

# 1.6 Momentum

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 11 marks**

**KEY WORDS** momentum 动量 • impulse 冲量 • conservation of momentum 动量守恒 • force 力  
• mass 质量

## Objective

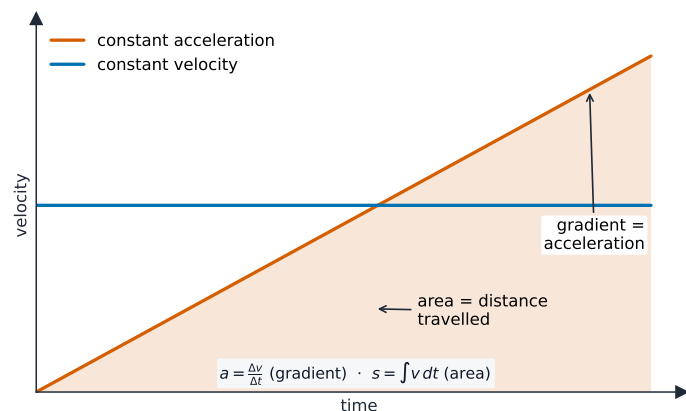
Build the skills to answer exam questions on **momentum** 动量 —  $p = mv$ ,  $F = \frac{\Delta p}{\Delta t}$ , and the **conservation of momentum** 动量守恒.

You must be able to:

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

## 1 Worked examples

### ■ Conservation of momentum



Momentum  $p = mv$  combines mass and velocity; in a collision the total is conserved

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

$$(3.0)v \Rightarrow v = 2.0 \text{ m/s.}$$

## 2 Practice

**2.1** Find the momentum of a 0.40 kg ball moving at 5.0 m/s. [2]

**2.2** State the principle of conservation of momentum. [1]

## 3 Exam-style questions

**3.1** The momentum of an object is its mass multiplied by its: [1]

- **A** acceleration
- **B** velocity
- **C** weight
- **D** density

**3.2** 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. [2]

(b) Find their common velocity after the collision. [2]

**3.3** 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. [3]

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## Solutions

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

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

**3.1 B.** Momentum = mass  $\times$  velocity.

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

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

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