

# Units and Measurements

Phys109

Fall 2019

1. How much work is done by the boy pulling his sister 30 m in a wagon as shown? Assume no friction acts on the wagon. (1299 j)

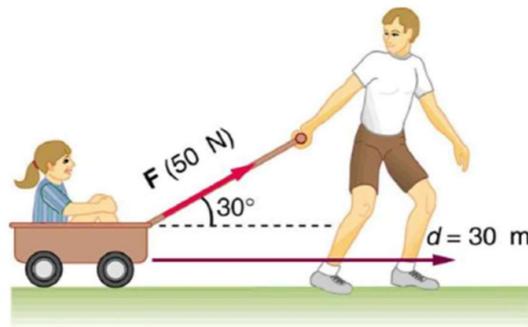


Figure 1: Problem no.6

2. The person in the figure does work on the lawn mower. If the force exerted by him to the lawn mower is 60 N and he pushes the mower with an angle of 30 degree below the horizontal axis.

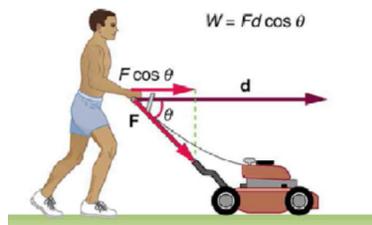


Figure 2: Problem no.8

- (a) Find the work done by him to the mower for a distance of 50 m. (2598 j)

- (b) the work done by him if friction does 20 j work on the mower over the same distance? (1998 j)
3. Suppose the ski patrol lowers a rescue sled and victim, having a total mass of 90 kg, down a  $60^\circ$  slope at constant speed, as shown. The coefficient of friction between the sled and the snow is 0.1.

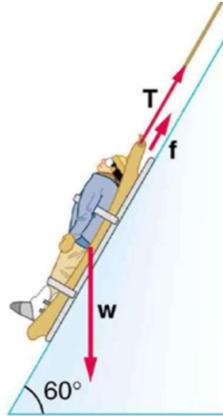


Figure 3: Problem no.9

- (a) How much work is done by friction as the sled moves 30 m along the hill? (-1323 j)
- (b) How much work is done by the rope on the sled in this distance? (24239 j)
- (c) What is the work done by gravitational force on the sled?(0)
- (d) What is the total work done? (22966 j)
4. Suppose that you push on the 30 kg package with a constant force of 120 N through a distance of 0.8 m. This motion is opposed by a friction force of 5 N.

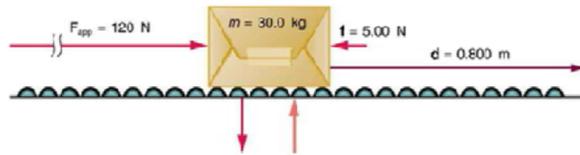


Figure 4: Problem no.10

- (a) Calculate the work done by each force. ( $W_{gr} = 0$ ,  $W_N = 0$ ,  $W_{app} = 96$  j,  $W_{fr} = -4$  j)

- (b) Find the net work done on the package and the power during 2 minutes. (92 J, 0.76 watt)
- (c) If the initial speed of the package is  $0.5 \text{ m/s}$ , find its speed at the end of the push. ( $2.53 \text{ m/s}$ )
5. You push your physics book 1.5 m along horizontal tabletop with a horizontal force of 2.4 N. The opposing force of friction is 0.6 N.
- (a) How much work does your 2.4 N force do on the book? (answer: 3.6 J)
- (b) What is the work done on the book by the friction force? (answer: -0.9J)
- (c) What is the total work done on the book? (answer: 2.7 J)
6. A fisherman reels in 12 m of line while pulling in a fish that exerts a constant resisting force of 25N, if the fish is pulled in at a constant velocity, how much work is done on it by the tension in the line? (answer 300J)
7. An elevator is hoisted by its cables at constant speed. Is the total work done on the elevator positive, negative or zero? Explain.
8. (a) Compute the kinetic energy, in joules of a 1600 kg automobile traveling at  $50 \text{ km/h}$ . (answer: 154123.52J)
- (b) by what factor does the kinetic energy change if the speed is doubled? (answer: 4)
9. A baseball leaves a pitcher's hand at a speed of  $32 \text{ m/s}$ , the mass of the baseball is 0.145 kg. Ignore air resistance. How much work has the pitcher done on the ball in throwing it? (answer: 74.24J)
10. If a force  $\vec{F} = 2\hat{i} - 4\hat{j}$  N exerts on a mass of 50 kg moving,
- (a) 0.5 m along x-axis, (1 J)
- (b) 0.040 km along y-axis, (-16 J)
- (c) in the direction of  $\vec{r} = 15\hat{i} + 5\hat{j}$ , (10 J) find the work for each corresponding displacement vector.