Your notes

GCSE Physics: revision notes

Momentum

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Momentum (Higher)

- **Momentum** is a property of moving objects: p = m v, where p is **momentum** (kg m/s), m is mass (kg) and v is velocity (m/s).
- **Momentum** is a vector: it has the same direction as the velocity.

Conservation of momentum (Higher)

- In a **closed system**, the total **momentum** before an event is equal to the total **momentum** after the event.
- This is called **conservation of momentum**. It applies to **collisions** and explosions.
- Example: a 2 kg trolley at 3 m/s hits a stationary 1 kg trolley and they stick together. **Momentum** before = 6 kg m/s, so their velocity after = 6 ÷ 3 = 2 m/s.
- In an explosion (such as a gun firing), the total **momentum** is zero before, so the two parts move apart with equal and opposite **momentum**.

Changes in momentum (Higher, separate sciences)

- When a force acts on a moving object, its **momentum** changes: F = m Δv ÷ Δt. Force equals the **rate of change of momentum**.
- Increasing the time taken for the **momentum** to change reduces the force.
- Safety features such as air bags, seat belts, **crumple zones**, gym crash mats, cycle helmets and cushioned playground surfaces all increase the impact time, reducing the force on the person.

Worked examples

Find the momentum of a 1200 kg car moving at 15 m/s.

Use momentum = mass × velocity. **p = m × v**

Put the numbers in. **1200 × 15**

Answer: 18 000 kg m/s

Key terms

Momentum	Mass × velocity (p = mv), measured in kg m/s.
Conservation of momentum	In a closed system, total momentum before an event equals total momentum after.
Closed system	A system with no external forces acting on it.
Collision	When two objects hit each other.
Rate of change of momentum	How quickly momentum changes; equal to the resultant force.
Crumple zone	A part of a car designed to crumple in a crash, increasing the impact time.

Quick questions

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

1. What is the equation for momentum? (Higher)
2. What is the momentum of a 70 kg runner moving at 5 m/s? (Higher)
3. What is the unit of momentum? (Higher)
4. What does conservation of momentum mean? (Higher)
5. A 2 kg trolley at 3 m/s hits a stationary 1 kg trolley and they stick together. What is their velocity? (Higher)
6. Before a cannon fires, what is the total momentum? (Higher)
7. Why do air bags reduce injuries? (Separate sciences)
8. A 0.5 kg ball moving at 20 m/s is stopped in 0.05 s. What force is needed? (Separate sciences)

Answers

1. p = m v
2. 350 kg m/s
3. kg m/s
4. Total momentum before equals total momentum after in a closed system
5. 2 m/s
6. Zero
7. They increase the time for the momentum to change, reducing the force
8. 200 N

Your notes

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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