

# Velocity

4.5.6.1.3 · Forces · revision notes

Velocity is speed in a given direction, so it is a vector. You need to explain the difference between speed and velocity.

## Key facts

- Velocity = speed in a given direction
- Unit of velocity: m/s, with a direction
- Along a line: + for one direction, – for the opposite direction
- Velocity is a vector; speed is a scalar
- Velocity changes if the speed OR the direction changes

## Notes

### Speed and velocity

- The **velocity** of an object is its speed in a given direction.
- Velocity is a **vector** quantity; speed is a **scalar** quantity.
- Velocity has the same unit as speed, m/s, but you also give a direction, e.g. 25 m/s north.
- Along a straight line, you can show direction with a sign: +3 m/s forwards, –3 m/s backwards.

### When does velocity change?

- Velocity changes if the speed changes, if the direction changes, or if both change.
- A car going round a bend at a steady 15 m/s has a constant speed but a changing velocity.
- Two objects with the same speed moving in different directions have different velocities.
- A change in velocity is an acceleration, and it needs a resultant force.

## How to answer each type of question

### Explain the difference between speed and velocity

2 marks

Grade 4

1. Say that speed is a scalar: magnitude only.
2. Say that velocity is a vector: speed in a given direction.

**Example.** Explain the difference between speed and velocity.

**Model answer.** Speed is a scalar: it has magnitude only (1).  
Velocity is a vector: it is speed in a given direction (1).

## Don't lose marks

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- ✗ Saying velocity is 'the same as speed'.
- ✗ Giving a velocity without a direction or a sign.
- ✗ After a bounce, subtracting the speeds ( $5 - 4 = 1$  m/s) instead of the velocities ( $-4 - 5 = -9$  m/s).

## More tips

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### Memory tricks

- Velocity = speed + direction.
- Steering wheel test: turning the wheel changes your velocity, even if the speedometer reading stays the same.

### Exam technique

- Whenever a question says 'velocity', think about direction as well as speed.
- Use the word 'vector' when you explain what velocity is.

## What each grade needs

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What you need to be able to do, from the first marks up to the top grade.

### Grade 3

#### Define velocity

The velocity of an object is its speed in a given direction.

### Grade 4

#### Explain the difference between speed and velocity

Speed is a scalar (magnitude only); velocity is a vector (magnitude and direction).

### Grade 5

#### Use + and – signs for velocity

Along a line, e.g. +4 m/s to the right and –4 m/s to the left.

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