Solutionbank M1

Heinemann Modular Maths for Edexcel AS and A-level

4 Forces

Exercise F, Question 9

Question:

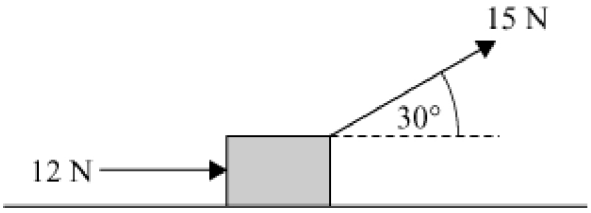
The diagram shows a small box resting on a rough horizontal surface.
The box is of weight W newtons. It is pushed with a horizontal force of 12 newtons, and pulled with a force of 15 newtons at an angle of 30° to the horizontal.
The box rests in limiting equilibrium.

(a) Draw a diagram to show all the forces acting on the box.

(b) Show that the frictional force acting on the box is approximately 25 newtons.

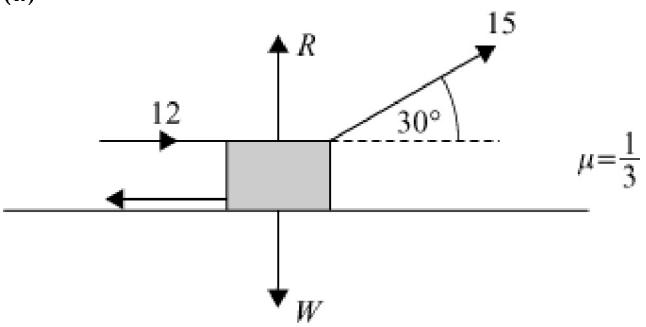
(c) The coefficient of friction between the box and the surface is $\frac{1}{3}$. Find the normal reaction force between the box and the surface.

(d) Find the value of W. [A]



Solution:

(a)



(b) Resolving horizontally

$F = 12 + 15 \cos 30°$
$F = 24.990...$
$F = 25.0$ N (3 s.f.)

Limiting equilibrium, $F = \mu R$ $\quad 24.990 = \frac{1}{3} \times R$

(c) $\therefore R = 3 \times 24.990...$

$R = 74.971...$

$R = 75.0$ N (3 s.f.)

Resolving vertically $\quad R + 15 \sin 30° = W$

(d) $\therefore 74.971 + 15 \sin 30° = W$

$\therefore W = 82.471...$

$W = 82.5$ N (3 s.f.)