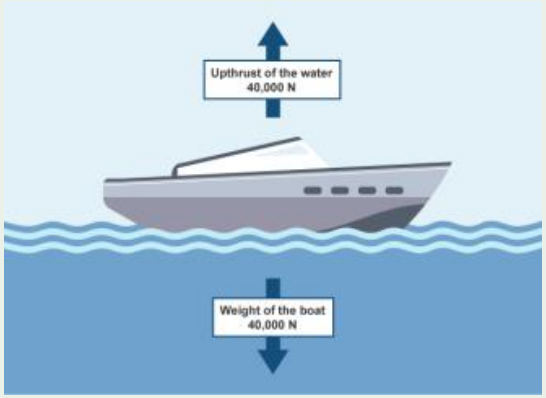
Forces

Key words

Force	A push or pull. The unit of force is the newton.
Air resistance	A force of friction produced when an object moves through the air.
Tension	Pulling force exerted by each end of an object such as a string or rope.
Weight	The force acting on an object due to the pull of gravity from a massive object like a planet
Upthrust	Upwards force exerted by a liquid or gas on an object floating in it.
Reaction force	Force exerted in the opposite direction to an action force.

Key diagram - Force diagrams

We can show the forces acting on an object using a force diagram. In a force diagram, an arrow represents each force. The arrow shows: the size of the force (the longer the arrow, the bigger the force); the direction in which the force acts. The arrow should be labelled with the name of the force and its size in newtons.



Key knowledge

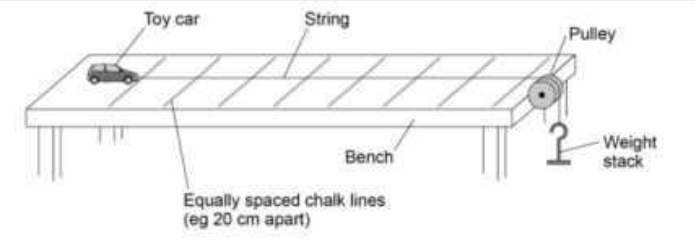
A **force** can be a **push** or a **pull**. You cannot see a force but often you can see what it does. When a force is exerted on an object, it can change the object's speed, direction of movement and/or shape.

Forces can be contact forces (objects must touch each other to exert a force). Other forces are non-contact forces (objects do not have to touch each other e.g. gravity; magnetism; force due to static electricity)

Whenever an object moves against another object, it feels **frictional forces**. These act in the opposite direction to the movement. Friction makes it more difficult for things to move. This can be helpful (e.g. shoes, tyres, brakes) or unhelpful (unnecessary traction, heat and noise).

Required practical – Acceleration

1. Set up the equipment as shown in the figure.
2. Mark at least five straight lines across the surface, each equal distance apart.
3. Place 300 g of mass on the trolley. Add 100 g of mass (1 N of force) to the hook and hold the trolley at the start.
4. Start the stopwatch as you release the trolley and press 'lap' as the trolley passes each line. Record the times at each distance for the applied force of 1 N.
5. Take a 100 g mass off the trolley and add it to the hook so the applied force is now 2N. Measure the time taken for each segment again.
6. Repeat step 4 up to 4 N so all four masses are on the hook and none on the trolley. Calculate the acceleration of your trolley in each segment, for each force.



Key process – Balanced forces and unbalanced forces

When two forces acting on an object are equal in size but act in opposite directions, or if there are no forces on an object, they are **balanced forces**. When forces are balanced, a stationary object stays still and a moving object continues to move at the same speed and in the same direction without gaining speed; an object can be moving, even if there are no forces acting on it. When two forces acting on an object are not equal in size, we say that they are unbalanced forces. The overall force acting on the object is called the **resultant force**. If the forces are balanced, the resultant force is zero. If the forces on an object are unbalanced, a stationary object starts to move in the direction of the resultant force, and a moving object changes speed and/or direction in the direction of the resultant force.