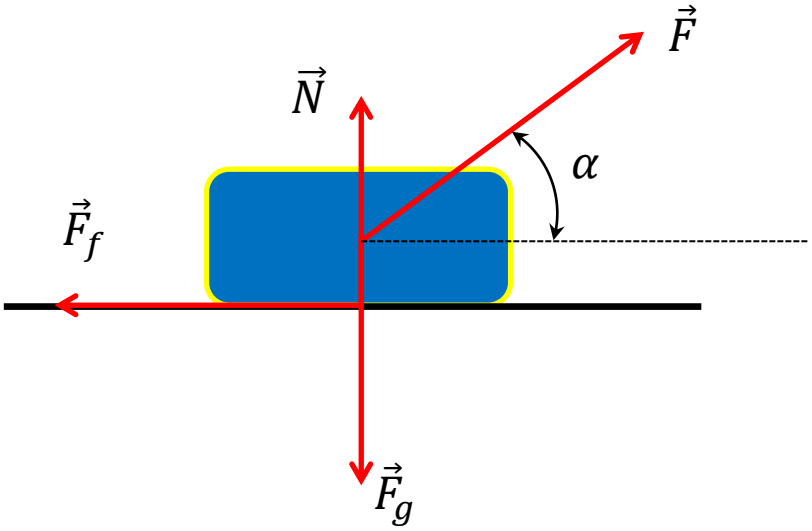
Answer on Question #73705, Physics / Mechanics | Relativity

Question. Crate is moved across the floor by pulling a rope tied to it. The force on the crate is of magnitude $450\ N$ and is directed at an angle of 60° to the horizontal. The force of friction on the crate is $125\ N$. The mass of the crate is $300\ kg$. Draw the free body diagram for the system and calculate the acceleration of the crate. Calculate the work done by each of the forces in displacing the crate by $5.0\ m$. Which of these forces is a "no-work" force?

Solution.



According to the second Newton's low

$$\vec{F} = m\vec{a}.$$

So

$$\sum F_x = ma$$

$$F\cos\alpha - F_f = ma \ \rightarrow\ a = \frac{F\cos\alpha - F_f}{m} = \frac{450\cdot\cos 60° - 125}{300} = 0.33\ \frac{m}{s^2}.$$

$$\sum F_y = 0.$$

$$N + F\sin\alpha - F_g = 0 \ \rightarrow\ N + 450\cdot\sin 60° - 300\cdot 9.8 = 0 \ \rightarrow\ N = 2940 - 390 = 2550\ N.$$

$$A = \left(\vec{F}\cdot\vec{r}\right) = F\cdot r\cdot\cos\alpha = 450\cdot 5\cdot\cos 60° = 1125\ J.$$

$$A_f = \left(\vec{F}_f\cdot\vec{r}\right) = F_f\cdot r\cdot\cos 180° = 125\cdot 5\cdot(-1) = -625\ J.$$

$\vec{N}\ and\ \vec{F}_g$ are"no-work" forces.

Answer. $a = 0.33\ \frac{m}{s^2}$; $A = 1125\ J$; $A_f = -625\ J$.