

MR SULLY UNFOLDS PHYSICS ANSWERS

Stopping distances

AQA 4.5.6.3
Forces · Paper 2
Foundation & Higher

Name _____ Class _____ Date _____

When a driver sees a hazard, the car keeps moving while they react, then while the brakes work.

KEY IDEAS

- **Stopping distance = thinking distance + braking distance.**
- Thinking distance depends on speed and **reaction time** (typically 0.2–0.9 s). Tiredness, drugs, alcohol and distractions increase it.
- Braking distance depends on speed, wet or icy roads, and the condition of the brakes and tyres.

Section A · Recall

Grade 4–5

1 Define thinking distance and braking distance. [2]

Thinking: the distance the vehicle travels during the driver's reaction time.

Braking: the distance the vehicle travels under the braking force.

2 Sort these factors into those that affect thinking distance and those that affect braking distance: icy road, tiredness, worn tyres, mobile phone, alcohol, worn brakes. [3]

Thinking: tiredness, mobile phone, alcohol

Braking: icy road, worn tyres, worn brakes

Section B · Calculate

Grade 5–6

3 A car travels at 20 m/s. The driver's reaction time is 0.7 s. Calculate the thinking distance. [2]

$s = vt = 20 \times 0.7 = 14$ m

4 The braking distance at 20 m/s is 30 m. Calculate the overall stopping distance. [1]

14 + 30 = 44 m

5 Describe a simple method to measure a person's reaction time. [3]

Drop a ruler between their open finger and thumb; they catch it.

Measure how far it fell; use a conversion table or equation to find the time.

Repeat several times and take a mean.

Section C · Stretch

Grade 7+

6 When a car brakes, explain what happens to its kinetic energy. [2]

Friction between the brakes and wheels does work,

transferring kinetic energy to the thermal store of the brakes.

7 Explain why large decelerations can be dangerous. [2]

They need very large braking forces,

which can overheat the brakes, cause skidding / loss of control, or injure people.

Exam-style question

AQA style

8 A car of mass 1000 kg is travelling at 25 m/s when the driver brakes. It stops in 50 m.

a Calculate the kinetic energy of the car before braking. [2]

Ek = ½ × 1000 × 25²

Ek = 312 500 J

b Calculate the average braking force. [2]

Work done = F × s = Ek: F = 312 500 ÷ 50

F = 6250 N

c Explain why doubling the car's speed would roughly quadruple its braking distance. [2]

Kinetic energy depends on speed squared, so it becomes four times bigger.

With the same braking force, four times the work (distance) is needed to stop.

Total: _____ / 21

How confident am I?	Not yet	Nearly	Got it
I can define thinking, braking and stopping distance	☐	☐	☐
I can name factors that affect each	☐	☐	☐
I can link braking to kinetic energy and work done	☐	☐	☐