3. A rock climber wears a 7.5-kg backpack while scaling a cliff. After 30.0 min, the climber is 8.2 m above the starting point.

a. How much work does the climber do on the backpack?

b. If the climber weighs 645 N, how much work does she do lifting herself and the backpack?

$W = F \cdot \Delta x \cdot \cos(\theta)$

d or Δx or Δy

a) $W = F \cdot \Delta y \cdot \cos\theta$ $F \parallel \Delta y$ one

$W = mg \cdot \Delta y \cos 0° = 75\,kg \cdot 9.8\,\frac{m}{s^2} \times 8.2\,m \times 1$

$W = 602.7\ J \approx 6.0 \times 10^2\ J$

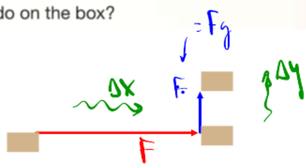
b) $W_{net} = W_{her} + W_{Backpack}$ $W = F_g$

$= 645\,N \times 8.2 \times \cos 0° + 602.7$

$W_{net} = 5911.7\ J \approx 5900 \approx 5.9 \times 10^3\ J$

4. CHALLENGE Marisol pushes a 3.0-kg box 7.0 m across the floor with a force of 12 N. She then lifts the box to a shelf 1 m above the ground. How much work does Marisol do on the box?

$W = F \cdot \Delta x \cdot \cos(\theta)$

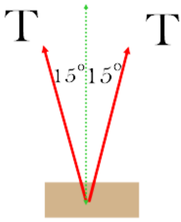


4.- $W_{net} = W_x + W_y = F_x \cdot \Delta x \cdot \cos 0° + F_y \cdot \Delta y \cdot \cos 0°$

$W_{net} = 12 \times 7 \times \cos 0° + 3 \times 9.8 \times 1 \times \cos 0°$

$W_{net} = 113.4\ J = 110\ J \approx 1.1 \times 10^2\ J$

6. Two people lift a heavy box a distance of 15 m. They use ropes, each of which makes an angle of 15° with the vertical. Each person exerts a force of 225 N. How much work do the ropes do?



$W_{Net} = W_T + W_T = 2W_T$

$W_{net} = 2 \times 225\,N \times 15 \times \cos(15°)$

$W_{net} = 6519.91\ J \approx 6500\ J$

$W_{net} = 6.5 \times 10^3\ J$

$W = F \cdot \Delta x \cdot \cos(\theta)$

9. CHALLENGE A bicycle rider pushes a 13-kg bicycle up a steep hill. The incline is 25° and the road is 275 m long, as shown in **Figure 5.** The rider pushes the bike parallel to the road with a force of 125 N.

a. How much work does the rider do on the bike?

b. How much work is done by the force of gravity on the bike?

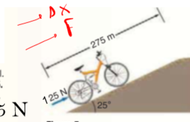
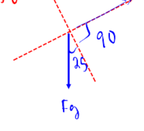


Figure 5

a) $W_F = F \cdot \Delta x \cdot \cos 0° = 125 \times 275 \cos 0°$

$W_F = 34{,}375\ J \approx 34{,}400\ J$



b) $W_{Fg} = F_g \cdot \Delta x \cdot \cos(115°)$

$W_{Fg} = 13 \times 9.8 \times 275 \times \cos(115°) \approx -14\,806\ J$

$W_{Fg} = -14{,}800\ J = -1.48 \times 10^4\ J$