

- Use of echo-location: exploration of oil, navigation of seas and oceans
- Use of ultrasound: clean small items, create images of foetuses, shatter gallstones
- Units of Speed: m/s, km/h, mph (only time miles is abbreviated to 'm')
- Units of distance: m, km, miles
- Units of time: s, min, mins, hr, hrs



- Always show units + working out
- Never abbreviate distance, speed or time in a question
- Correct units at all times

Motion and Speed

Forces • A force is either a push or a pull

Type of force	Explanation
Magnetic	Felt when holding two magnets together. Either attract (pull) or repel (push)
Electrical	Looked at further (electromagnetism)
Gravitational	The force pulling everything towards the earth, and is what gives every object a weight
Impact	A stationary object can start moving if a big enough object collides with it
Strain/tension or twisting	The force in a stretched or twisted rubber band
Frictional	Friction can't make an object move it can only stop motion or reduce the size of the force. Dynamic (always, and automatically varies)

To measure forces you use a Newton meter / Force meter / spring balance

- Forces are used to push, pull, turn, squash, stretch and support objects
- It occurs when 2 surfaces have contact with each other
- Causes heat energy and wears out moving parts
- Rough surfaces cause more friction than smooth surfaces
- Friction is useful when: tyres + road, brakes, sole + road
- Friction is not useful when: slide + person, swimming water + fingers, car engine + other parts

Friction + Cycling

The brake blocks rub against the wheel to produce friction to slow down the bike. The speed of the bike is reduced from friction between the tyre and the road.

Drag

A lubricant, like oil, can reduce friction

An object experiences an opposing force called drag when travelling through liquids and gases

This is caused by friction between the liquid or gas and the surface of the object that is travelling through the liquid or gas

The faster the speed, the more drag

Air Resistance

Reducing air resistance is called streamlining

Reasons for streamlining:

- Higher top speed on a given engine size
- More fuel efficient / go further on a given amount of fuel at a given speed

Balanced Forces

If equal forces are applied to a stationary object, it won't move

Any object not moving has balanced forces

Objects reach terminal velocity when forces are balanced

Unbalanced Forces

If one force is larger than the other, the object will move in the direction of the larger one

If forces are acting in opposite directions, you can subtract the smaller force from the larger one to find the force

Springs

Hooke's Law says that a spring will extend depending on the weight applied to it

The elastic limit is the point at which Hooke's Law no longer applies

For 2 springs in series the extension is double that of a single spring

For 2 springs in parallel the extension is half that of a single spring

Pressure

Unit of pressure = 1 pascal / N/m^2 and N/m^2 . 1 pascal = $1N/m^2$

The pressure in liquids and gases increase as the depth increases

Pressure in liquids and gases acts in all directions

Hydraulic systems increase the pressure and force by using liquids

Air pressure at sea level is about $100,000N/m^2$. This is called atmospheric pressure

The air pressure of the earth gets less the higher you go

On a bike, a braking system uses the force applied to the lever to make a larger force which uses friction to slow down the bike. This is called a force multiplier

Liquids are very difficult to compress, and the pressure applied at one side of a liquid sealed in a cylinder is transferred to the other side

In a car braking system, the force from the brake is transferred along the cylinder to the pistons, and since the pistons have a large surface area, a large force is exerted on the braking disc

Hydraulic systems are also used as a force multiplier in powerful cutting tools and to lift heavy weights

Hydraulic systems don't work as well if air gets into the system as gases are easily compressible and don't transmit the pressure

Using a longer lever means less force is needed to produce the same turning effect

Turning Forces

moment = Newton metre (Nm)

force = Newton (N)

distance = metre / centimetre (m/cm)

An anticlockwise turning = anticlockwise moment

A clockwise turning = clockwise moment

If balanced, the anticlockwise moment is equal to the clockwise moment

The idea of moments still applies if the pivot point is not in the middle, but on one side

When two turning forces are acting in the same direction, the overall moment is the sum of the two turning forces