SCIENCE FOUNDATIONS

Momentum and impulse

Difficulty level: Advanced

Science Foundations

This document was made by AI and there may be mistakes. If a question or answer looks wrong, use the Flag a mistake button to let Brett know so he can fix it.

Overview of the concept

This is how airbags and crumple zones save lives in a crash, by stretching out the stop so the same change in motion happens with a gentler force. A baseball catcher pulls their glove back as the ball arrives, giving the ball more time to stop so the hand feels less force. A boxer rolls with a punch for the same reason, spreading the impact over a longer time. Knowing momentum and impulse tells you why a quick stop hurts and a slow stop does not, even when the speed change is the same.



Rule

Momentum and impulse: $p = m \times v$, where p is momentum, m is mass and v is velocity. The unit of momentum is $\mathrm{kg}\frac{\mathrm{m}}{\mathrm{s}}$.

$J = F \times t$, where J is impulse, F is force and t is time, and impulse equals the change in momentum.

© 2026 Brett Robbins. All Rights Reserved.

Worked examples

EXAMPLE 1

Q Find the momentum of a 2 kg object moving at 10 $\frac{\text{m}}{\text{s}}$.

SOLUTION

Write the rule:

momentum = mass × velocity.

Substitute:

momentum = 2 × 10 = 20 kg $\frac{\text{m}}{\text{s}}$

Write the answer with kg $\frac{\text{m}}{\text{s}}$. Result: momentum 20 kg $\frac{\text{m}}{\text{s}}$.

EXAMPLE 2

Q A force of 10 N acts for 3 s. Impulse?

SOLUTION

Write the rule:

impulse = force × time.

Substitute:

impulse = 10 × 3 = 30 N s

Write the answer with its unit.

The result is impulse 30 N s.

© 2026 Brett Robbins. All Rights Reserved.

Practice questions

1 Momentum formula?

- **A** Mass times velocity
- **B** Mass divided by velocity
- **C** Force times time
- **D** Mass plus velocity

Understand It with Pulse | Flag a mistake

2 3 kg at 6 $\frac{m}{s}$: momentum?

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

3 12 N for 4 s: impulse?

- **A** 12 N s
- **B** 48 N s
- **C** 16 N s
- **D** 3 N s

Understand It with Pulse | Flag a mistake

4 Units of momentum?

- **A** $\text{kg}\,\frac{\text{m}}{\text{s}}$
- **B** kg m s
- **C** N s
- **D** $\frac{\text{m}}{\text{s}}$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

5 Impulse equals what change?

A Change in mass

B Change in momentum

C Change in velocity

D Change in force

Understand It with Pulse | Flag a mistake

6 Heavier or faster: which raises momentum?

A Only heavier raises it

B Only faster raises it

C Both raise it

D Neither raises it

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

7 Longer stopping time: force becomes?

- A Larger
- B The same
- C Smaller
- D Zero

Understand It with Pulse | Flag a mistake

8 A 2 kg object has momentum 10 kg$\frac{m}{s}$. What is its velocity?

- A $5\frac{m}{s}$
- B $20\frac{m}{s}$
- C $12\frac{m}{s}$
- D $8\frac{m}{s}$

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

9

An impulse of 60 N s comes from a force acting for 3 s. What was the force?

A 20 N

B 180 N

C 63 N

D 57 N

Understand It with Pulse | Flag a mistake

10

Momentum is a scalar or vector?

A Vector

B Scalar

Understand It with Pulse | Flag a mistake

© 2026 Brett Robbins. All Rights Reserved.

ANSWER KEY

1. Mass times velocity

2. 18 kg $\frac{m}{s}$

3. 48 N s

4. kg $\frac{m}{s}$

5. Change in momentum

6. Both raise it

7. Smaller

8. 5 $\frac{m}{s}$

9. 20 N

10. Vector

© 2026 Brett Robbins. All Rights Reserved.