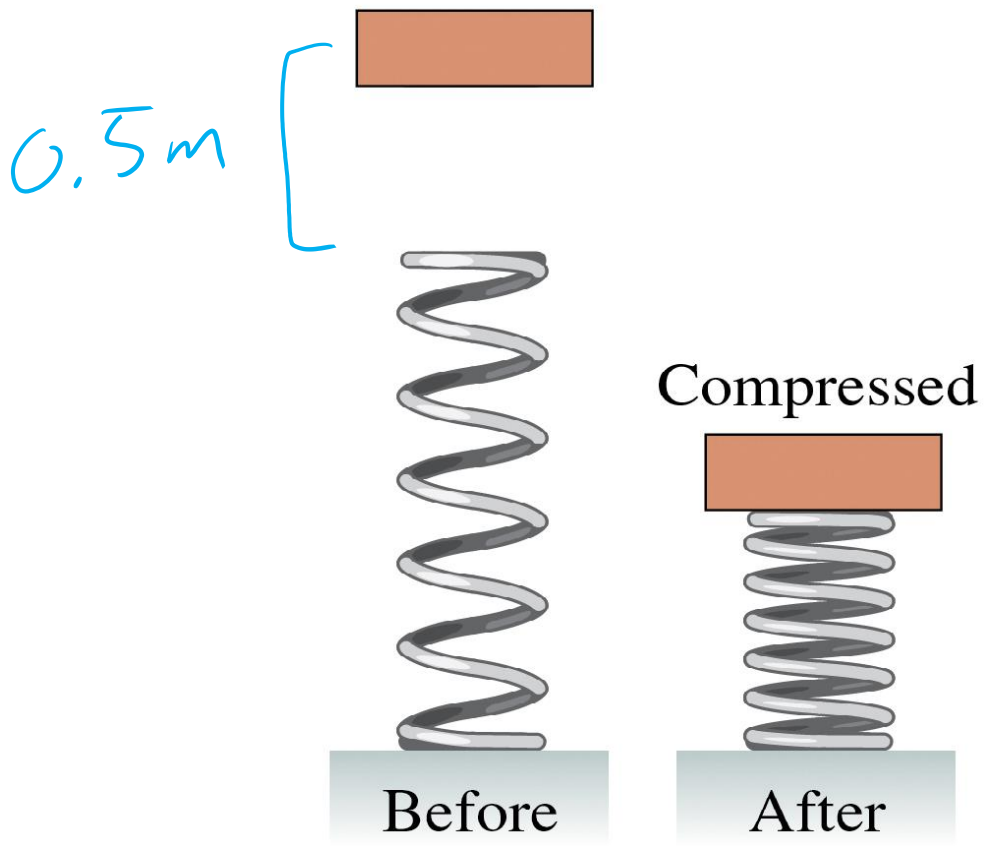
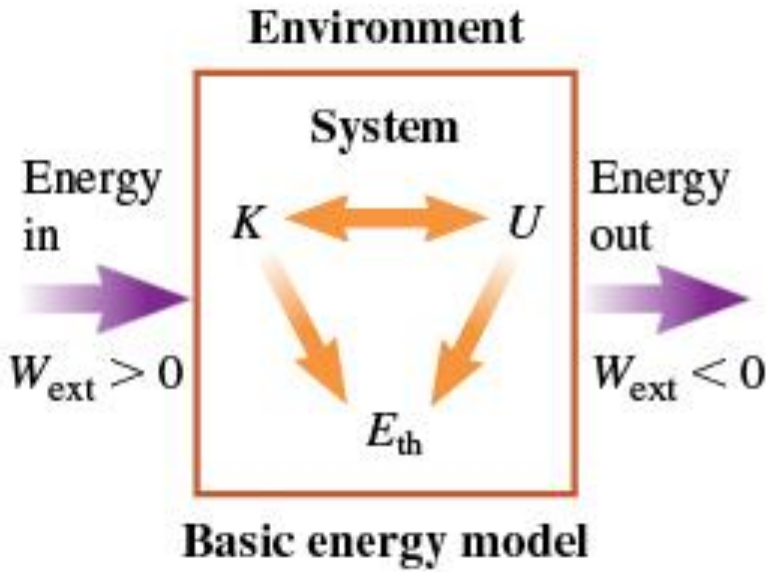
I drop a mass (m=1 kg) onto a spring (k=100 N/m) from a height (h=0.5 m). How much does the spring compress?



Chapter 10 – Interactions and Potential Energy

- Potential energy and conservation of energy
- Energy bar charts and energy diagrams
- Relationship between force and potential energy
- Conservative and nonconservative forces



Basic energy model

Solving Energy Problems

MODEL Define the system.

VISUALIZE Draw a before-and-after pictorial representation and an energy bar chart.

SOLVE Use the energy principle:

$$K_i + U_i + W_{ext} = K_f + U_f + \Delta E_{th}$$

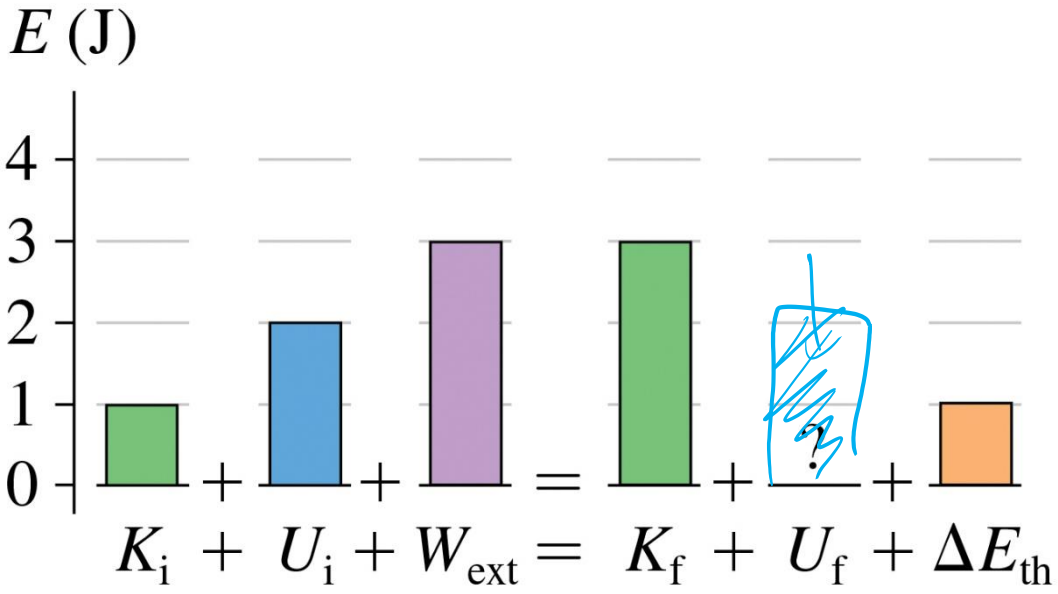
REVIEW Is the result reasonable?

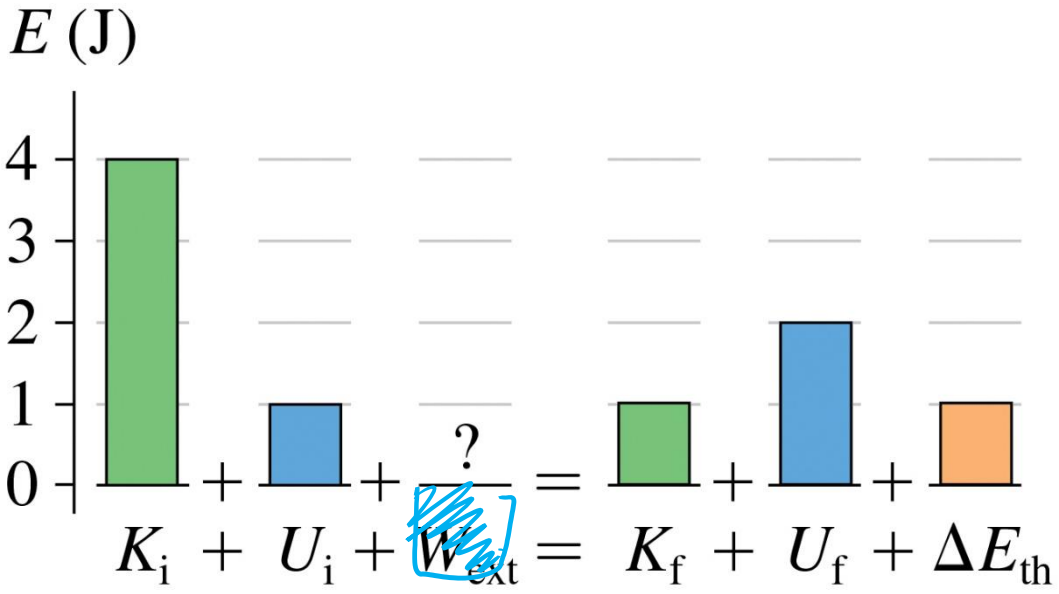
mechanical energies

Isolated System → $W = 0$

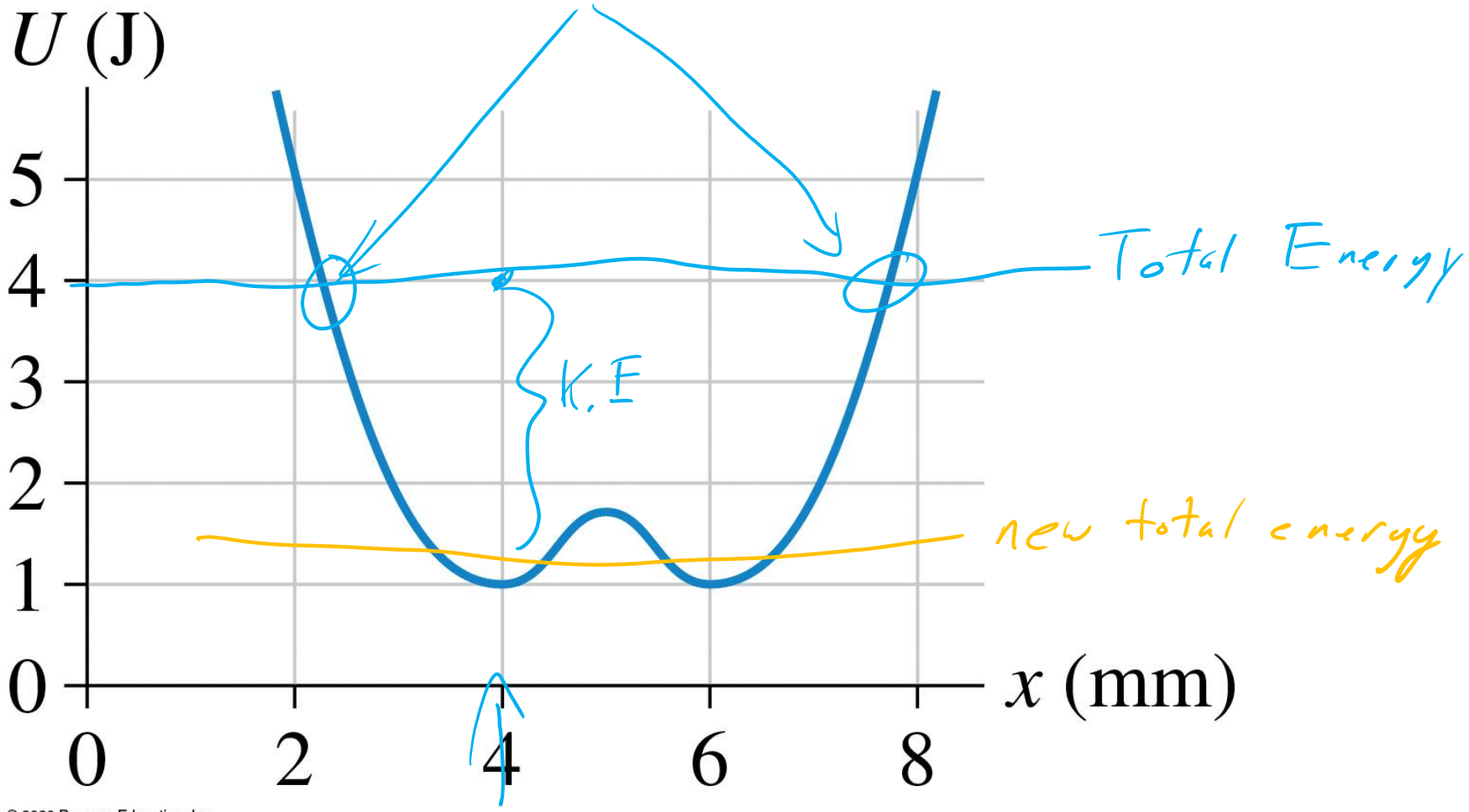
All conservative forces → $\Delta E_{th} = 0$

What is the missing value? Create a scenario for which each bar chart is a correct description of what happened.





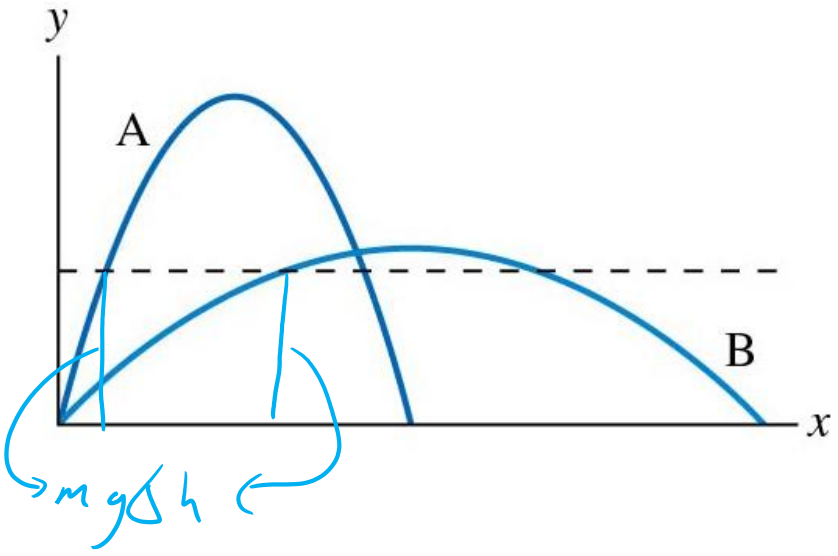
If this particle has 3 J of kinetic energy at x = 4 mm, where are the turning points?



Team Up Questions

STOP TO THINK 10.2 Two identical projectiles are fired with the same speed but at different angles. Neglect air resistance. At the elevation shown as a dashed line,

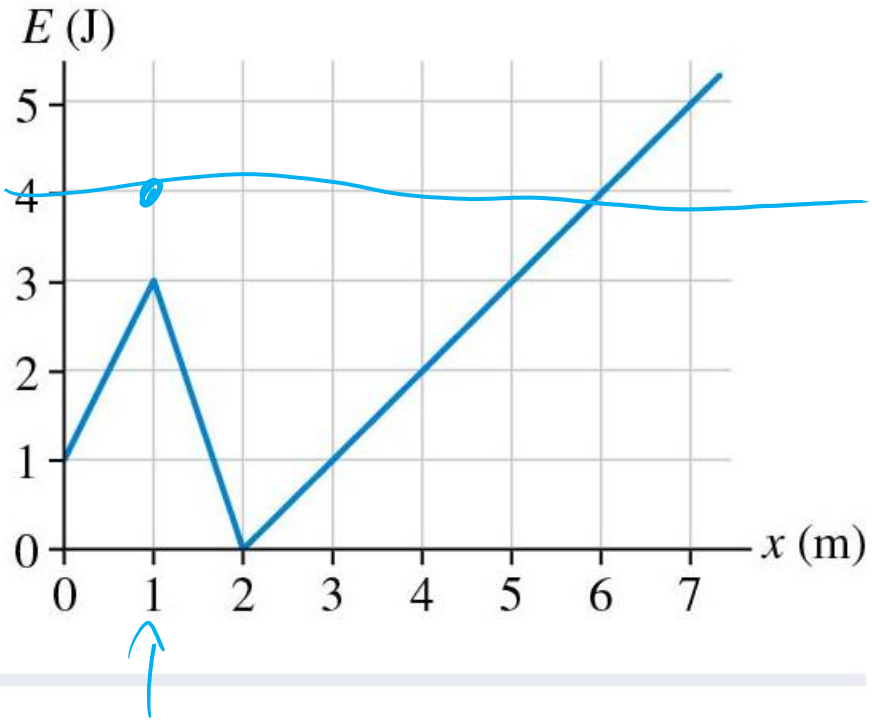
a. The speed of A is greater than the speed of B.
b. The speed of A is the same as the speed of B.
c. The speed of A is less than the speed of B.



$\Delta U_A = \Delta U_B \rightarrow \Delta K_A \; ? \; \Delta K_B$

Team Up Questions

STOP TO THINK 10.6 A single-particle system has the potential energy shown in the graph. Suppose the particle has 1 J of kinetic energy and is moving to the right at $x = 1$ m. Where is the particle's turning point?

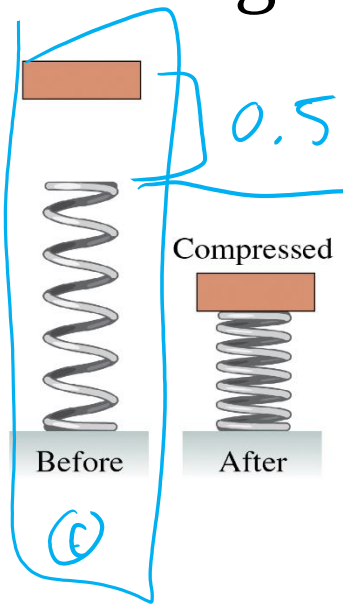


Team Up Questions

STOP TO THINK 10.7 A weight attached to a rope is released from rest. As the weight falls, picking up speed, the rope spins a generator that causes a lightbulb to glow. Define the system to be the weight and the earth. In this situation,

a. $U \rightarrow K + W_{ext}$. E_{mech} is not conserved but E_{sys} is.
b. $U + W_{ext} \rightarrow K$. Both E_{mech} and E_{sys} are conserved.
c. $U \rightarrow K + E_{th}$. E_{mech} is not conserved but E_{sys} is.
d. $U \rightarrow K + W_{ext}$. Neither E_{mech} nor E_{sys} is conserved.
e. $W_{ext} \rightarrow K + U$. E_{mech} is not conserved but E_{sys} is.

I drop a mass (m=1 kg) onto a spring (k=100 N/m) from a height (h=2 m). How much does the spring compress?



System

0.5 m = h

$y = 0$

y +ve

$K_i + U_i = K_f + U_f$

$mgh_i + 0 = mgh_f + \frac{1}{2}k(\Delta y)^2$

$mg(0.5m) + 0 = mg(-y) + \frac{1}{2}ky^2$

$-c \quad b \quad a$

$y = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

y is most negative