Your notes

GCSE Physics: revision notes

Speed, velocity and acceleration

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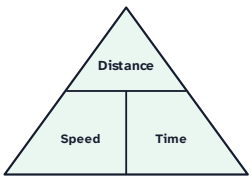
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Distance and displacement

- **Distance** is how far an object moves. It is a scalar: it has no direction.
- **Displacement** is the **distance** and direction in a straight line from the start to the finish. It is a vector.

Speed

- **Speed** is how fast something is moving. It is a scalar.
- **Distance** travelled = **speed** × time: s = v t.
- Typical **speeds**: walking about 1.5 m/s, running about 3 m/s, cycling about 6 m/s. The **speed** of sound in air is about 330 m/s.
- The **speed** of a moving object is rarely constant, so we often calculate an average **speed**: total **distance** ÷ total time.



Distance = Speed × Time

Speed = Distance ÷ Time

Time = Distance ÷ Speed

Cover the one you want: what's left shows how to work it out.

Velocity

- **Velocity** is the **speed** of an object in a given direction. It is a vector.
- (Higher) An object moving in a circle at constant **speed** has a changing **velocity**, because its direction keeps changing. So it is accelerating.

Acceleration

- **Acceleration** is the rate of change of **velocity**: $a = \Delta v \div t$, measured in m/s^2.
- A negative **acceleration** is a **deceleration**: the object is slowing down.

- For **uniform acceleration**: $v^2 - u^2 = 2as$, where u is the initial **velocity**, v the final **velocity** and s the distance.
- Near the Earth's surface, an object falling freely under gravity accelerates at about 9.8 m/s^2.

Worked examples

A cyclist travels 400 m in 50 s. Find her average speed.

Use speed = distance ÷ time. **v = s ÷ t**

Put the numbers in. **400 ÷ 50**

Answer: 8 m/s

A car goes from rest to 20 m/s in 4 s. Find its acceleration.

Use acceleration = change in velocity ÷ time. **a = Δv ÷ t**

Change in velocity: it starts from rest (0 m/s). **Δv = 20 − 0 = 20 m/s**

Divide. **20 ÷ 4**

Answer: 5 m/s^2

Key terms

Distance	How far an object moves; a scalar.
Displacement	Distance in a stated direction from the starting point; a vector.
Speed	How fast an object moves; distance ÷ time.
Velocity	Speed in a given direction; a vector.
Acceleration	The rate of change of velocity, in m/s^2.
Deceleration	Slowing down; a negative acceleration.
Uniform acceleration	Acceleration that stays constant.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. Which is a vector: speed or velocity?
2. A runner covers 100 m in 20 s. What is her average speed?
3. A car travels at 30 m/s for 60 s. How far does it go?
4. What is a typical walking speed?
5. What is the speed of sound in air?
6. A car speeds up from 0 to 20 m/s in 4 s. What is its acceleration?
7. What is the acceleration of an object falling freely near the Earth?
8. Why is an object moving in a circle at constant speed accelerating? (Higher)

Your notes

Answers

1. Velocity
2. 5 m/s
3. 1800 m
4. About 1.5 m/s
5. About 330 m/s
6. 5 m/s^2
7. About 9.8 m/s^2
8. Its direction, and so its velocity, keeps changing

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

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