



**Topic: Forces.**  
**(Contact forces & Pressure)**

**Year: 8**

**Strand: Physics**

**What should I already know?**

**Forces**

can act in any direction, causing stretching, compression and changes in motion. Some types of forces require contact, whereas others are non-contact forces, such as gravity.

**Friction and resistance**

Friction is a force that acts between moving surfaces, causing them to slow down or stop. Air resistance is friction between air and an object moving through it. A boat moving through water experiences water resistance.

**Floating and sinking**

When an object is placed in water, weight will pull it down, and an upthrust will act upwards. If the weight is greater than the upthrust, the object will sink. If the upthrust is equal to the weight, it will float.

**Resultant forces**

There may be several forces acting on an object. To understand how they affect the motion of the object we need to consider all of them. If forces are acting in the same direction, we get the resultant by adding them but if they are acting in opposing directions, we subtract one from the other. If the resultant is zero the object will have a steady speed, which might be zero. If the resultant is not zero the object will speed up, slow down or change direction.

**What will I know by the end of the unit?**

**Effects of forces**

Elastic materials behave in a special way when forces such as tension or compression change their shape. Materials can become permanently deformed when they are stretched or compressed by large forces. Stresses on a solid can explain effects such as the scratching of a surface, sinking or breakage.

**Friction and drag**

Friction is caused by one surface moving over another. If one of the surfaces is a fluid, it is called 'drag'

**Pressure, floating and sinking**

Pressure is the force acting on a certain area. Pressure can act in solids, liquids and gases. An upthrust force affects all objects that are submerged in a liquid. Pressure in a fluid increases with depth. The volume of an object affects the amount of upthrust it experiences in a liquid.

**Forces in equilibrium**

A force on a moving object may cause its speed to increase or decrease. If opposing forces act on an object and are balanced the object is in equilibrium.

**Vocabulary**

<b>Acceleration</b>	measurement of speed
<b>Atmosphere</b>	Air a mixture of gases around the Earth
<b>Atmospheric pressure</b>	Pressure exerted by the weight of air above that point
<b>Area</b>	Length X Width. m <sup>2</sup>
<b>Balanced forces</b>	Forces are in balance when they are equal in size and acting in the opposite direction



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<b>Buoyancy.</b>	Liquid such as water provides a <b>buoyancy</b> force called <b>upthrust</b> to an object in it. If the <b>density</b> of the object is <b>greater</b> than the water, it will <b>sink</b> .
<b>Compression</b>	A force squashing or pushing an object.
<b>Contact force</b>	A force acting between objects that are physically touching.
<b>Deformation</b>	By <b>stretching</b> or <b>compressing</b> a material so far that it changes shape. It has been stretched or compressed beyond its <b>elastic limit</b>
<b>Density</b>	Mass of a material per unit volume.
<b>Equilibrium</b>	a state of rest or balance due to the equal action of opposing forces.
<b>Gas pressure</b>	The collisions between air molecules within a container
<b>Fluid</b>	Any material that will flow. <b>Liquids</b> and <b>gases</b> are fluids.
<b>Forces</b>	Can be a pushing, pulling or turning force
<b>Friction</b>	A force that opposes movement..
<b>Hooke's Law</b>	States the extension of a spring is proportional to the load applied to it.
<b>Liquid pressure</b>	When a liquid exerts pressure due to molecules pushing on each other
<b>Linear relationship</b>	Changing the independent variable causes the exact change in the dependent variable; they are <b>directly proportional</b> . As seen in Hooke's Law and the straight line goes through zero on both axes.
<b>Newton (N)</b>	The unit of force (N). The measurement of pressure. $N/m^2$
<b>Non-contact force</b>	A force acting between objects that are not physically touching. Eg <b>Gravity</b>
<b>Pascal (Pa)</b>	<b>Pressure</b> = $\frac{\text{Force}}{\text{Area}}$ or $P = \frac{F}{A}$ so ... $1Pa = \frac{1N}{1m^2}$ or 1Pa is the same as $\frac{1N}{1m^2}$
<b>Pressure</b>	Force on a specific area
<b>Resultant forces</b>	The single force which has an effect on an object, the sum of a set of forces acting on the object
<b>Speed</b>	This is a measure of how far something travels in a specific time. Measurement of speed m/s
<b>Streamlined</b>	The <b>shape</b> of an object which can move through a <b>fluid</b> with minimal friction. E.g. a fish through <b>water</b> or a jet plane through the <b>air</b>
<b>Tension</b>	The force applied to a material which tries to stretch it.
<b>Upthrust</b>	The upwards force produced by objects pushing down on fluids (liquids and gases). Water is <b>displaced</b> when an object is lowered into it. The weight of the displaced water is equal to the <b>upthrust</b> force



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**Key information**



$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Area} = \frac{\text{Force}}{\text{Pressure}}$$

$$\text{Force} = \text{Pressure} \times \text{Area}$$

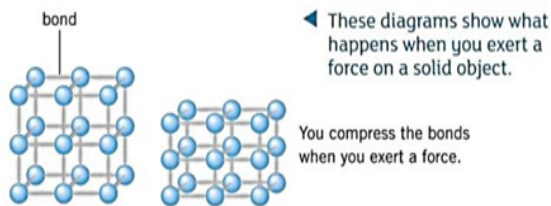
**Negative Buoyancy Body Will Sink if**

SQUASHING AND STRETCHING

- Forces can cause deformation of objects. They can also cause compression or tension.

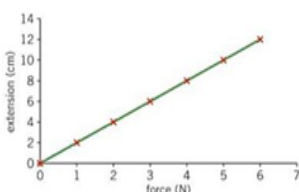
How can the floor push you up?

When you stand on the floor, your weight pushes the solid particles closer together. The bonds are slightly compressed and push back and support you. This is called the reaction force.

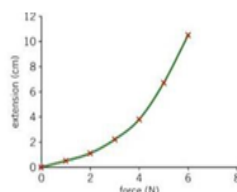


What happens when you stretch a spring?

- If you double the force on the spring, the extension will double (Hooke's Law).
- At some point, when you remove the force it will not go back to its original length (elastic limit).
- Not everything behaves like a spring when you stretch it.



▲ This graph shows how the extension of a spring changes as you pull it.



▲ This graph shows the relationship between force and extension for polythene. It is not linear.

**Key information**

**Forces** are pushes or pulls, arising from the interaction between two objects. you can only see what the changes to objects caused.

When a force is applied to an object, it can lead to.....

- A change in speed (acceleration)
- A change in the object's direction of movement
- A change in the object's shape (squash or stretch the object).

Forces can also be divided into two types, contact forces and non-contact forces.

**1. Contact forces** act between objects that are touching. Examples: friction, normal contact force, thrust, upthrust, and air resistance(drag). Friction occurs when an object moves through a fluid (a fluid is a liquid or gas) or when one solid surface moves along another solid surface.

**2. Non-contact forces** act between objects even if they are NOT touching. **Examples: gravity, weight, magnetic force.**

We use **force arrows** in diagrams; Force Arrows Forces have a size and a direction. The length of the arrows shows how large the force is. The direction the arrow points show the direction in which the force pushes or pulls. Diagrams that show the forces acting on objects using arrows are called free-body force diagrams.

**Resultant force** The resultant force acting on an object is the single force resulting from all the separate forces acting on it. In other words, the resultant force is the single overall force.

**Forces: associated with deforming objects;** stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water

**Forces are measured in Newtons**, measurements of stretch or compression as force is changed. **(N)**. This is named after Sir Isaac Newton, who developed a theory of gravity.

**Force -extension as a linear relation;** Hooke's Law as a special case

**Opposing forces and equilibrium:** weight held by a stretched spring or supported on a compressed surface.

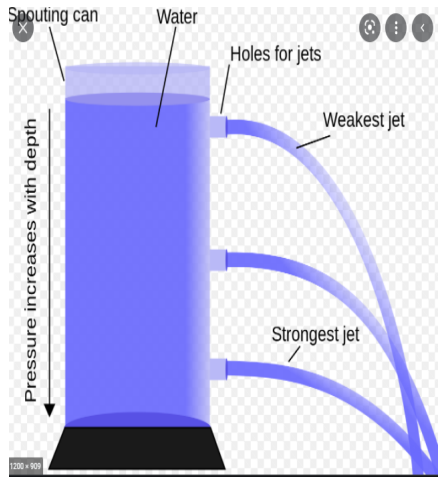
Forces are needed to cause objects to stop or start moving, or to change their speed or direction of motion

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

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(qualitative only) Change depends on the direction of force and its size.

**forces: associated with deforming objects;** stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water.

**Gas pressure** is due to the collision of gas molecules with the side of the container or object. If the gas is hotter or compressed into a smaller volume or if there are more gas molecules in the same space, there will be more collisions and the pressure will be greater.

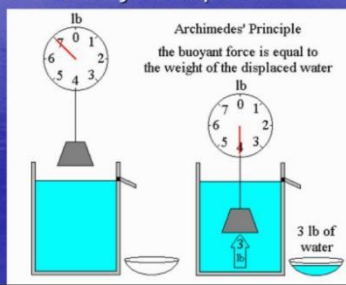
**Atmospheric pressure** is due to the collision of air molecules with objects. Atmospheric pressure decreases with height because there are fewer air molecules higher up.

**Liquids are incompressible.** The pressure at a particular depth in a liquid depends on the weight of the water above it. Pressure increases with depth.

**The centre of gravity** is the point at which the object's weight appears to act.

### Buoyant Force

- Archimedes' Principle states that the buoyant force on an object is equal to the weight of the fluid the object displaces.



### Useful Websites

Introduction to forces <https://www.bbc.co.uk/bitesize/guides/zttfyrd/revision/1>

Revision site <https://docbrown.info/ephysics/forces7.htm>

BBC Bitesize. Forces Pressure and speed. <https://www.bbc.co.uk/bitesize/articles/zwbqwnb>

Archimedes in the tub <https://www.youtube.com/watch?v=ijj58xD5fDI>

Hooke's Law <https://www.youtube.com/watch?v=a8Unbe4K8U4>

<https://www.youtube.com/watch?v=hHOHwuGPoal>

Calculating pressure <https://www.youtube.com/watch?v=8AysbEMEv50>

<https://www.youtube.com/watch?v=fheOYg9TKQA>

GCSE Calculating pressure. <https://slideplayer.com/slide/7897719/>

Sinking and floating <https://www.youtube.com/watch?v=skIRRfqA1s4>

<https://www.youtube.com/watch?v=nMIXU97E-uQ>

#### Revision monkey

Introduction to forces <https://www.youtube.com/watch?v=CyHTYdgWXzI>

Friction and drag <https://www.youtube.com/watch?v=xc3sM8TiTp0>

Stretch and compression <https://www.youtube.com/watch?v=RZfVYFvilLw>

Pressure on a solid surface <https://www.youtube.com/watch?v=bYvkvA1tGr0>

Pressure in a liquid <https://www.youtube.com/watch?v=wC0YfyB2Oac>