

Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise Test yourself, Question 4

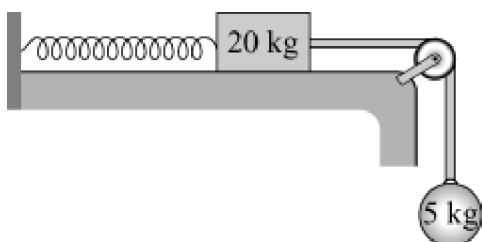
Question:

The diagram shows a spring fixed to a wall and a block of mass 20 kg, that is at rest on a rough horizontal plane. A string attached to the block passes over a small smooth pulley and is attached to a second block of mass 5 kg. The situation is shown in the diagram.

The tension in the spring is 8 N when the block is on the point of sliding towards the pulley.

(a) Find the coefficient of friction between the block and the plane.

(b) Describe what happens to the 20 kg block if the string attached to it is cut. Give reasons to support your answer.



Solution:

(a) Vertically $m = 5$ $T = 49$

Horizontally $m = 20$

$$F + 8 = T$$

$$\therefore F = T - 8$$

$$F = 49 - 8$$

$$\therefore F = 41 \text{ N}$$

Vertically, $m = 20$ $R = 196 \text{ N}$

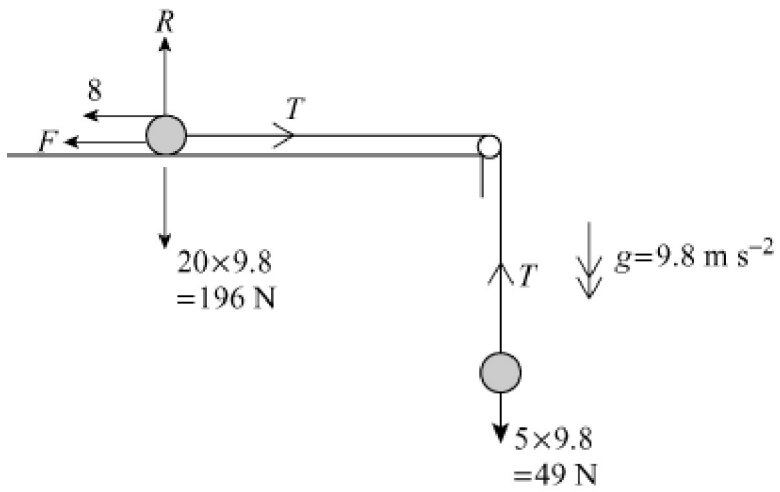
Limiting equilibrium $F = \mu \times R$

$$\therefore 41 = \mu \times 196$$

$$\text{i.e. } \mu = \frac{41}{196}$$

$$\mu = 0.20918\dots$$

$$\mu = 0.209 \text{ (3 s.f.)}$$



- (b) Maximum available friction is $\mu \times R = 0.20922... \times 196$
 $= 41 \text{ N}$

If string is cut the block stays at rest since 8 N is less than this value.

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