

Where did the energy go?

- **Example:** You pull a 30 N chest 5 meters across the floor at a constant speed, by applying a force of 50 N at an angle of 30 degrees.
- How much work did gravity do?

$$\begin{aligned}W &= F \Delta r \cos \theta \\ &= 30 \times 5 \cos(90) \\ &= 0\end{aligned}$$

- How much work did friction do?

$$\begin{aligned}\text{X-Direction: } \Sigma F &= ma \\ T \cos(30) - f &= 0 \\ f &= T \cos(30)\end{aligned}$$

$$\begin{aligned}W &= F \Delta r \cos \theta \\ &= 50 \cos(30) \times 5 \cos(180) \\ &= -217 \text{ Joules}\end{aligned}$$

