Australian Curriculum Year 4 Science Sample assessment | Assessment resource

The force of friction

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# Scientific concepts and student’s prior understandings

## Scientific concepts

### Force

A force is an influence that produces, or tends to produce, a change in the motion of an object. When there is a push, a pull, a bend, a twist, a turn, a squeeze, a tear, a lift, a stretch, friction or resistance, at least one force is being exerted.

A force can move something, make it go faster or slower, change its direction, stop it, or change its shape. Often an object will be affected by a number of forces at once. If these forces are balanced, the object will be held in place and will keep its shape.

When a force is applied, energy can be transferred or transformed. Transfer of energy refers to the shifting of energy from one object to another. For example, a bowling ball with kinetic energy (energy of movement) hits the tenpins and gives them kinetic energy.

### Gravity

According to the Newtonian model, gravity is a force of attraction that any body with mass has towards any other body with mass. The effect of gravity increases with increased mass. For example, the effect of gravity is greater on the Earth than it is on the moon because the Earth has a larger mass than the moon. The effect of gravity is also greater over shorter distances. For example, the sun has a greater gravitational pull on the Earth than other more distant stars do. Gravity contributes towards keeping the planets in orbit around the sun and is the reason that objects fall towards the Earth when they are dropped.

### Friction

Friction occurs when two objects slide across each other. It results from contact between the objects’ surfaces.

An object will move across a surface if the force applied to move it is greater than the force due to friction. The effect of friction can be reduced by streamlining, and by minimising the amount of contact between surfaces through the use of wheels, ball bearings, lubricants and flat surfaces — for example, snow skis. The presence of friction in many everyday situations is helpful — in fact, movement without friction is difficult, if not impossible. The use of bitumen on roads and treads on tyres and shoes helps to increase the effect of friction.

Air resistance is the friction that occurs when an object makes contact with particles in the air.

## Students’ prior understandings

Students’ prior understandings may differ from scientific concepts in a range of ways. Some students may:

* believe that the force of an object resides within the object rather than being an external effect. A common misconception is that if an object *is not* moving there are *no* forces acting on it, and if an object *is* moving there *is* force acting on it in the direction it is moving. This is incorrect, as demonstrated by these examples:
  + if an object is stationary on the ground, gravity is acting downwards and a reaction force from the ground is acting upwards
  + if an object such as a toy car is given a push across a flat surface, there is initially forward force acting on it, but once it is allowed to move freely, there is *no* forward force. Friction exerts a force in the opposite direction to the object’s motion and is the reason it eventually stops moving
* believe that forces can be applied only by living things, i.e. they may realise that a human can apply a force but may not consider the effects of gravity or friction
* be aware of one or several forces being exerted on an object, but may not consider *all* forces, e.g. students may realise that gravity is acting on a ball rolling down a hill, but may not consider the effect of friction acting in the direction opposite to the motion of the ball.

### Resource

Sourcebook modules provide teachers with a range of learning and teaching ideas. Teachers are encouraged to modify modules to meet the specific needs and interests of particular groups of students and individual students, their own needs and the learning environment.

QSA, Science (1999) sourcebook module > Energy and change > Force and motion, [www.qsa.qld.edu.au/992.html](http://www.qsa.qld.edu.au/992.html).