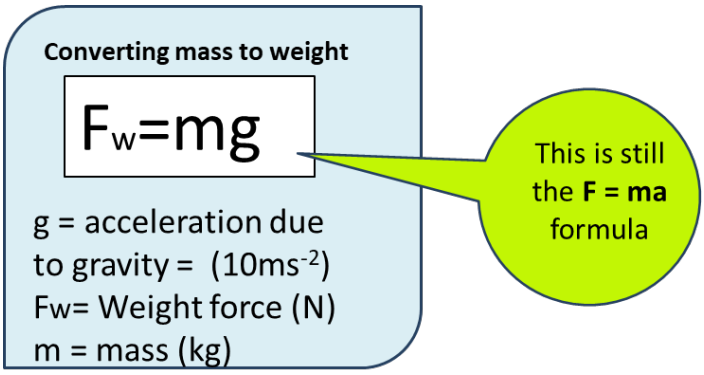
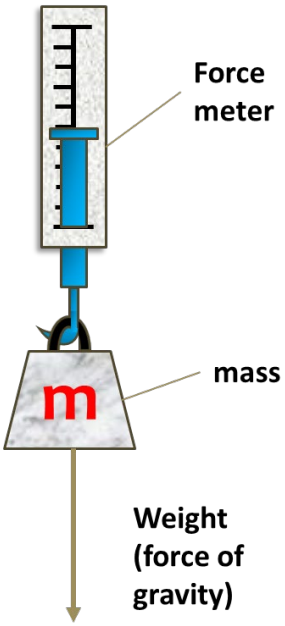
Mass and Weight

All objects have **Mass**. Mass refers to the amount of atoms, or substance, in an object. The formula symbol for mass is **m**.
Mass is measured in kilograms (kg). 1kg = 1000g
The mass of the object remains the **same** regardless of its **location**.



Weight is the downward force due to gravity that an object experiences due to its mass. The weight of an object depends on its location and the **gravity** pulling down on it. The weight of an object can change depending on where it is located. Astronauts weigh less on the moon because the force of gravity is less, but their mass is the same in both locations. The formula symbol for weight is F_w (weight force). Weight is measured in **Newtons** (N)

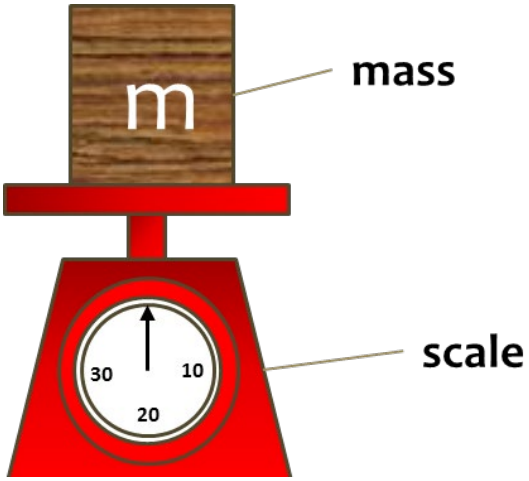
Measuring Mass and weight



Weight can be measured with a spring balance, where the mass can vertically hang, and the weight can be read off the force meter. The scale will be in Newtons (N).

A 2kg mass would read as (2 x 10ms^{-2}) **20N**

Mass can be measured with scales, where the mass can sit on top and the mass can be read off the meter. The scale will be in kilograms kg (or grams)



The Earth is the source of a gravitational field

The mass of the Earth creates an acceleration of 10 ms^{-2} for objects falling towards it. Regardless of the size of the object, they all fall with the same acceleration - only the shape, which causes changes in air resistance, results in some objects experiencing more opposing force and accelerate slower. To calculate our weight, which is a force on an object in a gravitational field, we multiply our mass by the gravitational acceleration of Earth. On Earth, due to the size and mass of the planet, we experience a gravitational pull of **10ms^{-2}**

This means if we were to freefall to Earth, every second we would accelerate 10m more per second – 1 second fall 10m, the next second fall 20m, the next second fall 30m etc

Force, mass and acceleration - EXTENSION

$$F=ma$$

a = acceleration (ms^{-2})
F= force (N)
m = mass (kg)

The Force experienced by an object can be calculated by multiplying the mass of the object by its acceleration.

Force = Mass x Acceleration

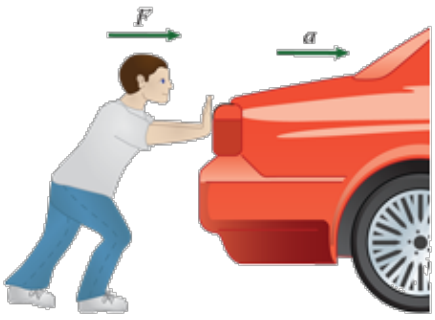
If more force is applied to an object, the faster it will accelerate.

Acceleration of a body depends both on its mass and on the size of the unbalanced force acting on it

Force = Mass x Acceleration

If the same amount of force is applied to two similar objects that have different mass, then then smaller object will accelerate faster.

F = ma calculations

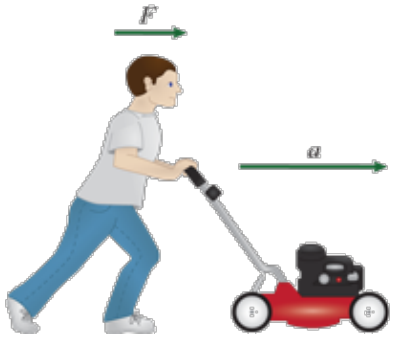


Car

F=ma

F=950kg x 0.5ms^{-2}

F= 475N



lawn mower

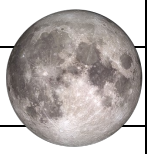
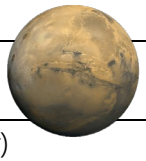
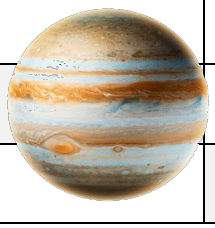
F=ma

F=10kg x 0.5ms^{-2}

F= 5N

Ben can push both the car and the lawnmower, so they accelerate at 0.5ms^{-2}. The mass of the car is 950kg and the mass of the lawn mower is 10kg. What is the force required to accelerate the car compared to the lawn mower?

1. Calculate the **force** (in Newtons) in each of these situations.

Weight (N)	Mass (Kg)	Gravity (ms^{-2})
	55	10 (Earth) 
670		10 (Earth)
	55	1.6 (Moon) 
	55	3.7 (Mars) 
825		24.8 (Jupiter)
354	95.7	

2. Fill in summary of weight and mass