Your notes

GCSE Physics: revision notes

Stopping distances

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Stopping distance

- The **stopping distance** of a vehicle is the sum of the **thinking distance** and the **braking distance**.
- **Thinking distance**: how far the vehicle travels during the driver's **reaction time**. **Thinking distance** = speed × reaction time.
- **Braking distance**: how far the vehicle travels under the **braking force**.
- For a given **braking force**, the greater the speed, the greater the **stopping distance**. Example (Highway Code): 23 m at 30 mph, 96 m at 70 mph.

Reaction time

- **Reaction times** vary from person to person, typically from 0.2 s to 0.9 s.
- Tiredness, drugs, alcohol and distractions (such as mobile phones) make **reaction times** longer, increasing the **thinking distance**.
- **Reaction time** can be measured with the ruler-drop test or with a computer test.

Braking distance

- **Braking distance** is increased by wet or icy roads, and by poor vehicle condition, such as worn brakes or tyres.
- When the brakes are applied, work is done by the friction force between the brakes and the wheel. This reduces the kinetic energy of the vehicle and the temperature of the brakes increases.
- The greater the speed, the greater the **braking force** needed to stop in a certain distance. Large **decelerations** can make the brakes overheat and the driver lose control.

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Estimating the forces

- Use $a = \Delta v \div t$ or $v^2 - u^2 = 2 a s$ to find the **deceleration**, then $F = m a$ to find the **braking force**.
- Example: a 1000 kg car stopping from 20 m/s in 4 s decelerates at 5 m/s², needing a **braking force** of 5000 N.

Key terms

Stopping distance	Thinking distance + braking distance.
Thinking distance	The distance travelled during the driver's reaction time.
Braking distance	The distance travelled while the brakes are applied, until the vehicle stops.
Reaction time	The time between seeing a hazard and reacting to it.
Braking force	The friction force from the brakes that slows the vehicle.
Deceleration	Slowing down: negative acceleration.

Quick questions

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

1. What is stopping distance?
2. What affects thinking distance?
3. What affects braking distance?
4. What is a typical reaction time range?
5. A car travels at 20 m/s and the driver's reaction time is 0.7 s. What is the thinking distance?
6. What happens to the brakes when a car stops?
7. What is the Highway Code stopping distance at 30 mph?
8. Why is it dangerous to brake very hard at high speed?

Answers

1. Thinking distance + braking distance
2. Reaction time and speed
3. Road conditions and the condition of brakes and tyres
4. 0.2 s to 0.9 s
5. 14 m
6. They get hot
7. 23 m
8. The brakes can overheat and the driver can lose control

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Your notes

Read the lesson, one step at a time

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