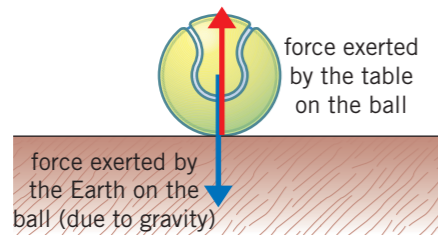


What is a force?

- A **force** can be a **push** or a **pull**
- A force is measured in **Newtons (N)**
- We measure forces with a **newton meter**
- Forces explain why objects will move, change direction and change speed

Forces always act in pairs, we call these **interaction pairs**
e.g. the tennis ball exerts a downward force of **weight** onto the table, the table exerts an equal and opposite reaction force onto the ball



Types of forces

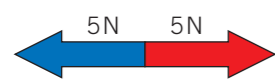
- **Contact forces** act when two objects are physically touching
- **Air resistance** and **friction** are examples of contact forces
- **Non-contact forces** act when two objects are physically separated (not touching)
- Examples of non-contact forces include **gravitational force** and magnetic forces
- We call the region where an object experiences a non-contact force a **field**, examples of these include gravitational fields and magnetic fields

Gravity

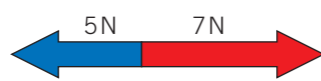
- **Gravity** is a non-contact force that acts between two objects
- **Gravitational force** pulls you back to Earth when you jump
- The size of the gravitational force depends on the mass of the two objects and how far apart they are
- **Weight** is the downward force caused by gravity acting upon the mass of an object, it is measured in Newtons (N)
- **Mass** is the amount of matter within an object, whereas weight is the downward force of the object, we measure mass in **kilograms**
- We calculate weight with the equation:
$$\text{weight (N)} = \text{mass (kg)} \times \text{gravitational field strength (N/kg)}$$
- The value of the gravitational field strength can vary, so although a person's mass would be the same on different planets, their weight would not be

Balanced and unbalanced forces

- When forces acting on an object are the same size, but acting in different directions, we say that they are **balanced**
- When forces are balanced, the object is either not moving (stationary) or moving at a constant **speed**
- When the two forces acting on an object are not the same size, we say that the forces are **unbalanced**
- When forces are **unbalanced**, the object will either be in **acceleration** or **deceleration**
- The **resultant force** is the difference between the two unbalanced forces



resultant = zero
stationary or
constant velocity



resultant = 2N
accelerating
to the right

Speed

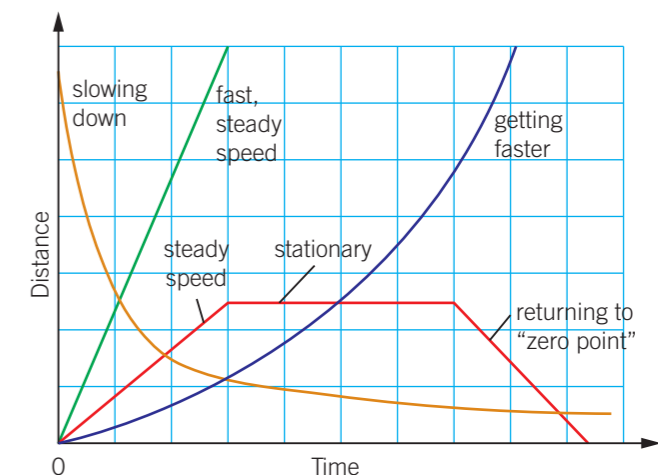
- **Speed** is a measure of how quickly or slowly that something is moving
- We measure speed in meters per second (m/s), this means that distance must be in meters and time must be in seconds
- We calculate speed with the following formula:

$$\text{speed (m/s)} = \frac{\text{distance travelled (m)}}{\text{time taken (s)}}$$

- **Relative motion** compares how quickly one object is moving compared to another
- If both objects are moving at the same speed, they are not changing position in comparison to one another, meaning that their relative speed is zero

Distance-time graphs

- **Distance-time graphs** tell the story of a journey, they show how much distance has been covered in a certain period of time



- To find the average speed, the total distance must be divided by the total time

Key terms

Make sure you can write definitions for these key terms.

acceleration air resistance balanced contact force deceleration distance-time graph field force friction gravity gravitational force interaction pair
kilograms mass Newton newton non-contact pull push relative motion resultant force speed unbalanced weight