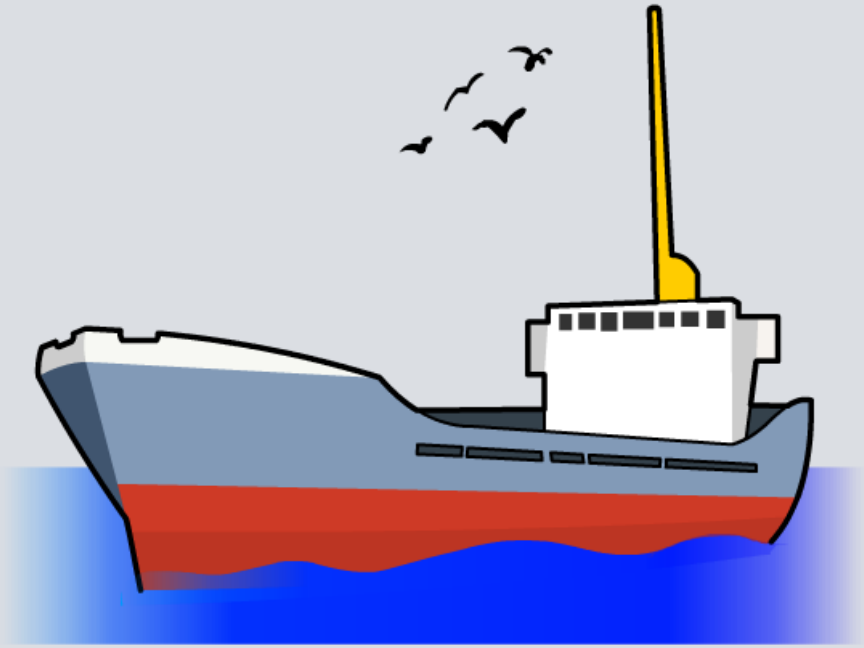
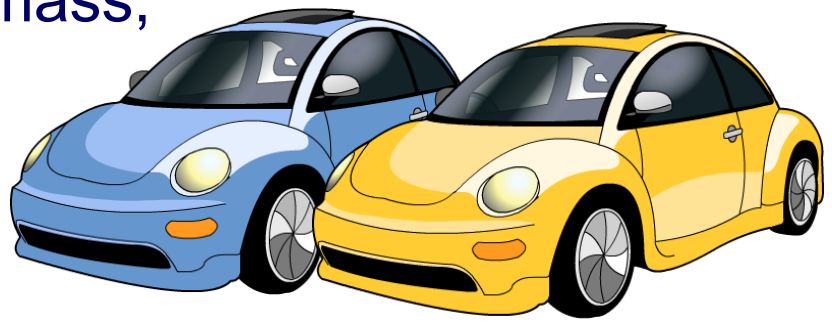
Momentum



What is momentum?

All moving objects have **momentum**. This is a measure of how difficult it is to stop a moving object.

If these two cars have the same mass, but one is quicker than the other, which has the most momentum?



The **faster** car.

If both cars travel at the same velocity, but one is full with luggage and the other is empty, which will have the most momentum?

The **heavier** car.

The bigger an object is and the faster it moves, the more momentum it will have and the more difficult it will be to stop.

How is momentum calculated?

The momentum of an object can be calculated using this equation:

momentum = mass × velocity

- Mass is measured in **kilograms** (**kg**).
- Velocity is measured in **meters per second** (**m/s**).
- Momentum is measured in **kilogram meters per second** (**kg m/s**).

Scalar or vector?

Velocity is a **vector** quantity – this means it has a magnitude (size) and direction.

Scalar quantities, such as speed, only have a magnitude.

As velocity is needed to calculate momentum, momentum must also be a vector quantity and it therefore has a direction.

If two objects of the same mass are moving in opposite directions but at the same speed (i.e. their velocities are different), the momentum of each object will be of the **same** magnitude but a **different** direction.

A '**+**' and a '**–**' are often used to indicate the direction of momentum of moving objects.

Calculating momentum question

A boat has a mass of 1,000,000 kg and a velocity of 15 m/s. What is its momentum?

momentum = mass × velocity

= 1,000,000 × 15

= **15,000,000 kg m/s**

Momentum calculations

You will need this equation to answer the following questions about momentum, mass and velocity:

momentum = mass x velocity

Click "**start**" to begin.

start