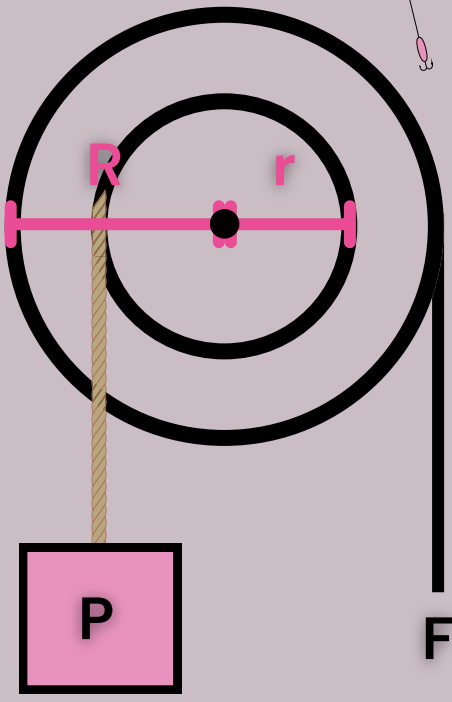
Shorter Diameter/Radius

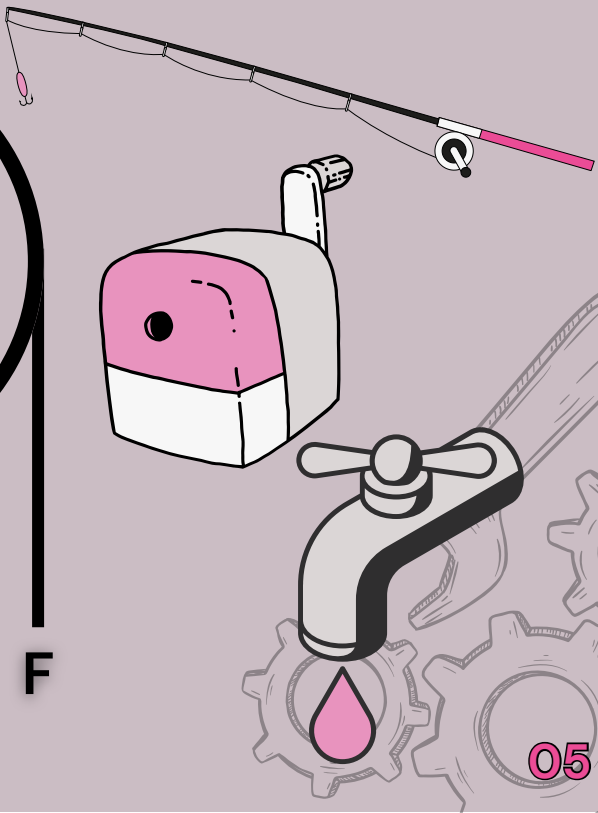


SPINNING WHEEL (TORQUE)

Spinning wheels are nested cylinders that have the same rotation axes but different radii and can rotate around an axis.
There is no gain from work and energy.

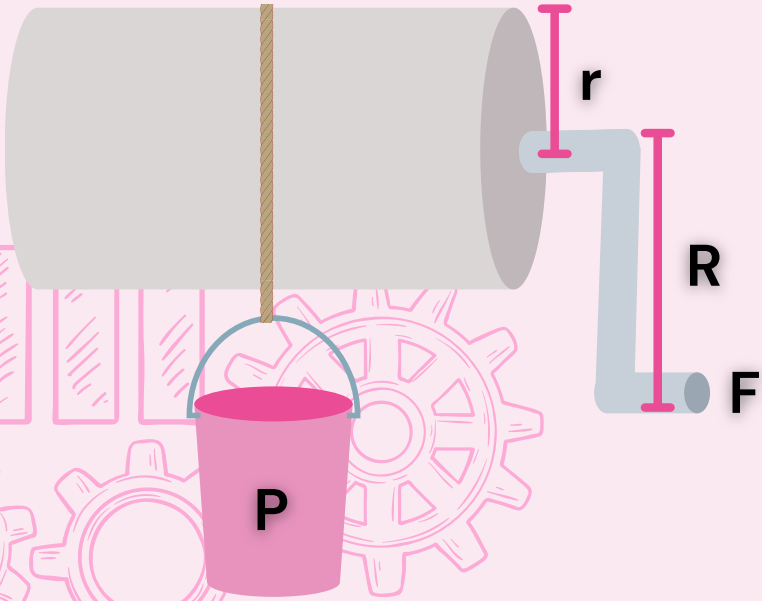
Force x Force Arm = Load x Load Arm
F x R = P x r





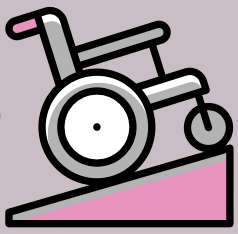
SPINNING WHEEL

- The rotation directions and rotation numbers of the cylinders are equal.
- The direction of movement of the force and load is the same.
- There is gain from strength and loss from path.
- As the length of the lever arm increases, strength gains are achieved.
- As the radius of the cylinder increases, the gain in force decreases.



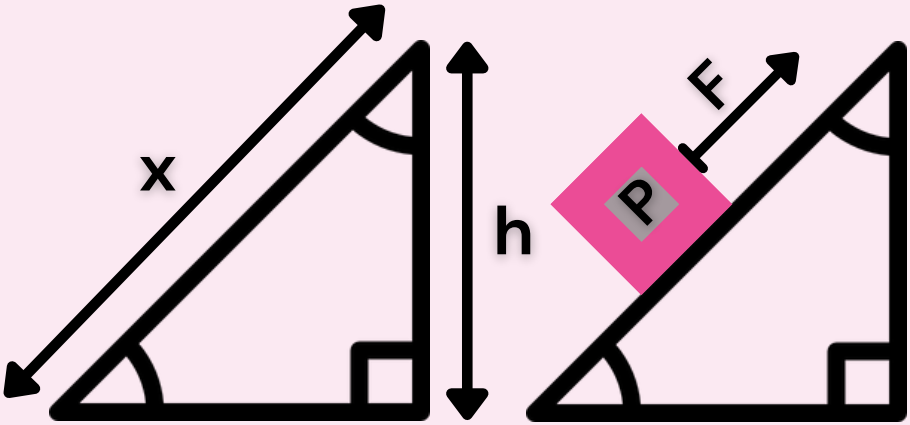
INCLINED PLANE

- An inclined plane is a tilted surface, in a certain angle.
- It helps move objects up or down. An inclined plane allows objects to be moved to higher places, requiring less force than a flat surface.



Ramps and hill roads are examples of inclined planes. Vehicles such as cars, wheelchairs, and freight elevators reach high places with ease thanks to the inclined plane.

INCLINED PLANE



h = height of the inclined plane
x = distance of the inclined path
F = force
P = load
F × x = P × h

x > h
distance > height

- **There is loss from the path and gain from the force needed to be applied.**

LEVER

Instead of using all your strength to lift a rock, you can use a lever to make it easier.
Levers have three main parts:

- Fulcrum, load, and effort.

The fulcrum is the point where the lever moves. The load is the thing that is moved. Effort is the force used to move the load.

F = effort (force)
P = load
x = distance between fulcrum and force (force arm)
y = distance between fulcrum and load (load arm)

In a lever in equilibrium, the product of the force and the force arm is equal to the product of the load and the load arm.
Lever Relation:
Force x Force Arm = Load x Load Arm

$$F \times x = P \times y$$

LEVER

There are three types of levers.

FIRST CLASS LEVERS:

The fulcrum is in between force and load.

- Scissors, seesaw, and pliers are examples of such levers.

X>Y:

There is loss from path & gain from force.

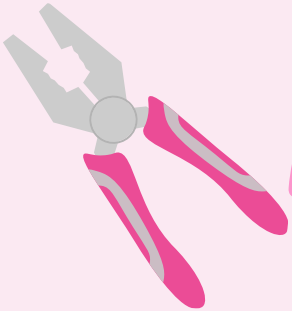
Y>X:

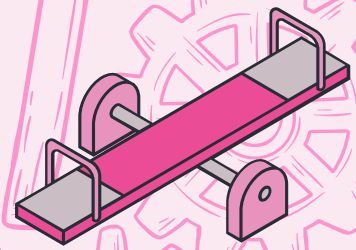
There is loss from force & gain from path.

X=Y:

There is no loss of gain.

You can see other examples on the following pages!



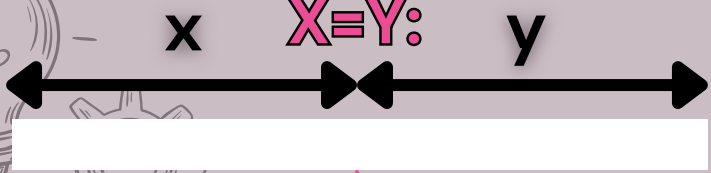


LEVER

X>Y:

Y>X:

X=Y:



LEVER

SECOND CLASS LEVERS:

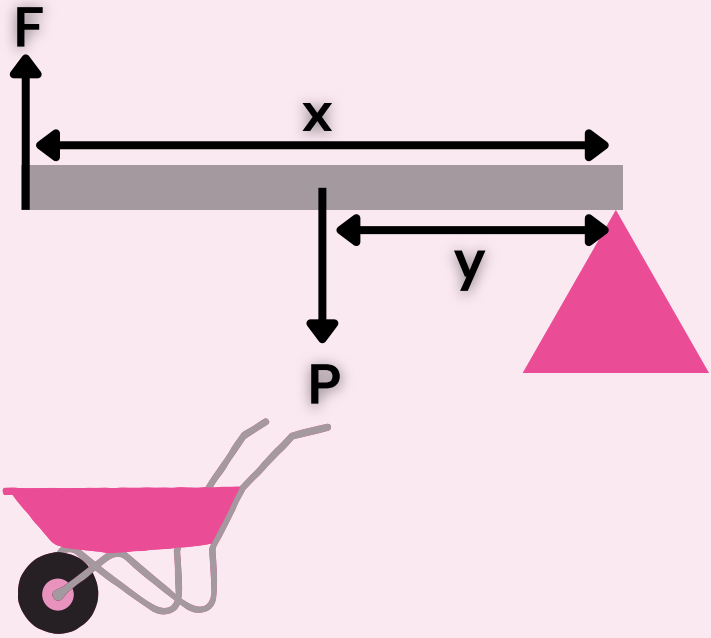
The load is in the middle, with the fulcrum at one end and the force at the other.

- **The wheelbarrow, door and walnut cracker are examples of such levers.**

$F \times x = P \times y$

$x > y$, $F < P$

There is gain from force and loss from path.



LEVER

THIRD CLASS LEVERS:

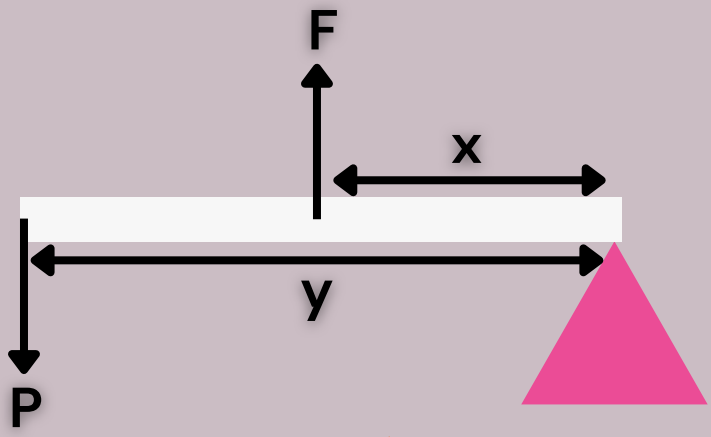
The force is in the middle, with the fulcrum at one end and the load at the other.

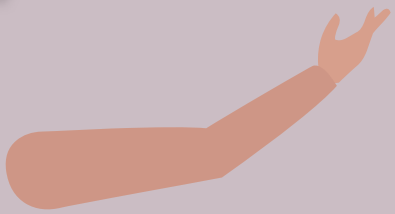
- **Tongs, tweezers and the human arm are examples of these class of levers.**

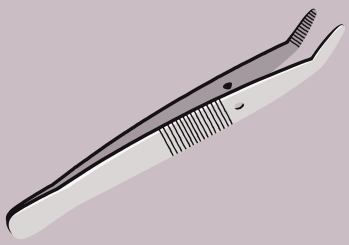
$F \times x = P \times y$

$y > x$, $F > P$

There is gain from path and loss from force.





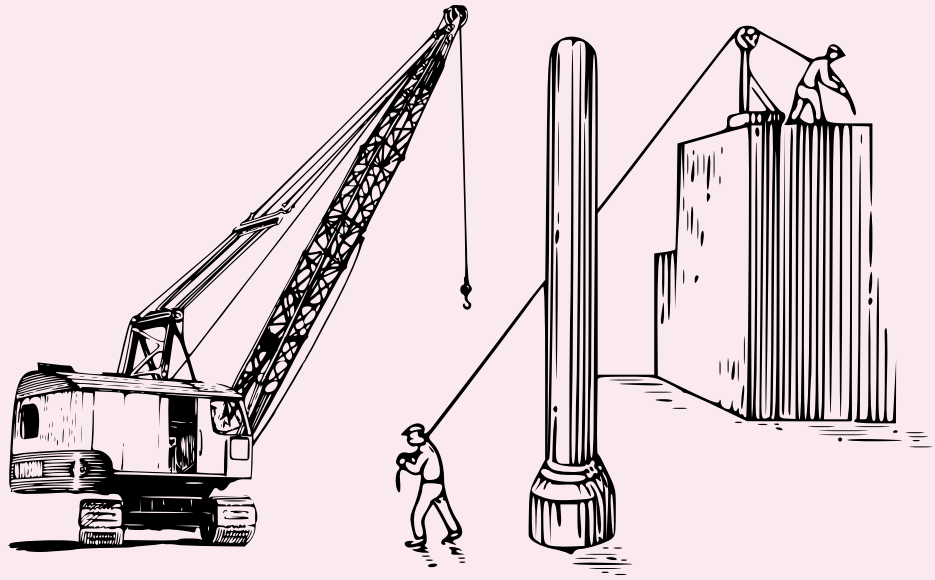


PULLEYS

Pulleys are used to lift or move a load. The pulley helps us change the direction of the load without changing the force.

For example, it is easier to pull a heavy load up using a pulley attached to one end of the rope because the pulley changes the direction of the force.

- **Elevators are examples of pulley systems used in daily life.**

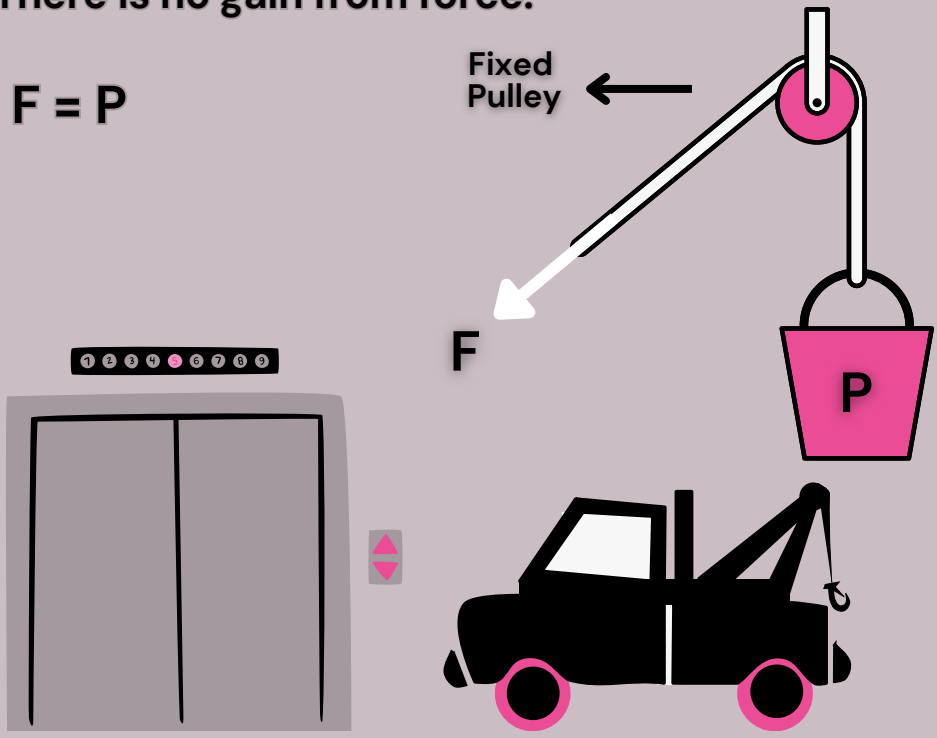


FIXED PULLEYS

A fixed pulley is attached to a stationary thing, like a ceiling or a beam. When the rope or the chain is pulled down, the pulley helps to lift the load upwards.

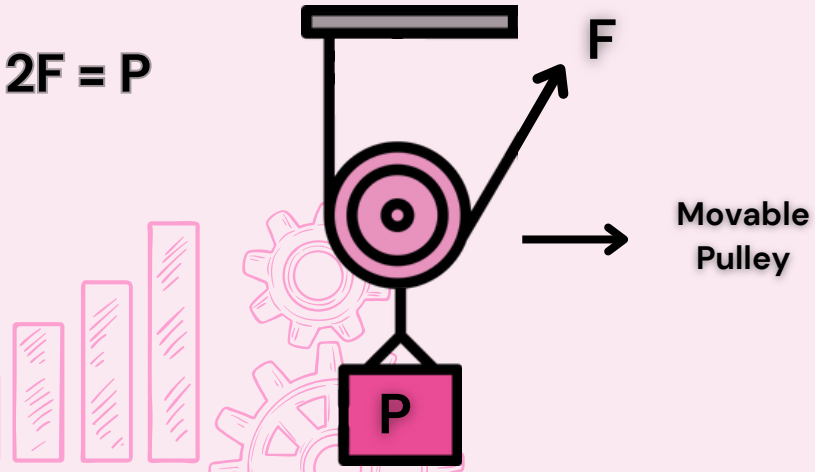
It changes the direction of the force applied. There is no gain from force.

F = P



MOVABLE PULLEYS

- A movable pulley is attached to the object that is intended to lift. As rope is pulled down, the pulley moves with the load.
- Movable pulleys help to lift heavy loads by distributing the force over multiple ropes or chains.
- Therefore, there is gain from force.



THINK!

Think, evaluate and indicate which type of simple machine the following daily life examples belong to.