

Answer on Question#39910, Physics, Mechanics

Question:

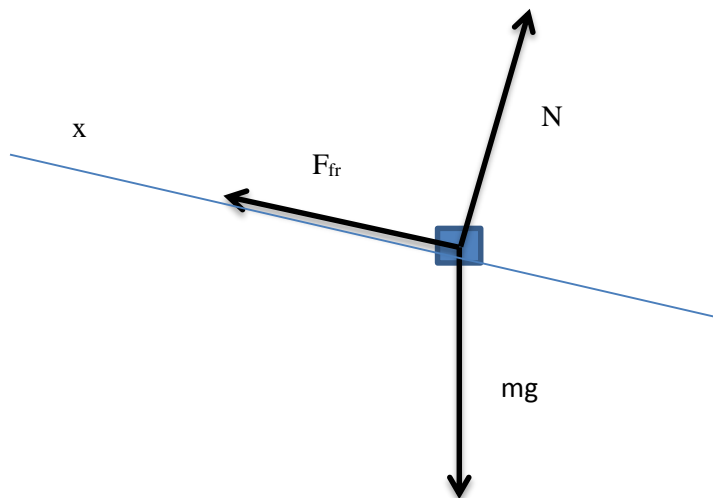
A bus is moving downhill at a slope of 5 degree on a rainy day. At the moment when the speed of the bus is 30km/h, the driver spots a deer 30m ahead. He applies the brakes and comes to a stop. The deer is paralyzed by fear and does not move. Will the bus stop before reaching it or will it hit the deer? Do relevant calculations and draw appropriate force diagram. Take the coefficient of kinetic friction to be= 0.26 .

Answer:

Distance before stopping equals

$$s = \frac{v^2}{2a}$$

where v is initial speed, a is deceleration.



Newton's laws of motion:

$$x: \quad ma = F_{fr} - mg \sin 5^\circ$$

$$y: \quad N = mg \cos 5^\circ$$

Friction force equals $F_{fr} = \mu N = \mu mg \cos 5^\circ$, μ - coefficient of friction.

Therefore:

$$a = \frac{\mu mg \cos 5^\circ - mg \sin 5^\circ}{m} = (\mu \cos 5^\circ - \sin 5^\circ)g$$

$$s = \frac{v^2}{2(\mu \cos 5^\circ - \sin 5^\circ)g} \cong 21 \text{ m}$$

So, we have $s < 30 \text{ m}$, therefore bus will stop before reaching the deer.