

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

6 Connected particles

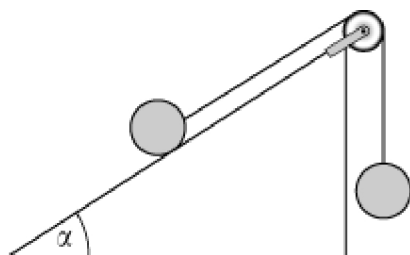
Exercise A, Question 20

Question:

The diagram shows two particles connected by a light, inelastic rope. One has a mass of 4 kg and is on a smooth slope and the other has a mass of 6 kg and hangs freely.

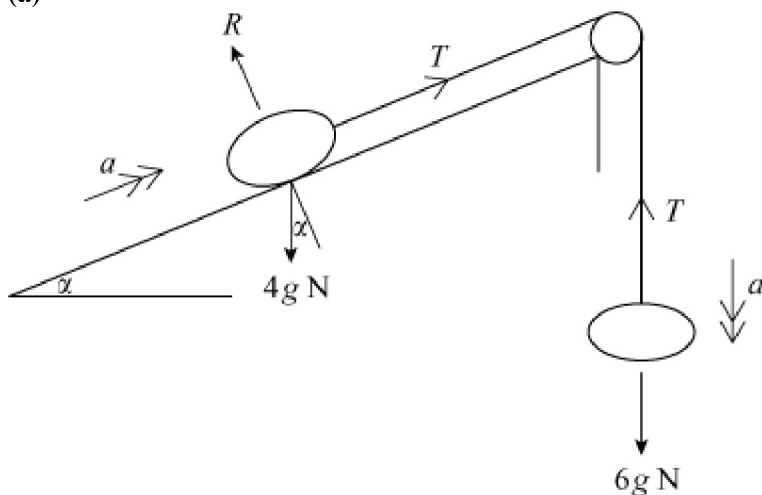
(a) Find the acceleration of the particles if $\alpha = 30^\circ$.

(b) Find the tension in the rope if $\alpha = 10^\circ$.



Solution:

(a)



Using $F = ma$ for 6 kg particle $6g - T = 6a$

and for 4 kg particle (in the direction of movement, i.e. along the slope with $\alpha = 30^\circ$)

$$T - 4g \sin 30^\circ = 4a$$

$$\text{Adding } 6g - 4g \sin 30^\circ = 10a$$

$$4g = 10a$$

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

If $\alpha = 10^\circ$, the use of $F = ma$ gives $6g - T = 6a$ [1]

$$T - 4g \sin 10^\circ = 4a$$

$$\text{Adding } 6g - 4g \sin 10^\circ = 10a$$

$$\therefore a = 5.199$$

$$(b) \quad [1] \Rightarrow 6g - T = 6 \times 5.199$$

$$T = 6g - 6 \times 5.199$$

$$= 58.8 - 31.195$$

$$= 27.605$$

\therefore Tension is 27.6 N.

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