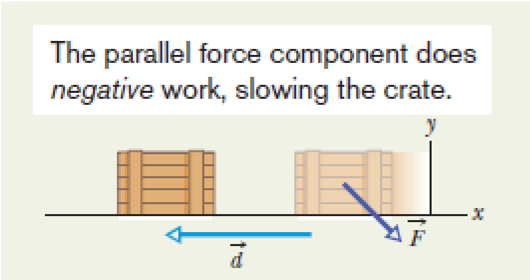
Answer on Question #62329, Physics / Mechanics | Relativity

During a storm, a crate of crepe is sliding across a slick, oily parking lot through a displacement d=(-3.0m)i while a steady wind pushes against the crate with a force F=(2.0N)i+(-6.0N)j.

(a) How much work does this force do on the crate during the displacement?

(b) If the crate has a kinetic energy of 10J at the beginning of displacement d, what is its kinetic energy at the end of d?

Solution:



(a)

Because we can treat the crate as a particle and because the wind force is constant ("steady") in both magnitude and direction during the displacement to calculate the work we can use equation

$$W = \vec{F} \cdot \vec{d}$$

$$W = [(2.0\text{N})\vec{\imath} + (-6.0\text{N})\vec{\jmath}] \cdot [(-3.0\text{m})\vec{\imath}\,] =$$
$$= (2.0\text{N})(-3.0\text{m})\vec{\imath}\vec{\imath} + (-6.0\ N)(-3.0\ m)\vec{\imath}\vec{\jmath} =$$
$$=(-6.0\text{ J})(1)+0=-6.0\text{ J}$$

Thus, the force does a negative 6.0 J of work on the crate, transferring 6.0 J of energy from the kinetic energy of the crate.

(b) Because the force does negative work on the crate, it reduces the crate's kinetic energy. Using the work–kinetic energy theorem we have

$$K_f = K_i + W = 10\text{ J} + (-6.0\text{ J}) = 4.0\text{ J}.$$

Less kinetic energy means that the crate has been slowed.

Answer: (a) -6.0 J;
(b) 4.0 J.