

# Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

## 8 Momentum

### Exercise A, Question 10

#### Question:

A car of mass 1.2 tonnes collides with a stationary van of mass 2.4 tonnes. After the collision the two vehicles become entangled and skid 15 m before stopping. Police accident investigators estimate that the magnitude of the friction force during the skid was 2880 N. Assume the road is horizontal and that all the motion takes place in a straight line.

- (a) Find the speed of the vehicles just after the collision.  
 (b) Find the speed of the car before the collision. [A]

#### Solution:

- (a) After the collision, frictional force acting is 2880 N

Using  $F = ma$ ,

$$2880 = -3600a$$

$$a = -\frac{2880}{3600} = -\frac{4}{5}$$

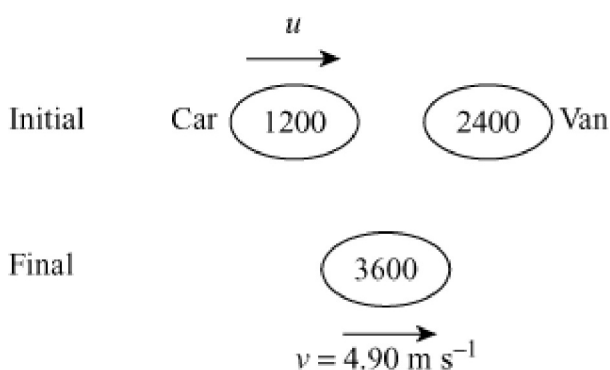
Using  $v^2 = u^2 + 2as$  to find the speed just after the collision ( $u$  in this equation;  $v = 0$ )

$$0 = u^2 - 2 \times \frac{4}{5} \times 15$$

$$u = \sqrt{24} = 4.898 \text{ m s}^{-1}$$

$\therefore$  Speed of vehicles after the collision is  $4.90 \text{ m s}^{-1}$

- (b) At the collision;



Using conservation of momentum

$$1200u = 3600 \times 4.90$$

$$\therefore u = 14.7 \text{ m s}^{-1}$$

$\therefore$  Speed of the car before the collision is  $14.7 \text{ m s}^{-1}$ .

