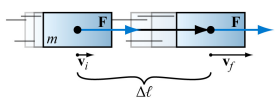
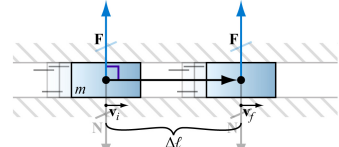
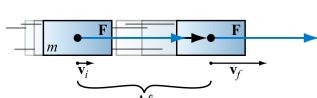
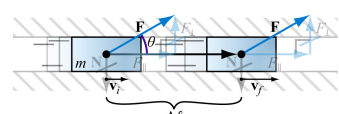

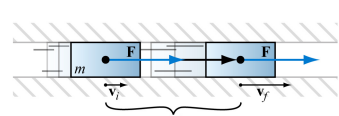
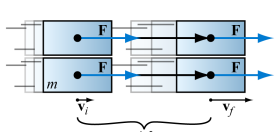


A net force can perform work that contributes to a change in $\frac{1}{2}mv^2$

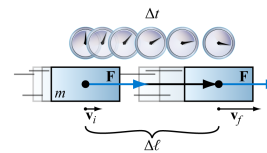
How much can I change the v^2 of an object of mass m by applying a constant force while the object moves through a path length?

 <p style="text-align: center;">$\Delta(v^2) \neq 0$</p>	 <p style="text-align: center;">$\perp \Rightarrow \Delta(v^2) = 0$</p>
 <p style="text-align: center;">$\uparrow \vec{F} \Rightarrow \uparrow \Delta(v^2)$</p>	 <p style="text-align: center;">oblique \Rightarrow some $\Delta(v^2)$</p>
 <p style="text-align: center;">$\uparrow \Delta\ell \Rightarrow \uparrow \Delta(v^2)$</p>	 <p style="text-align: center;">$\parallel \Rightarrow \max \Delta(v^2)$</p>
 <p style="text-align: center;">$\uparrow \Sigma \vec{F} \Leftarrow \uparrow m$</p>	

Deduced **relationship**

$$\begin{aligned}
 \underbrace{(\Sigma F \cos \theta)}_{\Sigma F_{\parallel}} \Delta\ell &= \frac{1}{2} m \Delta(v^2) \\
 &= \frac{1}{2} m (v_f^2 - v_i^2) \\
 &= \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2 \\
 &= \Delta \left(\frac{1}{2} m v^2 \right)
 \end{aligned}$$

Vocabulary



Kinetic energy

$$K := \frac{1}{2} m v^2$$

Work delivered by a force

$$\Delta W_F := \underbrace{(F \cos \theta)}_{F_{\parallel}} \Delta\ell$$

Power delivered by a force

$$P_{F,AVG} := \frac{\Delta W_F}{\Delta t}$$

Work-energy theorem

$$K_i + \overbrace{\sum_F \Delta W_F}^{\Delta W_{\Sigma \vec{F}}} = K_f$$

(for an object having no accessible internal degrees of freedom)

A net force can perform work that contributes to a change in $\frac{1}{2}mv^2$

Work done by a varying force

Consider the work performed by a force of varying strength. Allow increments of path length to be small enough so that, for each increment, the force is roughly constant.

$$\Delta W_{F,i} \approx F_{\parallel,i} \Delta \ell$$

The total work done along a path of finite length

$$\Delta W_F \approx \sum_i F_{\parallel,i} \Delta \ell$$

is the signed area “under” the plot of F_{\parallel} vs. ℓ

