Your notes

KS3 Science: revision notes

P3.1 Acceleration

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Scalars and vectors

- A **scalar** has size only: distance, speed, mass, time, energy and temperature.
- A **vector** has size and direction: **displacement**, **velocity**, force, acceleration and weight. Velocity is speed in a given direction.
- Forces at right angles combine like the sides of a right-angled triangle: 3 N and 4 N at 90° give a resultant of 5 N. A single force can also be resolved (split) into two parts at right angles, using a scale drawing.

Newton's laws

- First law: if the **resultant force** on an object is zero, it stays still, or keeps moving at the same **velocity**.
- Second law: **resultant force** = mass × **acceleration** ($F = m \times a$). A 1000 kg car accelerating at 2 m/s² needs a **resultant force** of 2000 N.
- Third law: when two objects interact, they exert equal and opposite forces on each other. A rocket pushes gas down, and the gas pushes the rocket up.

Acceleration

- **Acceleration** = change in **velocity** ÷ time taken. It is measured in metres per second squared (m/s²).
- A car that speeds up from 0 to 20 m/s in 10 s has an **acceleration** of 20 ÷ 10 = 2 m/s². Slowing down is a negative **acceleration** (**deceleration**).
- The same force gives a smaller **acceleration** to a bigger mass.
- To investigate **acceleration**, pull a trolley along a runway with hanging masses and measure its speed with **light gates**, which avoid human reaction-time errors.

Velocity-time graphs

- A horizontal line means a constant **velocity**.

- A straight line sloping upwards means a constant **acceleration**; sloping downwards means a constant **deceleration**.
- The gradient (steepness) of the line is the **acceleration**.
- The area under the line is the distance travelled: a car at 15 m/s for 20 s travels 15 × 20 = 300 m.

Your notes

Key terms

Scalar	A quantity with size only, such as speed.
Vector	A quantity with size and direction, such as velocity.
Displacement	The distance moved in a particular direction.
Velocity	Speed in a particular direction.
Acceleration	The rate of change of velocity, measured in m/s^2.
Deceleration	Slowing down (a negative acceleration).
Resultant force	The single force that has the same effect as all the forces acting.
Inertia	The tendency of an object to keep doing what it is doing.
Newton's first law	With no resultant force, an object stays still or moves at a steady velocity.
Newton's second law	Resultant force = mass × acceleration.
Newton's third law	Interacting objects exert equal and opposite forces on each other.
Velocity-time graph	A graph showing how velocity changes over time.
Light gate	A sensor that times an object passing through a beam, to measure speed.

Quick questions

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

1. Which of these is a vector quantity?
2. Which of these is a scalar quantity?
3. What is acceleration?
4. A car speeds up from 0 to 20 m/s in 10 s. What is its acceleration?
5. What is the unit of acceleration?
6. A 50 kg trolley accelerates at 2 m/s^2. What is the resultant force on it?
7. What does Newton's first law say?
8. What does the gradient of a velocity-time graph show?

Answers

1. Velocity
2. Distance

3. The rate of change of velocity
4. 2 m/s^2
5. m/s^2
6. 100 N
7. An object stays still or moves at a steady velocity unless a resultant force acts on it
8. Acceleration

What to do next

Practise 15 questions on this topic

Try 4 exam questions, with mark schemes

Read the lesson, one step at a time

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