

Answer on Question #69189-Physics-Classical Mechanics

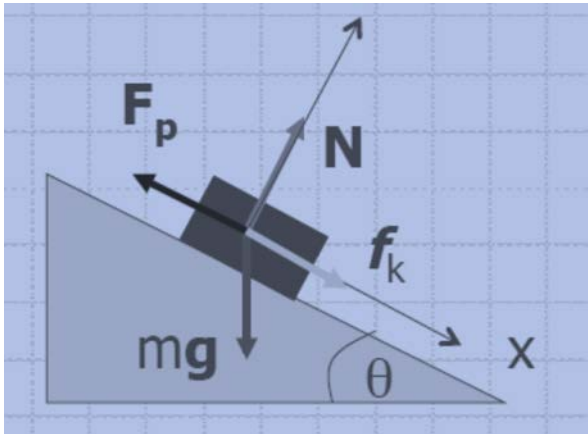
A skier is pulled up a slope at a constant velocity by a tow bar. The slope is inclined at 25.0 degrees with respect to the horizontal. The force applied to the skier by the tow bar is parallel to the slope. The skier's mass is 55.0 kg, and the coefficient of kinetic friction between the skis and the snow is 0.120. Find the magnitude of the force that the tow bar exerts on the skier

_____ N

Solution

$$m = 55.0 \text{ kg}, \mu_k = 0.120, \theta = 25.0^\circ$$

Free Body Diagram:



Since velocity is constant, $a_x = 0$; Also $a_y = 0$ since skier remains on slope. Thus, we have an equilibrium.

$$\sum \vec{F} = 0 \rightarrow \sum F_x = 0; \sum F_y = 0.$$

1.

$$\sum F_y = 0 \rightarrow N - mg \cos \theta = 0$$

$$N = mg \cos \theta$$

2.

$$\sum F_x = 0 \rightarrow f_k - F_p + mg \sin \theta = 0$$

The magnitude of the force that the tow bar exerts on the skier is

$$F_p = f_k + mg \sin \theta = \mu_k N + mg \sin \theta = \mu_k mg \cos \theta + mg \sin \theta = mg(\mu_k \cos \theta + \sin \theta)$$

$$F_p = (55.0)(9.81)(0.120 \cos 25.0^\circ + \sin 25.0^\circ) = 286 \text{ N}$$

Answer: 286 N.

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