Answer on Question #46640, Physics, Mechanics | Kinematics | Dynamics

Question:

a body takes time t to reach the bottom of an inclined plane of angle with horizontal. if plane is rough time taken is 2t. what is the cofficient of friction of rough surface.

Answer:

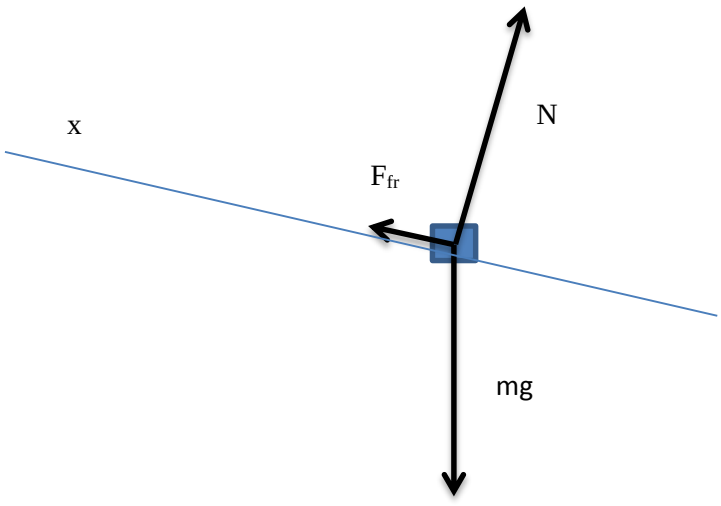
Suppose length of plane equals l:

$$l = \frac{at^2}{2}$$

Therefore:

$$t = \sqrt{\frac{2l}{a}}$$

In case with friction we have:



Newton's laws of motion:

$$x: \quad ma = mg\sin\theta - F_{fr}$$

$$y: \quad N = mg\cos\theta$$

Friction force equals $F_{fr} = \mu N = \mu mg\cos\theta$, μ - coefficient of friction.

Therefore:

$$a_2 = g\sin\theta - \mu g\cos\theta$$

In first case $\mu = 0$:

$$a_1 = g\sin\theta$$

Therefore:

$$t_1 = t = \sqrt{\frac{2l}{g\sin\theta}}$$

$$t_2 = 2t = \sqrt{\frac{2l}{(g\sin\theta - \mu g\cos\theta)}}$$

$$g\sin\theta = 4\cdot(g\sin\theta - \mu g\cos\theta)$$

$$\mu = 3\tan\theta$$

Answer: $\mu = 3\tan\theta$

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