

Forces and momentum · supported focus

Supported focus · HL

Supported scope

- Supported HL focus. First assessment 2025; full Physics guide acquired (84 PDF pages). Remaining guide, assessment and practical requirements retain their recorded holds.
- State model conditions and distinguish fictional data from measurements.

Forces · 1.1

Reasoning

A passenger continues moving when a vehicle brakes. The seat belt provides the force needed to change the passenger momentum . Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

Forces · 2.1

Reasoning

Resultant force causes acceleration, not motion itself. Momentum is mass multiplied by velocity. For an isolated system, total momentum is conserved even when kinetic energy is not. momentum: Mass multiplied by velocity; resultant force: The vector sum of forces on an object.

Forces · 3.1

Reasoning

Impulse equals momentum change. Increasing stopping time for the same momentum change reduces average force. Identify external forces before applying momentum conservation. Draw a free-body diagram containing only forces on the selected object. For spring measurements, add loads in steps within the elastic range and measure extension from the unloaded position.

Forces · 4.1

Reasoning

State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution. Known: a 60 kg passenger slows from 10 to 0 metres per second in 0.50 s. $\Delta p = m(v-u) = 60(0-10) = -600$ kg metres per second. Average $F = \Delta p / \Delta t = -600 / 0.50 = -1,200$ N. The sign shows the force opposes the initial motion.

Forces · 4.2

Reasoning

A 2 kg trolley travels at 3 metres per second. Find its momentum. Use the same sequence: known quantities $\rightarrow$ model $\rightarrow$ relation $\rightarrow$ substitution $\rightarrow$ unit and interpretation.

Forces · 5.1

Reasoning

Balanced forces do not require the object to be at rest. Mass and weight have different units and meanings. Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

Forces · 5.2

Reasoning

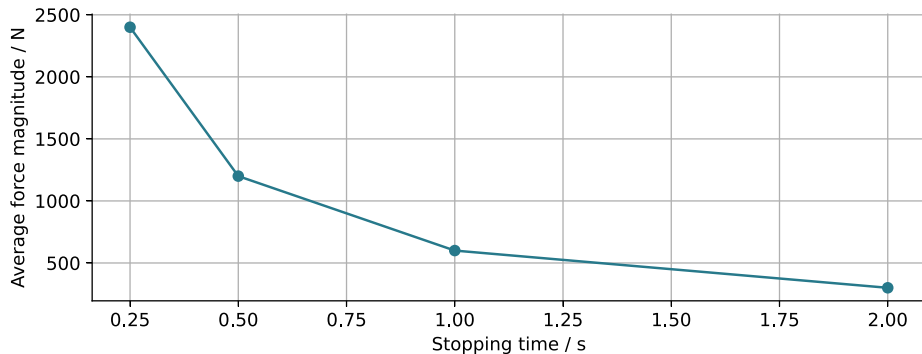
An object moving at constant velocity must have a nonzero resultant force. This claim is false: Balanced forces do not require the object to be at rest. Mass and weight have different units and meanings.

Forces · 5.3

Reasoning

Forces, momentum and safe stopping: Impulse equals momentum change. Increasing stopping time for the same momentum change reduces average force. Identify external forces before applying momentum conservation.

Forces · diagram



- Original teaching diagram: Forces, momentum and safe stopping
- Use the labels and the stated model together.

Forces · original transfer

Your turn

A 2 kg trolley changes velocity from $+3$ to -1 m/s in 0.20 s. Find impulse and average force; explain why momentum change is not just change in speed.

Forces · transfer reasoning

Method and interpretation

$\Delta p = 2(-1 - 3) = -8 \text{ kg m/s}$; average force $= -40 \text{ N}$. Direction reverses although speed falls from 3 to 1 m/s. Using magnitudes loses the direction information.

Check yourself

- Explain momentum using the stated model.
- Explain resultant force using the stated model.
- Change one value in the original transfer; explain which assumption still matters.