A force of 315 N is applied horizontally to a crate in order to displace the crate 37.5 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 21 percent of the crate's initial internal energy. Calculate the initial internal energy of the crate.

Solution:

In order to accomplish work on an object there must be a force exerted on the object and it must move in the direction of the force.

Work = Force * distance moved in direction of force
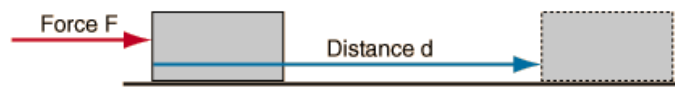
$$W = Fd = 315 * 37.5 = 11812.5 \text{ J}$$

Energy can be defined as the capacity for doing work. It may exist in a variety of forms and may be transformed from one type of energy to another. However, these energy transformations are constrained by a fundamental principle, the Conservation of Energy principle.

In our case work= increasing of internal energy:

$$W = \Delta U = 0.21 \cdot U_0$$

Thus, the initial internal energy of the crate is

$$U_0 = \frac{W}{0.21} = \frac{11812.5}{0.21} = 56250 \text{ J} = 56.25 \text{ kJ}$$

Answer. U_0 = 56250 J = 56.25 kJ.