

Impulse, momentum and force-time graphs

AP Physics 1 (algebra-based) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers momentum, impulse, force-time graphs and the link between contact time and force. Show all working, give units and state the direction of vectors. A calculator is allowed.

Level: AP Physics 1 (algebra-based) · **Curriculum:** AP P1 Unit 4

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Definitions (2 marks)

- State what is meant by the impulse of a force. (1 mark)
- State the relationship between impulse and momentum. (1 mark)

Question 2 Bullet and car (2 marks)

A 0.0040 kg bullet travels at 400 m/s. A 1500 kg car creeps forward at 1.0 m/s.

- Calculate the momentum of each. (1 mark)
- Calculate how many times larger the car's momentum is. (1 mark)

Question 3 Goalkeeper's catch (3 marks)

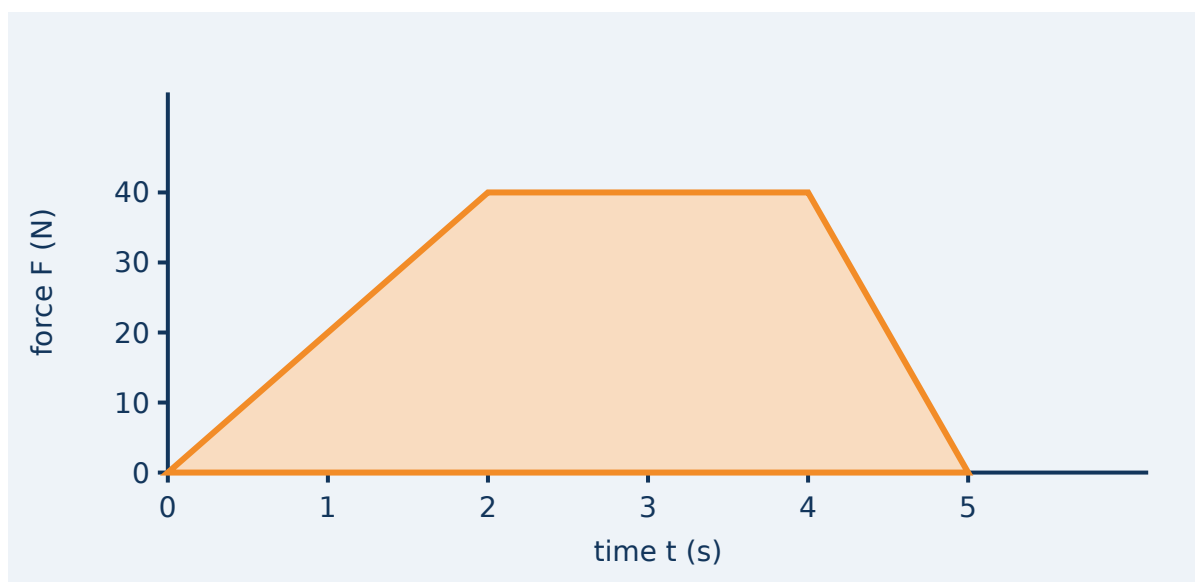
A goalkeeper catches a 0.43 kg football travelling at 20 m/s and stops it in 0.040 s.

- Calculate the change in momentum of the ball. (1 mark)
- State the impulse on the ball. (1 mark)
- Calculate the average force on the ball. (1 mark)

Question 4 Skater and a graph (3 marks)

The graph shows the net force on a 70 kg skater who starts at rest.

- Calculate the impulse during the five seconds. (2 marks)
- Calculate the skater's final speed. (1 mark)



Net force on a 70 kg skater who starts at rest.

Question 5 Airbags (3 marks)

Explain, using the impulse-momentum theorem, why an airbag reduces the force on a driver in a crash. (3 marks)

Question 6 Rebounding ball (3 marks)

A 0.25 kg ball hits a wall at 8.0 m/s and rebounds at 6.0 m/s. The contact lasts 0.020 s.

- Calculate the change in momentum of the ball, taking the initial direction as positive. (2 marks)
- Calculate the average force on the ball. (1 mark)

Question 7 Car acceleration (2 marks)

A 1500 kg car speeds up from 8.0 m/s to 20 m/s in 5.0 s.

- Calculate the change in momentum. (1 mark)
- Calculate the average net force. (1 mark)

Question 8 Sticking or bouncing (2 marks)

A clay ball and a rubber ball of equal mass strike a wall at the same speed. The clay sticks and the rubber bounces back. Explain which ball receives the larger impulse. (2 marks)