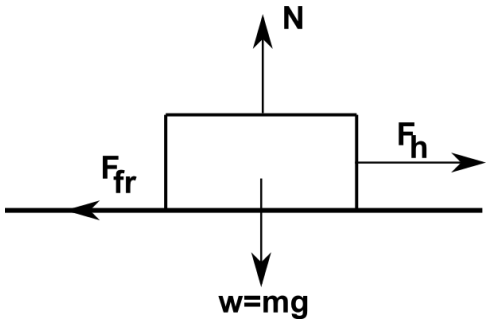
Answer on Question 49964, Physics, Mechanics | Kinematics | Dynamics

Question:

A person pulls a crate with 120 N of force against 100 N of friction a distance of 5 meters. Sketch a free-body diagram showing the forces acting on the crate and find the energy the person expends pulling the crate, the amount of energy converted to heat via friction, and the increase in the kinetic energy of the crate.

Solution:



Let us sketch a free-body diagram that show the forces acting on the crate. There are four forces acting on the crate: the horizontal force F_h, the friction force F_{fr}, the gravitational force (weight) w and the normal force N.

1) The energy the person expends pulling the crate is equal to work done on the crate by the horizontal force:

$$W_h = F_h s = 120N \cdot 5m = 600J.$$

2) The amount of energy converted to heat via friction is equal to work done on the crate by the friction force (we take the friction force with sign minus because it have opposing direction to the horizontal force):

$$W_{fr} = F_{fr} s = -100N \cdot 5m = -500J.$$

3) According to the Work-Kinetic Energy Theorem the change in the kinetic energy of the crate is equal to the net work done on it:

$$\Delta KE = KE_f - KE_i = W_{net} = W_h + W_{fr} = 600J - 500J = 100J.$$

Hence, the increase in the kinetic energy of the crate will be $100J$.

Answer:

1) $W_h = 600J.$

2) $W_{fr} = -500J.$

3) $\Delta KE = 100J.$