

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

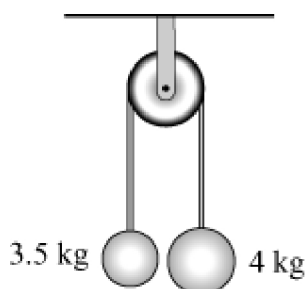
6 Connected particles

Exercise Test yourself, Question 1

Question:

Particles of mass 4 kg and 3.5 kg are attached to the ends of a light, inextensible string, which passes over a smooth pulley. The system is released from rest.

- (a) Find the tension in the string.
- (b) Find the time that it takes for the heavier particle to fall 0.5 m.



Solution:

- (a) Using $F = ma$ for

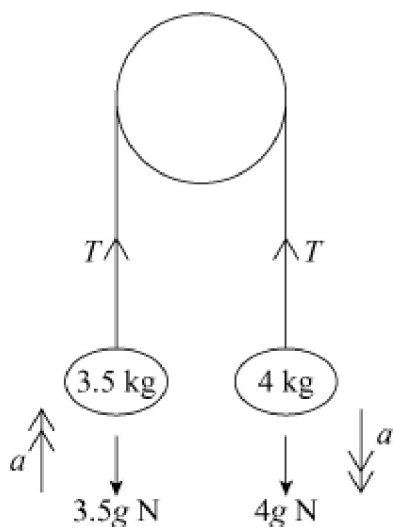
$$4 \text{ kg particle; } 4g - T = 4a \quad [1]$$

$$3 \frac{1}{2} \text{ kg particle; } T - 3.5g = 3.5a$$

$$\text{Adding } 0.5g = 7.5a$$

$$a = \frac{1}{15}g$$

$$= 0.6533 \text{ m s}^{-2}$$



$$\begin{aligned}\text{From [1] } T &= 4g - 4a \\ &= \frac{56}{15}g \text{ or } 36.586\dots\end{aligned}$$

∴ Tension is 36.6 N.

(b) To find the time taken to fall 0.5 m,

$$\text{use } s = ut + \frac{1}{2}at^2$$

$$0.5 = \frac{1}{2} \times 0.6533 \times t^2$$

$$t^2 = \frac{1}{0.6533} = 1.5306$$

$$t = 1.2372$$

∴ Time is 1.24 s.

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