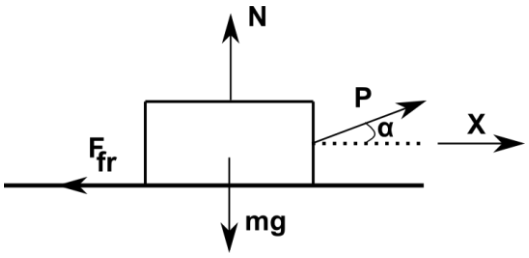
Answer on Question 49770, Physics, Other

Question:

A $1.2\cdot10^2 kg$ crate is being pushed across a horizontal floor by a force P that makes an angle of 30.0 degree below the horizontal. The coefficient of kinetic friction is 0.350. What should be the magnitude of P, so that the net work done by it and the kinectic friction is zero?

Solution:



Let's write the expression for the net work done by a force P and the kinetic friction force:

$$W = P_x - F_{fr} = 0,$$

where P_x is the projection of the force P on the x axis, F_{fr} is the kinetic friction force and the net work must be equal to zero from the condition of the question.

From the free-body diagram we can find P_x and F_{fr}:

$$P_x = P\cos\alpha,$$

$$F_{fr} = \mu_k N = \mu_k\left(mg + P\sin\alpha\right).$$

After substituting P_x and F_{fr} to the expression for the net work and solving it for P we obtain:

$$P = \frac{\mu_k mg}{\cos\alpha - \mu_k \sin\alpha} = \frac{0.35\cdot1.2\cdot10^2 kg\cdot9.8\frac{m}{s^2}}{\cos30^\circ - 0.35\cdot\sin30^\circ} = 596N.$$

Answer:

The magnitude of force P should be 596 N.