

## National Curriculum Science - Knowledge

- Explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object.
- Identify the effects of air resistance, water resistance and friction, that act between moving surfaces.
- Recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

## Key Learning

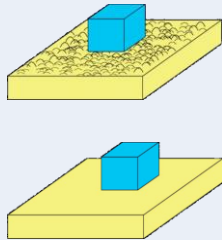
A force causes an object to start moving, stop moving, speed up, slow down or change direction.

Gravity is a force that acts at a distance. Everything is pulled to the Earth by gravity. This causes unsupported objects to fall.



Air resistance, water resistance and friction are contact forces that act between moving surfaces. The object may be moving through the air or water or the air and water may be moving over a stationary object.

### Friction

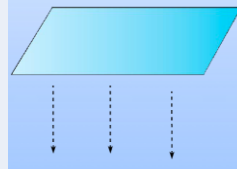


When an object moves across another surface there is sometimes lots of friction (high friction) and sometimes very little friction (low friction).

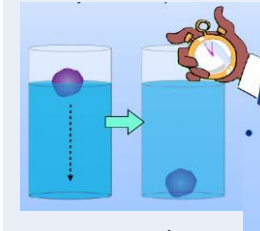
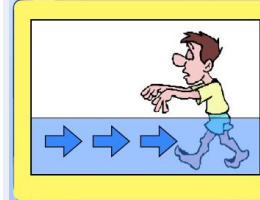
### A Force Meter



### Air resistance



### Water resistance



### Streamline

Streamlined shapes encounter little water resistance.



## Vocabulary

**Force:** a push or pull that causes an object to start moving, stop moving, speed up, slow down or change direction.

**Gravity:** the force that attracts a body towards the centre of the Earth, Moon or other such large mass.

**Air resistance:** a force that occurs when air pushes against a moving object and causes it to slow down.

**Water resistance:** the force that pushes against objects as they pass through the water.

**Friction:** the force which acts between a surface and object that may make it harder for the object to move.

**Mechanism:** a simple machine such as levers, pulleys or gears.

**Mass:** the amount of matter something has.

**Weight:** the force acting on the object due to gravity.

**Newtons:** the International System of Units derived unit of force. It is named after Isaac Newton in recognition of his work on forces and motion.

**Force Meter:** used to measure the size of a force (also known as a newton meter). Force meters have a spring inside them. The weight of the mass causes the spring to stretch. It is important to 'zero' the force meter before you use it.

## National Curriculum Science – working scientifically

- Plan different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary.
- Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate.
- Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.
- Use test results to make predictions to set up further comparative and fair tests.
- Report and present findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations.
- Identify scientific evidence that has been used to support or refute ideas or arguments.

## Key Learning continued...

A mechanism is a device that allows a small force to be increased to a larger force. Pulleys, levers and gears are all mechanisms, also known as simple machines. Due to their affect on forces, they are used in many larger machines.

### Levers

Levers work by increasing the amount of force. A beam is placed over a fulcrum. The position of the fulcrum affects how much the force is increased or decreased.



### Pulleys

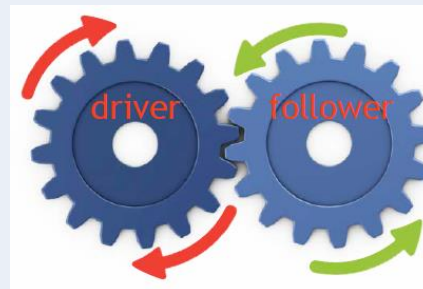
Pulleys make it easier to lift objects. The Greek scientist and inventor, Archimedes, developed the design of pulleys to make them more efficient.

Belt pulleys are used in lots of different machines to make it easier to lift or move heavier objects.



### Gears

Gears (sometimes called cogwheels) are wheels that have 'teeth'. Two or more gears working together are called a transmission. When the Teeth of two gears mesh together, force can be transmitted from one gear to the other.



## Scientific investigations

- 1) Does weight affect the size of a crater?
  - 2) Which surface has the most friction?
  - 3) Does the shape of an object affect water resistance?
- Plan scientific enquiries, identifying and managing independent, dependent and control variables.
  - Record and present measurements using diagrams, tables and graphs.
  - Interpret results to answer the scientific question being investigated, linking to knowledge of forces to explain them.

Ask scientific questions and make predictions about the variables that will have an effect on how long a spinner take to reach the ground.

Research how the work of scientists such as Archimedes, Galileo Galilei and Isaac Newton helped to develop understanding of forces, including pulleys, levers and the theory of gravitation.

**Key Learning: Identify the effect of a range of forces and how these can be increased and/or decreased.**

Pre Complete a thought shower to describe and explain forces based on current understanding (retrieval from prior learning and experiences).

**1 Why do unsupported objects fall towards the Earth?**



Discuss ideas about weight. Weight describes how heavy an object is and that it is Earth's gravitational force that causes objects to have weight. Gravity is a force that pulls objects towards the Earth's centre. One of the ways we can see the effect of gravity is by looking at craters left in the ground on the Moon by meteorites that have landed. Discuss: 'How might the shape and size of a meteorite affect the shape and size of the crater that it leaves in the ground on impact? How might the depth of crater and amount of material scattered be dependent on the weight of the meteorite? Conduct an investigation, measure and interpret results to answer these questions.

**2 What are the effects of friction?**

Friction acts between moving surfaces. To make an object move on a surface you need to either push it or pull it, and that there is a force between the surface and object that may make it harder for the object to move – this is called friction. Plan and conduct an experiment to investigate the effects of friction on different surfaces, using a force meter / Newton meter.

**3 What are the effects of air resistance?**

Air can act as a force against moving objects in the same way that water does. Air resistance is a force that occurs when air pushes against a moving object and causes it to slow down. The size of a surface affects how fast it will move through the air because air resistance acts against it and slows it down. For example, a parachute saves the sky diver's life because the air resistance acts against the gravitational force and slows the sky diver down so he can land safely. Think scientifically to question the factors that may affect the time it takes for a spinner to fall. Make predictions, justifying these using knowledge of forces and air resistance.

**4 What are the effects of water resistance?**

Water resistance is the force that pushes against objects as they pass through the water. This is what you can feel pushing against you as you try to walk in water and why it makes it more difficult than walking on land. The shape of an object dictates how much water resistance it will meet as it moves through the water. Streamlined shapes encounter little water resistance (e.g. boats, fish). Plan, conduct and conduct an experiment to investigate the effect of shape on water resistance.

**5 What is the effect of levers and pulleys?**

Levers and pulleys allow a smaller force to have a greater effect. They are therefore used in lots of different machines. The Greek scientist and inventor, Archimedes, developed the design of pulleys to make them more efficient. Make model catapult and use to complete a variety of simple activities. Test and modify designs based on results.

**6 What are the effects of gears?**

Like levers and pulleys, gears allow a smaller force to have a greater effect. Gears (sometimes called cogwheels) are wheels that have 'teeth'. When the teeth of two or more gears mesh together, force can be transmitted from one gear to another. Design / draw transmissions described, then labelling the driver gear, follower gear/s and the directions of rotation.