

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

6 Connected particles

Exercise A, Question 14

Question:

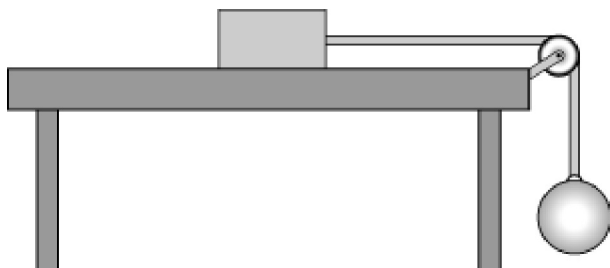
A block, of mass 6 kg, is held at rest on a rough horizontal table. The block is attached, by a light string that passes over a light, smooth pulley, to a sphere of mass 4 kg, that hangs freely, as shown in the diagram.

(a) The block is released and travels 60 cm in 2 seconds. Show that the acceleration of the block is 0.3 m s^{-2} .

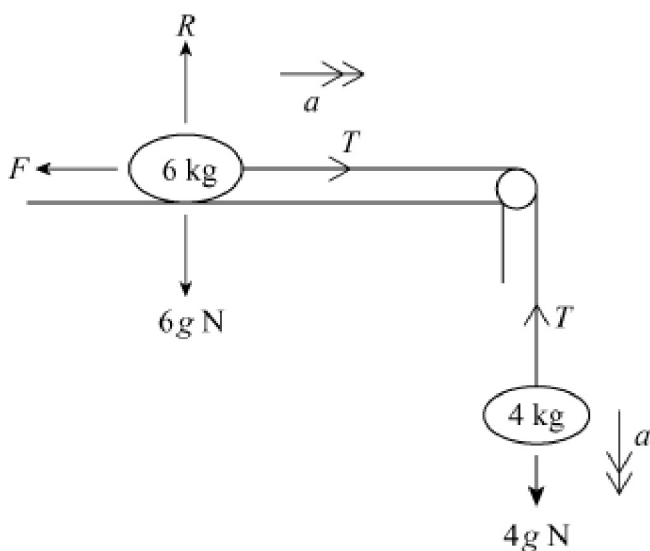
(b) Find the magnitude of the tension in the string.

(c) Find the magnitude of the friction force that acts on the block.

(d) Find the coefficient of friction between the block and the table. Give your answer correct to two significant figures. [A]



Solution:



(a) Using $s = ut + \frac{1}{2}at^2$, $0.6 = \frac{1}{2} \times a \times 2^2$

Acceleration is 0.3 m s^{-2}

(b) Using $F = ma$ for 4 kg sphere;

$$4g - T = 4a$$

$$4g - 4 \times 0.3 = T$$

\therefore Tension is 38 N

(c) Using $F = ma$ for 6 kg block, in the direction of movement,

$$T - F = 6a$$

$$\therefore F = T - 6a$$

$$= 38 - 6 \times 0.3$$

\therefore Magnitude of frictional force is 36.2 N

(d) Resolving vertically at the block, $R = 6g$

$$\begin{aligned} F = \mu R \quad \Rightarrow \quad \mu &= \frac{F}{R} \\ &= \frac{36.2}{6g} \\ &= 0.6156 \end{aligned}$$

\therefore Coefficient of friction is 0.62 (to 2 s.f.).