Exercise walk-through

Momentum ▪ 1.6

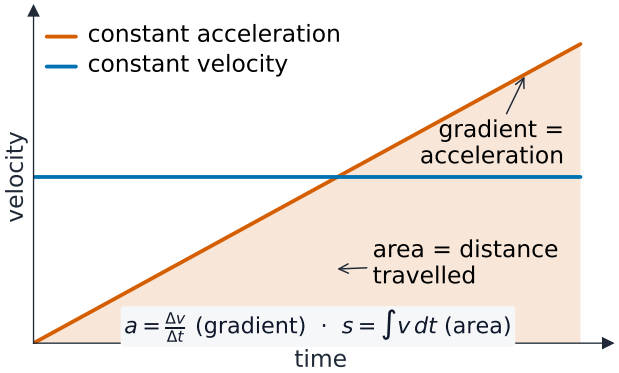
eXercise

You must be able to

- calculate momentum $p = mv$ (a vector — mind the direction)
- use $F = \dfrac{\Delta p}{\Delta t}$ (impulse)
- apply conservation of momentum to a collision

Method — Conservation of momentum

2.0 kg at 3.0 m/s hits stationary 1.0 kg, they stick:
$(2.0 \times 3.0) + (1.0 \times 0) = (3.0)v \Rightarrow v = 2.0$ m/s.



A velocity–time graph — velocity is central to momentum $p = mv$

Practice 2.1 ▪ 2 marks

Find the momentum of a 0.40 kg ball moving at 5.0 m/s.

Solution 2.1

Method: Conservation of momentum

Worked steps

$p = mv = 0.40 \times 5.0 = 2.0$ kg m/s **M1** **A1**.

Practice 2.2 ▪ 1 mark

State the principle of conservation of momentum.

Solution 2.2

Method: Conservation of momentum

Worked steps

when no external force acts, the total momentum before a collision equals the total momentum after B1.

Exam-style 3.1 ▪ 1 mark

The momentum of an object is its mass multiplied by its:

A acceleration

B velocity

C weight

D density

Solution 3.1

Method: Conservation of momentum

A acceleration

B velocity ✓

C weight

D density

Worked steps

B. Momentum = mass × velocity.

Exam-style 3.2 ▪ 2 marks

A 3.0 kg trolley moving at 4.0 m/s collides with a stationary 1.0 kg trolley and they move off together.

(a) Find the total momentum before the collision.

(b) Find their common velocity after the collision.

Solution 3.2

Method: Conservation of momentum

Worked steps

(a) before $= 3.0 \times 4.0 + 1.0 \times 0 = 12$ kg m/s **M1** **A1**.

(b) $12 = (3.0 + 1.0)v \Rightarrow v = 3.0$ m/s **M1** **A1**.

Exam-style 3.3 ▪ 3 marks

A force acts on a 2.0 kg ball for 0.10 s and changes its velocity from 0 to 6.0 m/s. Find the force.

Solution 3.3

Method: Conservation of momentum

Worked steps

$$F = \frac{\Delta p}{\Delta t} = \frac{2.0 \times 6.0}{0.10} = \frac{12}{0.10}$$ M1 M1; $= 120$ N A1.