KS4 – Year 11 – P5 – Forces

Key Vocabulary	
Tier 1	
Force	A push or pull that can change the motion or shape of an object.
Speed	How fast something is moving.
Pull	To move something towards yourself.
Push	To move something away from yourself.
Weight	The force due to gravity on an object; calculated by mass × gravitational field strength
Tier 2	
Gravity	The force that pulls objects towards the Earth
Contact force	A force that acts only when two objects are touching
Non-contact force	A force that acts at a distance without touching
Gravity	The force that pulls objects towards the Earth
Friction	A force that opposes motion between two surfaces in contact.
Tier 3	
Vector	A quantity that has both size (magnitude) and direction
Scalar	A quantity that has only size (magnitude), no direction
Hooke's Law	The principle that the extension of a spring is directly proportional to the force applied, within the elastic limit
Acceleration	The rate of change of velocity of an object
Inertia	The resistance of an object to change its motion

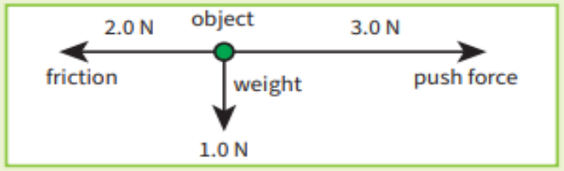
Career Links

Mechanical Engineer, Civil Engineer, Aerospace Engineer, Automotive Engineer, Physiotherapist, Sports Scientist, Architect, Safety Inspector, Material Scientist, Robotics Engineer, Occupational Therapist, Structural Engineer, Pilot, Kinesiologist

Homework

Drawing forces

Free body diagrams use arrows to show all of the forces acting on a single object. For example:

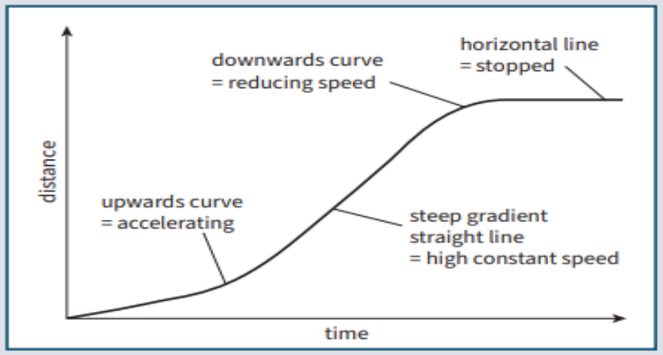


A dot or circle represents the object, with the forces drawn as arrows:

- the arrow length represents the magnitude of the force
- the arrow direction shows the direction of the force.

Distance–time graphs

A distance–time graph shows how the distance travelled by an object travelling in a straight line changes with time.

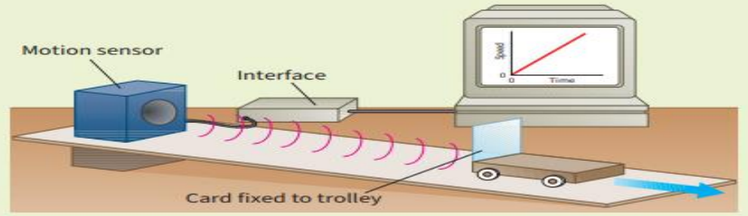


The gradient of the line in a distance–time graph is equal to the object's speed.

If the object is accelerating, the speed at any time can be found by calculating the gradient of a tangent to the curved line at that time.

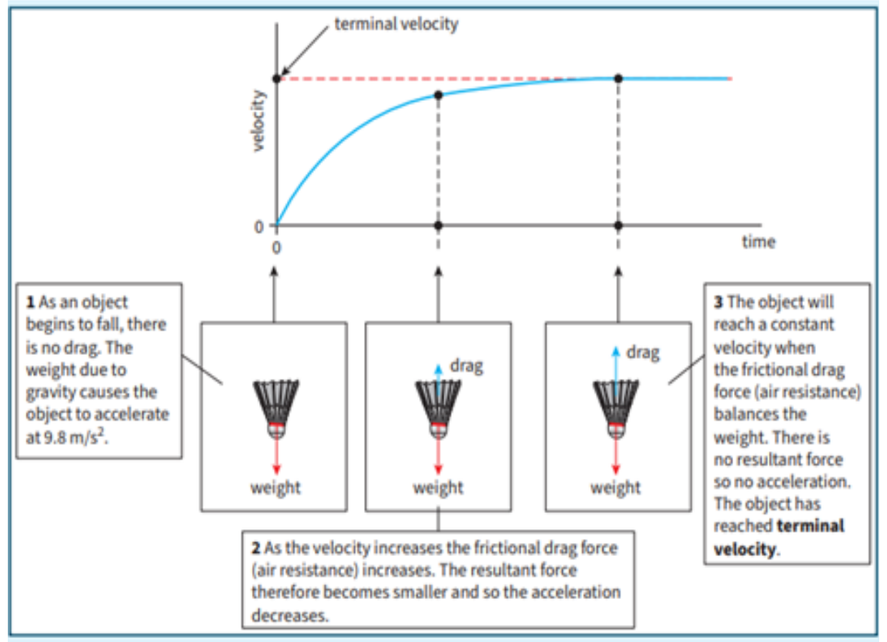
Investigating acceleration

Motion sensors which are attached to a computer can be used to record how the velocity of an object changes.



As the trolley accelerates down the runway, the velocity increases with time. Therefore, the line on the graph will go up and remain straight to suggest that the acceleration of the trolley is constant.

Alternatively, making the runway steeper will mean the trolley accelerates faster, and the line on the graph will be steeper.



Key Knowledge

- A force is a push or pull that can change the motion or shape of an object.
- Forces can act by contact (touching) or at a distance (non-contact).
- Common forces include gravity, friction, air resistance, and applied forces.
- Gravity pulls objects towards the Earth and gives them weight.
- Weight is the force due to gravity acting on an object's mass.
- Mass is the amount of matter in an object and does not change with location.
- Forces have both size (magnitude) and direction, making them vector quantities.
- Scalars are quantities with only magnitude, like speed or mass.
- When forces acting on an object are balanced, the object stays still or moves at a constant speed.
- Hooke's Law states that extension is directly proportional to force, up to the elastic limit.