

1.2 Forces and movement

Name: _____ Class: _____ Date: _____

Total: 23 marks

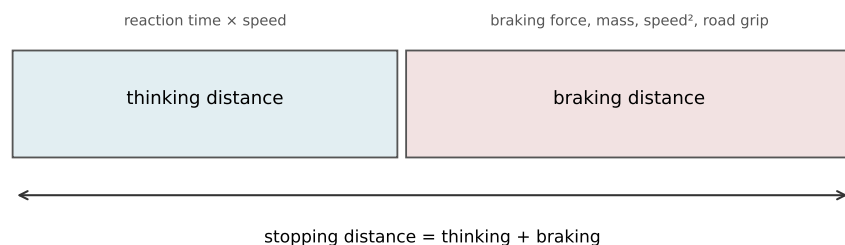
Objective

Cover forces and movement (1.11–1.24): scalars and vectors, resultant force, $F = ma$, weight, stopping distances, terminal velocity and Hooke's law. Original IGCSE-level practice.

1 Key knowledge and worked examples

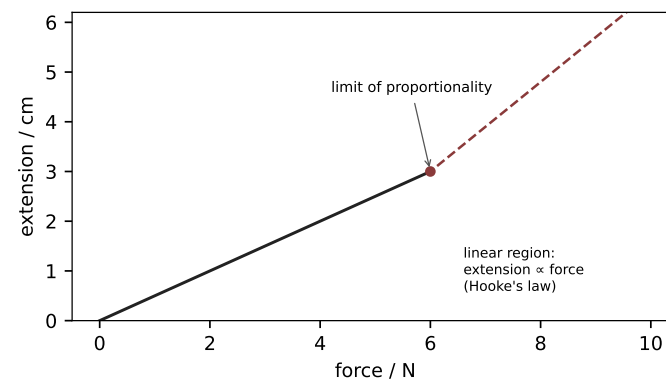
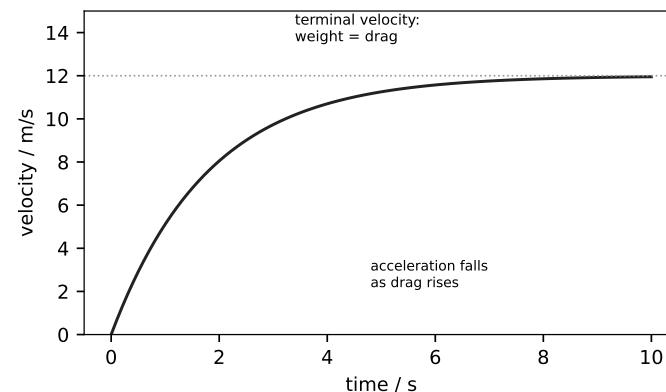
■ Resultant force first

Add forces along a line: 8 N forward and 3 N back give a resultant of 5 N forward. Friction always opposes motion. Only an **unbalanced** force accelerates: $F = ma$, and weight $W = mg$ (g in N/kg).



Thinking grows with speed × reaction time; **braking** grows with speed², mass, poor brakes and poor road grip.

■ Terminal velocity and Hooke's law



2 Practice

2.1 State the difference between a vector and a scalar, giving one example of each. [2]

2.2 A 1500 kg car has a driving force of 4500 N and total drag of 1500 N. Calculate its acceleration. [3]

2.3 Calculate the weight of a 65 kg person at $g = 10 \text{ N/kg}$. [2]

2.4 State two factors that increase the braking distance. [2]

2.5 State Hooke's law and where it stops applying. [2]

3 Exam-style questions

3.1 Explain, naming the forces at each stage, why a parachutist who jumps from a plane reaches a terminal velocity before opening the parachute, and again (lower) after opening it. [5]

3.2 A trolley of mass 2 kg is pulled with 8 N along a surface with friction 2 N. Calculate the acceleration, and the new acceleration if friction doubles. [4]

3.3 Explain why speed cameras and longer following distances matter when roads are wet, referring to stopping distance. [3]

Solutions

2.1 A vector has size and direction (force, velocity); a scalar has size only (speed, mass).

2.2 Resultant = $4500 - 1500 = 3000$ N; $a = 3000/1500 = 2$ m/s².

2.3 $W = 65 \times 10 = 650$ N.

2.4 Any two: higher speed, greater mass, worn brakes, worn tyres, wet or icy road, downhill gradient.

2.5 Extension is directly proportional to the force applied; it applies only up to the limit of proportionality of the material.

3.1 At the start weight is far larger than drag, so the parachutist accelerates; as speed rises, drag (air resistance) increases; drag grows until it equals the weight – resultant zero, terminal velocity. Opening the parachute instantly raises the drag above weight, so she decelerates until drag falls to equal weight again at a much lower terminal velocity.

3.2 Resultant = $8 - 2 = 6$ N; $a = 6/2 = 3$ m/s². Friction 4 N: resultant 4 N; $a = 4/2 = 2$ m/s².

3.3 Wet roads cut tyre grip, lengthening the braking distance, so the total stopping distance grows; longer following distances and speed checks give drivers room and time to stop within it.