

Reaction time

6.5.4.3.2 · Physics · revision notes

Reaction time is the time between a driver seeing a hazard and acting on it. You need to recall typical values (0.2 s to 0.9 s), the factors that increase reaction time, how reaction time affects thinking distance, and how to measure and evaluate reaction times, for example with a falling ruler.

Key facts

- Typical reaction time: 0.2 s to 0.9 s
- Thinking distance = speed × reaction time
- Ruler drop: the longer the distance fallen, the longer the reaction time
- Reaction time is increased by tiredness, drugs, alcohol and distractions
- Longer reaction time → longer thinking distance → longer stopping distance

Notes

Reaction time

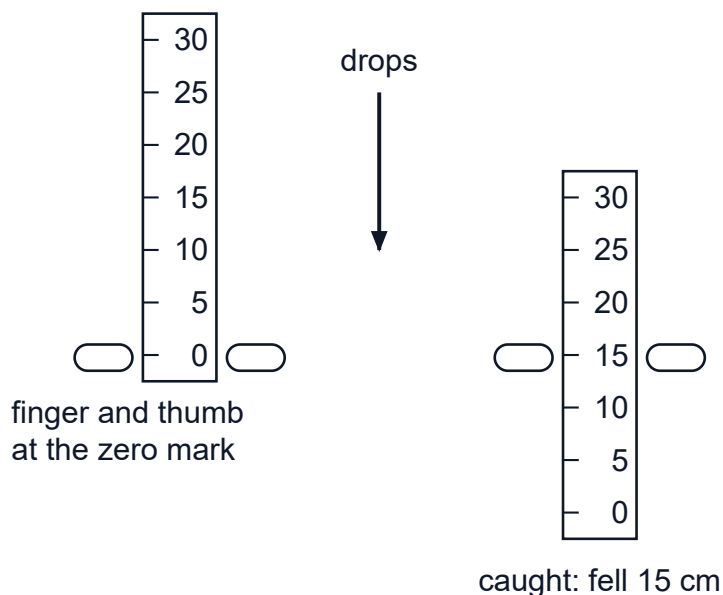
- Reaction time is the time between seeing a hazard (or other stimulus) and responding to it, e.g. pressing the brake pedal.
- Reaction times vary from person to person. Typical values range from **0.2 s to 0.9 s**.
- A driver's reaction time can be increased by **tiredness**, **drugs** and **alcohol**.
- **Distractions**, such as using a mobile phone or talking to passengers, may also affect a driver's ability to react.

Reaction time and thinking distance

- During the reaction time, the vehicle keeps moving at its original speed.
- Thinking distance = speed × reaction time ($s = v t$).
- A longer reaction time or a greater speed gives a longer thinking distance, and so a longer stopping distance.
- Example: at 25 m/s, an increase in reaction time from 0.5 s to 0.9 s increases the thinking distance from 12.5 m to 22.5 m.

Measuring reaction time: the ruler drop

- A partner holds a metre ruler vertically, with the zero mark level with the top of your open finger and thumb.
- They drop it without warning. You catch it as quickly as you can and read the distance it fell.



The ruler-drop test: the further it falls before you catch it, the longer your reaction time.

- The further the ruler falls, the longer your reaction time. A conversion table or graph turns the distance into a time.
- Repeat several times and calculate a mean. Keep the same catching hand, the same starting position and the same person dropping the ruler.
- Computer tests, where you click as soon as the screen changes, are another method.

How to answer each type of question

Recall typical values and factors

3 marks

Grade 3

1. Give a value between 0.2 s and 0.9 s.
2. Choose from tiredness, alcohol, drugs, distractions.

Example. (a) Give a typical value for a person's reaction time.
(b) Give **two** factors that could increase a driver's reaction time.

Model answer. (a) any value from 0.2 s to 0.9 s (1)
(b) any two from: tiredness / drinking alcohol / taking drugs / distractions such as using a phone (2)

Calculate a change in thinking distance

3 marks

Grade 5

1. Calculate the thinking distance for each reaction time with $s = v t$.
2. Subtract to find the change.

Example. A driver's reaction time is normally 0.50 s. While using a phone, it is 0.80 s.
Calculate the increase in thinking distance at a speed of 20 m/s.

Model answer. normal: $20 \times 0.50 = 10 \text{ m}$ (1)
using a phone: $20 \times 0.80 = 16 \text{ m}$ (1)
increase = 6.0 m (1)

Don't lose marks

- ✗ Saying alcohol increases the braking distance. It increases the reaction time, and so the thinking distance.
- ✗ Giving a reaction time of several seconds. Typical values are less than 1 s.
- ✗ Including an anomalous result when calculating a mean.
- ✗ In the ruler drop, letting the catcher see when the ruler is about to be dropped, or changing the starting position of the fingers.

More tips

Memory tricks

- Things that slow reactions: tiredness, drugs, alcohol, distractions.
- Quick thinking distance: speed in m/s $\times$ reaction time in s. At 30 m/s with 0.7 s, it is 21 m.
- Reaction time affects the thinking distance only, never the braking distance.

Exam technique

- For method questions, say what is measured (the distance fallen), how it becomes a reaction time, and how you make the result more reliable (repeats and a mean).
- In 'evaluate' questions, quote numbers from the data and compare like with like, e.g. at the same speed.
- Link each factor in a chain: reaction time $\rightarrow$ thinking distance $\rightarrow$ stopping distance.

What each grade needs

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

Grade 3

Recall typical reaction times

Typical reaction times range from 0.2 s to 0.9 s.

Grade 4

List factors that increase reaction time

Tiredness, drugs, alcohol and distractions (e.g. using a phone).

Grade 5

Calculate thinking distance from reaction time

Thinking distance = speed $\times$ reaction time.

Describe the ruler-drop reaction time test

Catch a dropped ruler; the further it falls before you catch it, the longer your reaction time.

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