Part II: Conservation Laws
Chapter 10: Interactions and Potential Energy

10.4 Conservation of Energy
the isolated system.

- \((K_f + U_f) + \Delta E_{\text{th}} = (K_i + U_i) + W_{\text{ext}}\)
- No external agents at all, or ...
- External agents do no work:
  - \(W = \int_{\vec{r}_i}^{\vec{r}_f} \vec{F} \cdot d\vec{r}\)
  - 90° between \(\vec{F}\) and \(d\vec{r}\)

isolated + non-dissipative.

- \((K_f + U_f) + \Delta E_{\text{th}}^0 = (K_i + U_i) + W_{\text{ext}}^0\)
- **Lingo:** \(E_{\text{mechanical}}\) is conserved.
For you to do: What is the speed of the ball as it swings through the bottom?¹

You might prefer to take your origin \((y = 0)\) to be where the string is tied to the ceiling. How would this change your setup?

¹You might prefer to take your origin \((y = 0)\) to be where the string is tied to the ceiling. How would this change your setup?
For you to do: A block of mass 200 g oscillates right and left from the end of a spring whose other end is fastened to a wall. The maximum stretch* of the spring is 16 cm. The maximum speed* of the block is 2.4 m/s. The block-floor interface is frictionless.

* maximum stretch: deviation from $L_0$, maximum compression too. At turning points, the block is instantaneously at rest.

* maximum speed: zipping through the middle. The spring is instantaneously relaxed.

- Find the spring’s spring constant.
- By how much is the spring stretched (or compressed) when the block’s speed is 1.2 m/s?