



QUESTION WORKBOOK

Momentum and impulse

Mechanics · Year 12

AQA 3.4.1.6 · CIE 3.1, 3.3 · OCR A 3.5.1, 3.5.2

10 questions · 31 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 Calculate the momentum of a 2.0 kg trolley moving at 8.0 m s^{-1} , and state its unit. [2]

A2 State the principle of conservation of linear momentum, including the condition under which it applies. [2]

A3 Define the impulse of a force and state how it is related to momentum. [2]

SECTION B · Standard

B1 A constant force of 20 N acts for 3.0 s on a 4.0 kg object initially at rest. Calculate (a) the impulse delivered and (b) the final velocity of the object. [4]

- B2** A 2.0 kg trolley moving at 3.0 m s^{-1} collides with a stationary 1.0 kg trolley and they move off together. Calculate their common velocity. [3]

- B3** For the collision in the previous question, show that kinetic energy is not conserved by calculating the kinetic energy before and after, and state the type of collision. [4]

- B4** A 4.0 kg gun fires a 0.040 kg bullet at 200 m s^{-1} . Assuming the gun is free to move, calculate its recoil velocity. [3]

SECTION C · Stretch

- C1** A 3.0 kg trolley moving right at 4.0 m s^{-1} collides head-on with a 1.0 kg trolley moving left at 2.0 m s^{-1} , and they stick together. Calculate the velocity of the combined trolleys, stating its direction. [4]

- C2** A 1000 kg car travelling at 20 m s^{-1} is brought to rest in a collision. Calculate the average force on the car if it stops in (a) 0.10 s and (b) 0.50 s, and comment on the role of a crumple zone. [4]

- C3** Explain, in terms of impulse and momentum, how a seatbelt and an airbag reduce the risk of injury in a crash. [3]