

# Force, mass, acceleration

Extension Sheet

If there is an unbalanced resultant force on an object, it accelerates.

$$\frac{F}{m \times a}$$

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

$$\text{Force} = \text{mass} \times \text{acceleration}$$

(in N) (in kg) (in m/s<sup>2</sup>)

## Example

A car of mass 800 kg accelerates from rest to 10 m/s in 20 s.

- What is the acceleration?
- What is the force exerted?

Answer

$$\text{Acceleration} = \frac{\text{change in velocity}}{\text{time taken}} = \frac{10 - 0}{20} = 0.5 \text{ m/s}^2$$

$$\text{Force} = \text{mass} \times \text{acceleration} = 800 \times 0.5 = 400 \text{ N}$$

Name : \_\_\_\_\_  
Grade : \_\_\_\_\_

## Questions

For each question show all your working clearly.

- What force is needed to give a mass of 10 kg an acceleration of 2 m/s<sup>2</sup>?
- What acceleration is given to a mass of 0.5 kg by a resultant force of 4 N?
- What is the mass of an object that accelerates at 3 m/s<sup>2</sup> when a force of 15 N is applied?
- A car of mass 800 kg accelerates from 5 m/s to 25 m/s in 10 s.
  - Calculate the acceleration.
  - Calculate the resultant force exerted.
- A car-driver of mass 60 kg is in a crash. He decelerates, from 20 m/s to rest, in 2 seconds. Calculate:
  - His deceleration.
  - The force exerted on him (by his seat and seat-belt).
- A supermarket trolley has a mass of 20 kg. When pushed by a force of 15 N it accelerates at 0.5 m/s<sup>2</sup>.
  - Calculate the resultant force on the trolley that gives it this acceleration.
  - What is the friction force on the trolley?
- A car has a mass of 1000 kg and is travelling at 20 m/s. The brakes then exert a steady force of 5000 N.
  - What is the deceleration?
  - How long does it take to stop the car?

