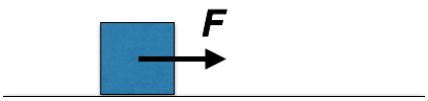
Prelab: Conversion of Mechanical Energy to Heat

Friction and heat: A box is moving with <u>constant velocity</u> to the right on a horizontal surface with friction. In addition to the force of kinetic friction acting on the box there is also a force $F=3N$ as shown in the figure.

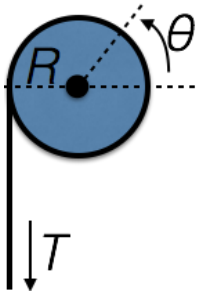


A. What is the work done by F while the box moves 2 meters to the right?

B. What is the work done on the box by kinetic friction during this time? (don't forget the sign)

C. How much heat is generated by friction during this time?

Work and torque: A pulley of radius R has a string wrapped around it. A force is applied to the free end of the string such that the string has a tension T. Assume that the pulley is rotating with constant angular velocity in the counter-clockwise direction (this could be accomplished by a frictional force which is counteracting the torque due to the string). Convince yourself that while the pulley rotates by an angle θ a point on the boundary of the pulley moves by the distance $d=R\theta$. Therefore the work done by the tension force on the pulley is given by $W=Td=TR\theta$.



A. What is the torque τ on the pulley due to the tension in the rope?

B. Rewrite the expression for the work done on the pulley by the rope (given above) using your expression for the torque τ. The formula you obtain is the general formula for the work done by a torque on a rotating object. Explain why it can be said that this formula is analogous to the formula for work done by a force for linear motion.