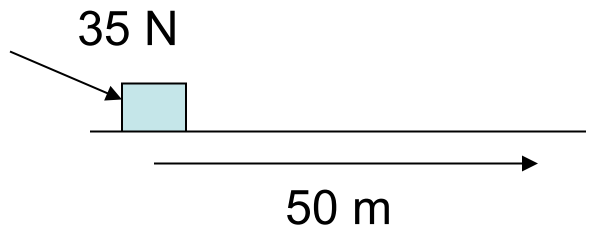
Problem 5.4

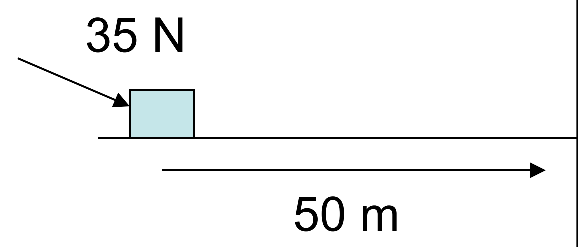
A 35 N force acting on a cart at 25° down just overcomes friction.

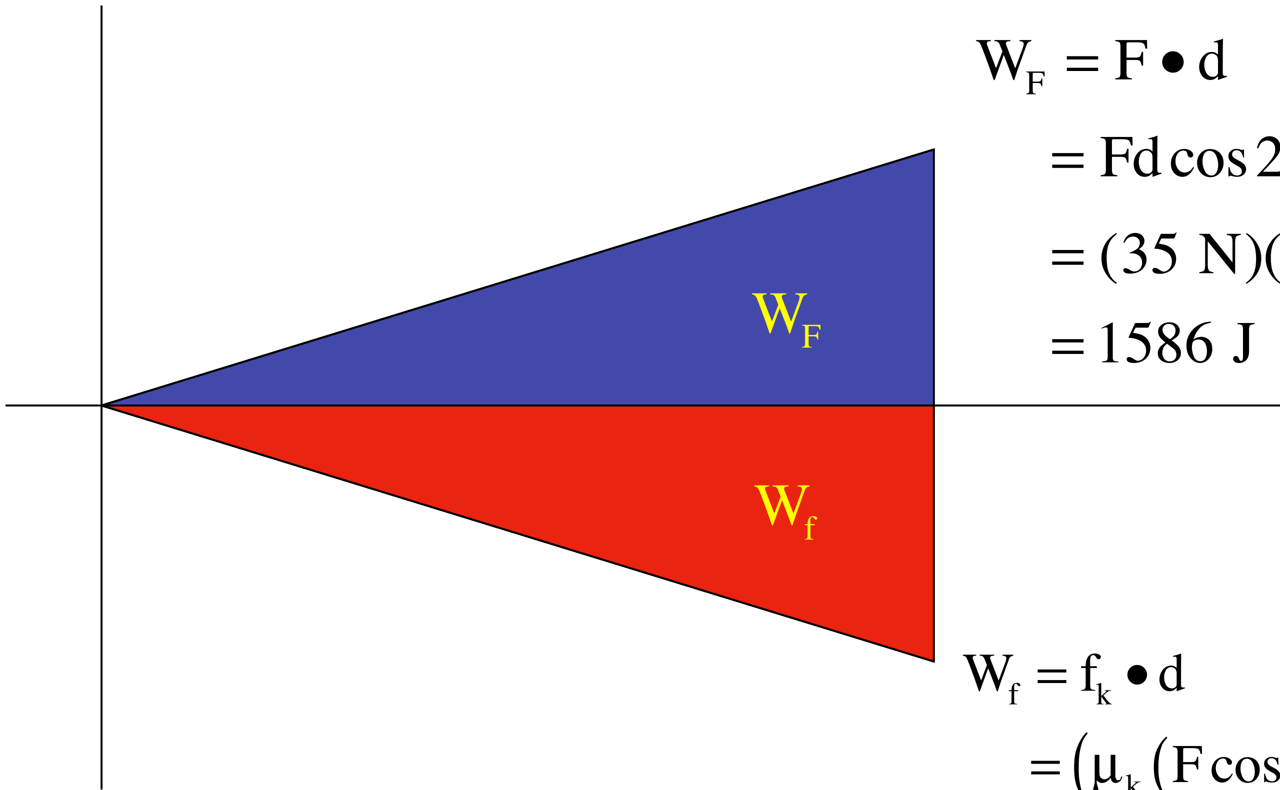


a.) How much work does the pusher do?

b.) What is the net work done on the cart?

Note: Graphically, the work done looks like:



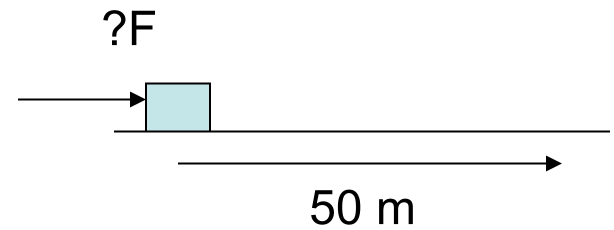


$$W_F = F \bullet d$$
$$= Fd\cos 25^{o}$$
$$= (35\ \text{N})(50\ \text{m})\cos 25^{o}$$
$$= 1586\ \text{J}$$

$$W_f = f_k \bullet d$$
$$= \left(\mu_k\left(F\cos\theta + mg\right)\right)d\cos 180^{o}$$

NET WORK DONE EQUALS ZERO!

c.) Assuming the frictional work remains the same and the velocity is still constant, how would force change if applied in the horizontal (speak from the perspective of energy)?



Minor Note having nothing to do with energy: Friction is a function of the normal force. If the direction of the force F changes, the normal force will change. For the "frictional work" to remain the same, then, something would have to change with the surface (we are assuming that happens so that the frictional work CAN stay the same).

As for energy, for the situation to stay the same in a work related sense, the new horizontal force ?F will have to equal the old component of F along the line of motion (i.e., $F\cos\theta$) , which means the ?F would have to be smaller than F.

d.) What would happen to the net work done?

As long as the velocity remained constant, the net force must remain zero (work/ energy theorem).