Mass and weight

Some people might think that the kilogram is a unit of weight, but in science, we use kilograms to measure mass, not weight. Mass and weight are different. Mass is the amount of matter in an object. Weight is the pull of gravity on an object. It is a force and is measured in newtons.

Key facts

✓ Weight is the force that acts on an object due to gravity.

✓ Mass is measured in kilograms, but weight is measured in newtons.

✓ Weight can be measured using a force meter (newton meter).

✓ Weight can be calculated using mass and the strength of gravity.

Measuring weight
You can measure the weight of an object with a force meter (newton meter), which has a spring that stretches along a scale as the force pulling the hook increases. You can also calculate weight using the formula below. The formula takes into account the strength of gravity, which varies on different planets. An object's weight depends on the strength of gravity, but its mass is the same everywhere.

The scale shows the force in newtons.

weight (N) = mass (kg) × gravitational field strength (N/kg)

$$W = m \times g$$

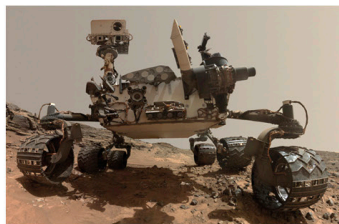On Earth's surface, the gravitational field strength (g) is 10 N/kg.

An apple with a mass of 0.1 kg is pulled downward by Earth's gravity with a force of 1 N.
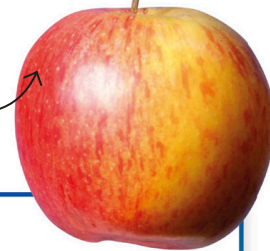
Calculating weight

Question
Curiosity is a car-sized rover on Mars. Its mass is 899 kg and the gravitational field strength on Mars is 3.7 N/kg. Calculate *Curiosity*'s weight on Mars. How much does it weigh on Earth?

Answer
Weight on Mars = $m \times g$
= 899 kg × 3.7 N/kg
= 3326 N = 3300 N (2 s.f.)
Weight on Earth = $m \times g$
= 899 kg × 10 N/kg
= 8990 N = 9000 N (2 s.f.)