

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

Exam style practice papers

Exercise MM1B, Question 3

Question:

Two particles of mass 3 kg and 7 kg are joined by a light, inextensible string that passes over a light, smooth pulley. Assume that there is no air resistance.

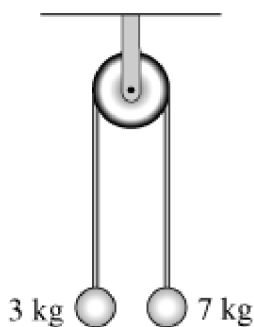
The particles are initially released from rest at the same level.

(a) By forming an equation of motion for each particle, find the acceleration of the particles.
(4 marks)

(b) Find the tension in the string. (2 marks)

(c) Find the speed of the particles when they are 20 cm apart. (2 marks)

(d) If the string was not light, what would happen to the acceleration of the particles?
(2 marks)



Solution:

Using $F = ma$

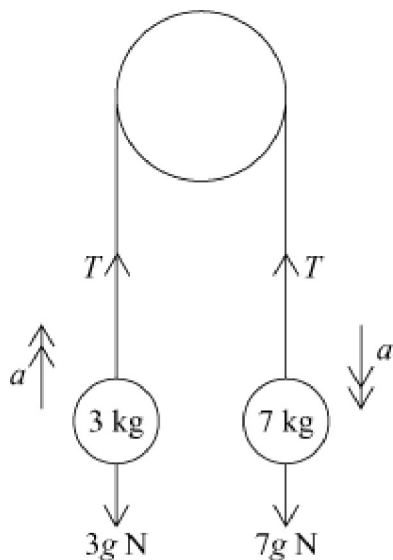
$$\text{for 7 kg particle; } 7g - T = 7a$$

$$\text{3 kg particle; } T - 3g = 3a \quad [1]$$

$$\text{Adding } 4g \quad = 10a$$

$$a = \frac{4}{10}g$$

$$\therefore \text{Acceleration is } 3.92 \text{ m s}^{-2}$$



From [1] $T = 3g + 3a$

(b) $\quad \quad \quad = 41.16$

Tension is 41.16 N

(c) When the particles are 20 cm apart, each particle has moved 10 cm or 0.1 m

To find the speed, use $v^2 = u^2 + 2as$

$$v^2 = 2 \times 3.92 \times 0.1$$

$$v = 0.8854$$

Speed is 0.885 m s⁻¹

(d) If the string was not light, as time went by more of the string, and hence more weight, would move to the side with the 7 kg particle; thus the acceleration would increase as time goes by.