



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

Year: 8

Strand: Physics

What should I already know?

Forces

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

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



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



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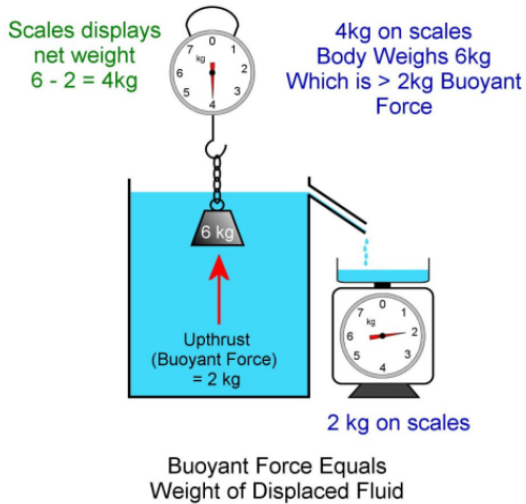
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Key information

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**Negative Buoyancy
Body Will Sink if
Released From Scales**



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

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 2 types, contact forces and non-contact forces.

1.Contact forces act between objects that are touching. Examples: friction, normal contact force, thrust, upthrust, air resistance (drag). Friction acts whenever an object is moving through a fluid (a fluid is a liquid or gas), or when one solid surface is moving 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 show how large the force is. The direction the arrow points show the direction 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.

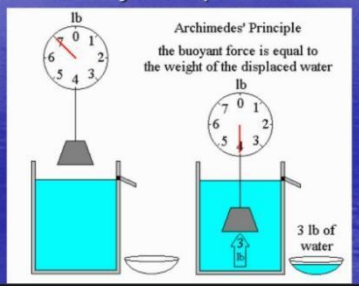
Force -extension as a linear relation; Hooke's Law as a special case

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

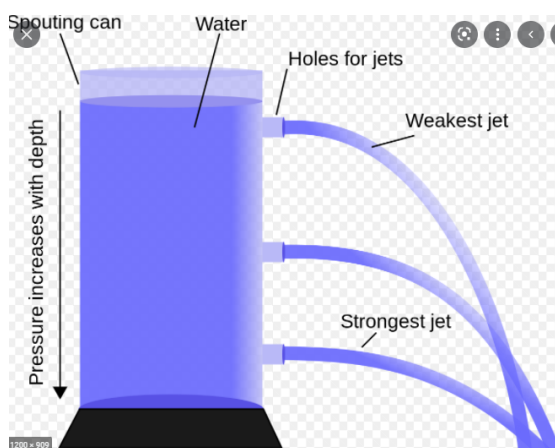
What happens when you stretch a spring?

Buoyant Force

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



you pull it. force and extension for poly(ethene). It is not linear





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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 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 all the weight of the object appears to act.

Archimedes. Stated that

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

Density is a measure of an object's mass divided by its volume.

Useful Websites

<https://www.bbc.co.uk/teach/class-clips-video/physics-ks3ks4-5-average-speed/z4mb42p>

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

<https://www.bbc.co.uk/bitesize/guides/zttfyrd/revision/3>

<https://slideplayer.com/slide/7897719/>

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

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