Problem:

A force of 277 N is applied horizontally to a crate in order to displace the crate 40.0 m across a level floor at a constant velocity. As a result of this work, the crate's internal energy is increased by an amount equal to 19 percent of the crate's initial internal energy. Calculate the initial internal energy of the crate. (Disregard the work done on the floor, and assume that all work goes into the crate.)

Solution:

As the velocity of the crate is constant and it remains at the same vertical level, there are no changes in kinetic and potential energies of the crate. Thus, in assumption that all work goes into the crate (disregard the work done on the floor), we get:

$FL = U_2 - U_1 = 0.19U_1 =>$

$U_1 = \frac{FL}{0.19} = \frac{277 * 40}{0.19} = 58.3\ [kJ]$

Where L=40 m – displacement;

$F = 277\ [N]$ – force applied;

U_1 and $U_2 = 1.19U_1$ – initial and final internal energy of the crate;

Answer: $U_1 = 58.3\ [kJ]$.