# FORCES, WATER, RESISTANCE AND MECHANISMS

## Forces

**What is a force?**

A force is either a push or a pull.

Forces can make things:

- speed up
- slow down
- change shape

| The effect of forces | Example |
|---|---|
| A force that speeds something up | The child is pushing the car to speed it up. |
| A force that slows something down | The girl is pulling the dog to slow it down. |
| A force that changes the shape of something | The can is being squeezed so that it changes shape and becomes smaller. |
| A force that changes the direction of something | When the ball is hit with the racket, it will change direction. |

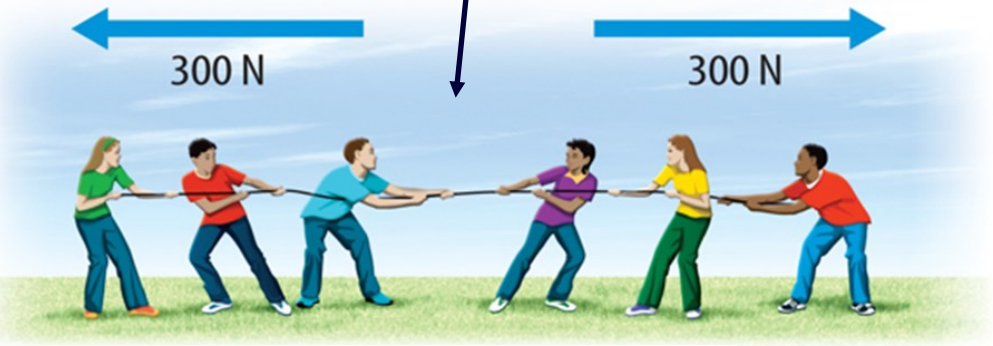
Forces are shown by arrows in diagrams. The direction of the arrow shows the direction in which the force is acting. The bigger the arrow, the bigger the force .

**Balanced forces**

If two forces are balanced, it means the forces are the same size but are acting in opposite directions. If two balanced forces are acting on an object, that object will not change its motion. If it is still, the object will stay still or if it is moving, it will continue moving in the same direction and at the same speed.

| Force | Definition |
|---|---|
| Friction | Friction happens when two surfaces touch each other. Rougher surfaces slow things down a lot whereas smoother surfaces don't slow things down as much. Friction gives us grip and produces heat. |
| Air resistance | Air resistance is a type of friction which slows down moving objects. To travel faster through the air, things need to be streamlined. |
| Water resistance | Water resistance is a type of friction which slows down moving objects. To travel faster through the water, things need to be streamlined . |
| Gravity | Gravity is the forces that pulls objects down towards the centre of the Earth. Gravity stops things from floating away into space. When things go into the air (like a football) gravity pulls them back down. |

In this diagram both forces are equal. This means the rope will stay in the same position as there is not a dominant (stronger) side.





In this diagram, there is more force on the left hand side, so the rope will be pulled that direction because it is now unbalanced.

**Mass** – The weight measured by an objects acceleration under a given force or by the force exerted on it by gravity.

**More about friction**

Friction always works in the direction **opposite** to the direction in which the object is moving, or trying to move. The amount of friction depends on the materials from which the two surfaces are made. Friction can be a useful force because it prevents our shoes slipping on the pavement when we walk and stops car tyres skidding on the road.

**Unbalanced forces**

When two forces acting on an object are not equal in size, we say that they are unbalanced forces. Unbalanced forces do change the way something is moving. They can make objects start to move, speed up, slow down or change direction.

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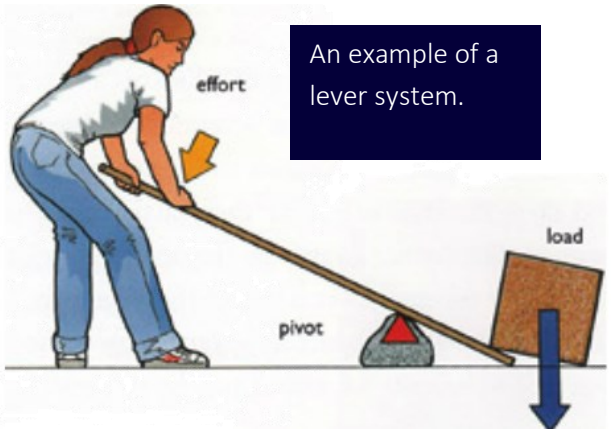
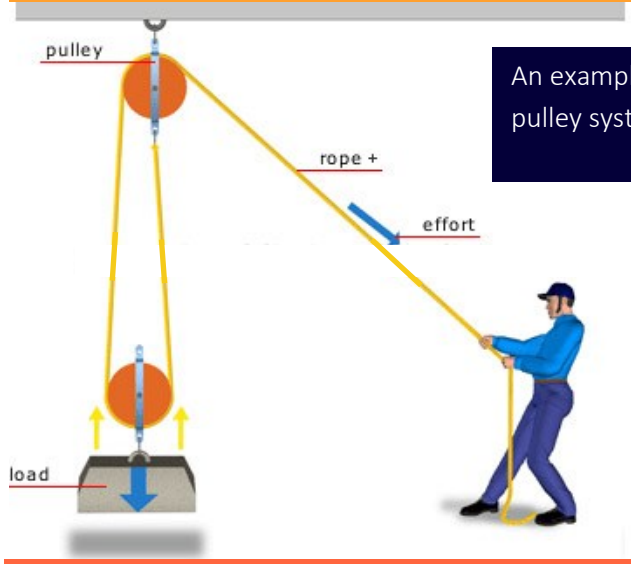
## Mechanisms

Mechanisms such as levers, pulleys and gears, allow a smaller force to have a greater effect.

- **Levers** – A rigid bar resting on a pivot that is used to move a heavy or firmly fixed load
- **Pulleys** – A wheel with a grooved rim around that changes the direction of a force applied to the cord
- **Gears** – A toothed wheel that works with others to alter the relation between the speed of a driving mechanism (e.g. engine) and the speed of the driven parts (e.g. the wheels)




An example of a lever system.



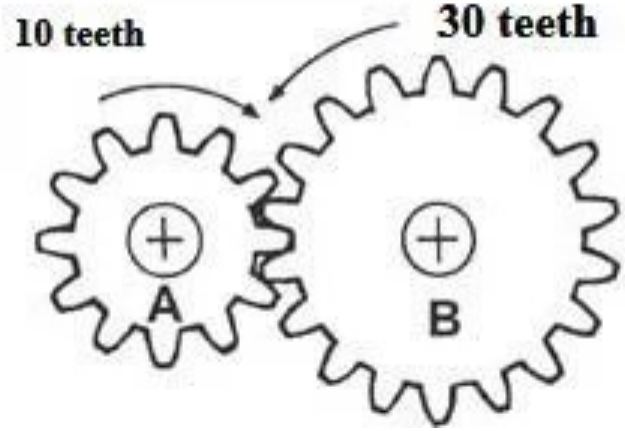

An example of a pulley system.

## Key vocabulary

| | |
|---|---|
| Surface | The top layer of something |
| Grip | To have good connection with a surface |
| Drag | To cause to slow down |
| Centre | The middle |
| Pivot | The central point on which a mechanism turns |

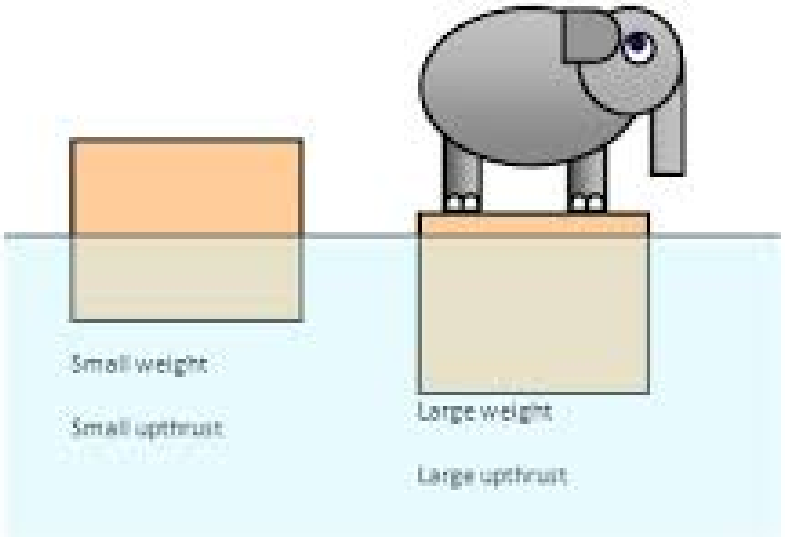
You have read on the other page that friction is a force which makes things grip. However sometimes in machines we want to **reduce friction**. For example, we use oil to reduce the friction between the moving parts inside a car engine. The **oil holds the surfaces apart and can flow between them**. The reduced friction means there is less wear on the car's moving parts and less heat produced.

An example of a gear system.



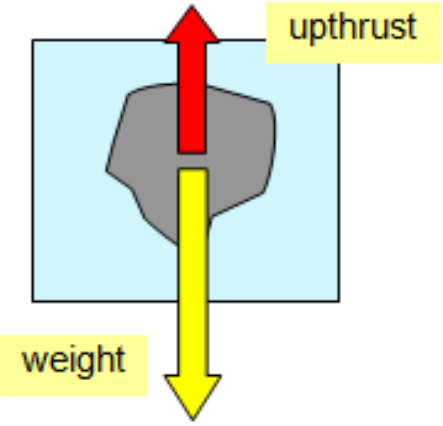

## Water

When something is in water, there are **two forces** acting on it. Its **weight** and the force of the water pushing up, **the upthrust**. If the weight is equal to or less than the upthrust, it floats. Things that float are **buoyant**. If the weight is greater than the upthrust, it sinks.




## Resistance

When an aeroplane flies through the air, air particles hit the aeroplane making it more difficult for it to move through the air. It's the same for an object moving through water. If you go swimming, there is friction between your skin and the water particles. This is known as water resistance.




Resistance is the **stopping effect** exerted by one material thing on another. It is used to describe friction.