Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

8 Momentum

Exercise A, Question 12

Question:

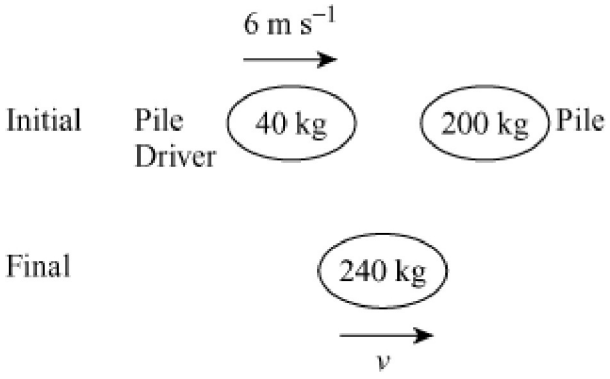
A pile-driver consists of a pile of mass 200 kg and a driver of mass 40 kg. The driver drops on the pile with velocity 6 m s^{-1} and sticks to the top of the pile.

(a) Calculate the velocity of the pile immediately after impact.
Resistances to motion of the pile amount to 1400 N.

(b) Calculate the distance penetrated by the pile.

Solution:

(a)



Using conservation of momentum

$$40 \times 6 = 240v$$
$$v = 1$$

Velocity of pile immediately after impact is 1 m s^{-1}

(b) After the impact,

using $F = ma$,
$$-1400 = 240a$$
$$a = -\frac{35}{6}$$

To find distance moved,

using $v^2 = u^2 + 2as$

$0 = 1^2 - 2 \times \frac{35}{6} \times s$

$s = \frac{1}{2 \times \frac{35}{6}}$

$= 0.08571 \text{ m}$

$\therefore$ Distance penetrated is 8.57 cm.