Answer on Question #65619, Physics / Mechanics | Relativity

A box of mass 50 kg is placed on an inclined plane. When the angle of the plane is increased to 30º, the box begins to slide downwards. Calculate the coefficient of static friction between the plane and the box. Draw the free body diagram

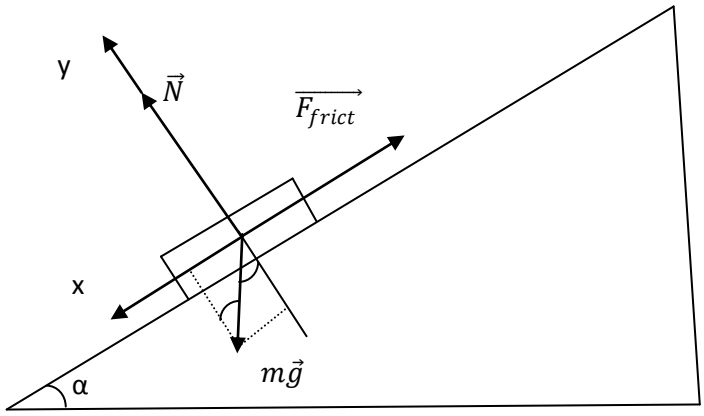
Find: μ – ?

Given:

m=50 kg

α=30°

Solution:



Newton's Second Law:

$\sum_{i=1}^{n} \overrightarrow{F_i} = m\vec{a}$ (1)

We believe that the body moves in straight lines and uniformly.

In this way, $\vec{a} = \vec{0}$ (2)

Write the vector sum of all forces:

$\sum_{i=1}^{n} \overrightarrow{F_i} = \overrightarrow{F_{frict}} + \vec{N} + m\vec{g}$ (3),

where $\overrightarrow{F_{frict}}$ – friction force, $\vec{N}$ – reaction force, $m\vec{g}$ – gravity force

(2) and (3) in (1):

$\overrightarrow{F_{frict}} + \vec{N} + m\vec{g} = \vec{0}$ (4)

Find projections of forces.

OX: $-F_{frict} + mg\sin\alpha = 0$ (5)

OY: $N - mg\cos\alpha = 0$ (6)

Friction force:

$F_{frict} = \mu N$ (7),

where μ – coefficient of static friction ($\mu < 1$)

(7) in (5): $-\mu N + mg \sin \alpha = 0$ (8)

Of (8) $\Rightarrow$ $\mu N = mg \sin \alpha$ (9)

Of (6) $\Rightarrow$ $N = mg \cos \alpha$ (10)

Of (9) and (10) $\Rightarrow$ $\frac{\mu N}{N} = \frac{mg \sin \alpha}{mg \cos \alpha}$ (11)

Of (11) $\Rightarrow$ $\mu = \tan \alpha$ (12)

Of (12) $\Rightarrow$ μ=0.58

Answer:

0.58