Answer on Question #60033-Physics-Mechanics-Relativity

A sailor pushes a 100 kg crate up a ramp that is 3 m high and 5 m long onto the deck of a ship. He exerts a 650 N force parallel to the ramp. What is the mechanical advantage of the ramp? What is the efficiency of the ramp?

Solution

Work using ramp:

$$W_1 = (650)(5) = 3250\,J$$

Actual work done

$$W_2 = mgh = (100)(9.8)(3) = 2940\,J$$

F using ramp is

$$F_1 = 650\,N$$

F using direct displacement:

$$F_2 = mg = (100)(9.8) = 980\,N$$

Mechanical advantage is

$$\frac{F_2}{F_1} = \left(\frac{980}{650}\right) = 1.508$$

Efficiency is

$$\left(\frac{2940J}{3250J}\right)100\% = 90.46\%$$