

Force, mass, acceleration

Extension Sheet

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

$$\begin{array}{c} F \\ \hline m \times a \end{array}$$

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

$$\begin{array}{llll} \text{Force} & = & \text{mass} & \times & \text{acceleration} \\ \text{(in N)} & & \text{(in kg)} & & \text{(in m/s}^2\text{)} \end{array}$$

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^2 ?
- 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^2 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^2 .
 - 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?

