

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

Exam style practice papers

Exercise MM1B, Question 4

Question:

A car, of mass 1000 kg, skids for 20 m and then hits a car of mass 1200 kg that is moving at 10 m s^{-1} in the same direction. After the collision, both cars move together at a speed of 12 m s^{-1} . The coefficient of friction between the tyres and the road for the first car is 0.8. Assume that all the motion takes place on a horizontal surface.

(a) Use conservation of momentum to find the speed of the first car, just before the collision. (2 marks)

(b) Find the speed of the first car when it begins to skid. (4 marks)

Solution:

(a) Using conservation of momentum

$$1000v + 1200 \times 10 = 2200 \times 12$$

$$1000v = 14400$$

$$v = 14.4$$

\therefore speed of first car was 14.4 m s^{-1}

At impact ; $\longrightarrow v$ $\longrightarrow 10 \text{ m s}^{-1}$

Initial $\textcircled{1000}$ $\textcircled{1200}$

Final $\textcircled{2200}$
 \longrightarrow
 12 m s^{-1}

(b) For the first car;

$$\text{resolve vertically } R = 1000g$$

$$\text{Using } F = \mu R$$

$$F = 0.8 \times 1000g$$

$$= 7840 \text{ N}$$

$$\text{Using } F = ma$$

$$- 7840 = 1000a$$

$$a = - 7.84 \text{ m s}^{-2}$$

To find the speed when the car started to slide,

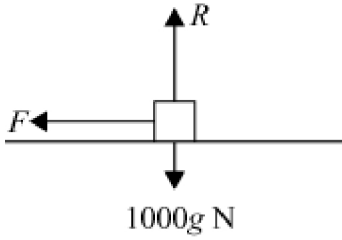
$$\text{using } v^2 = u^2 + 2as$$

$$14.4^2 = u^2 - 2 \times 7.84 \times 20$$

$$u^2 = 520.96$$

$$u = 22.82$$

Speed was 22.8 m s^{-1} .



© Harcourt Education Ltd 2005