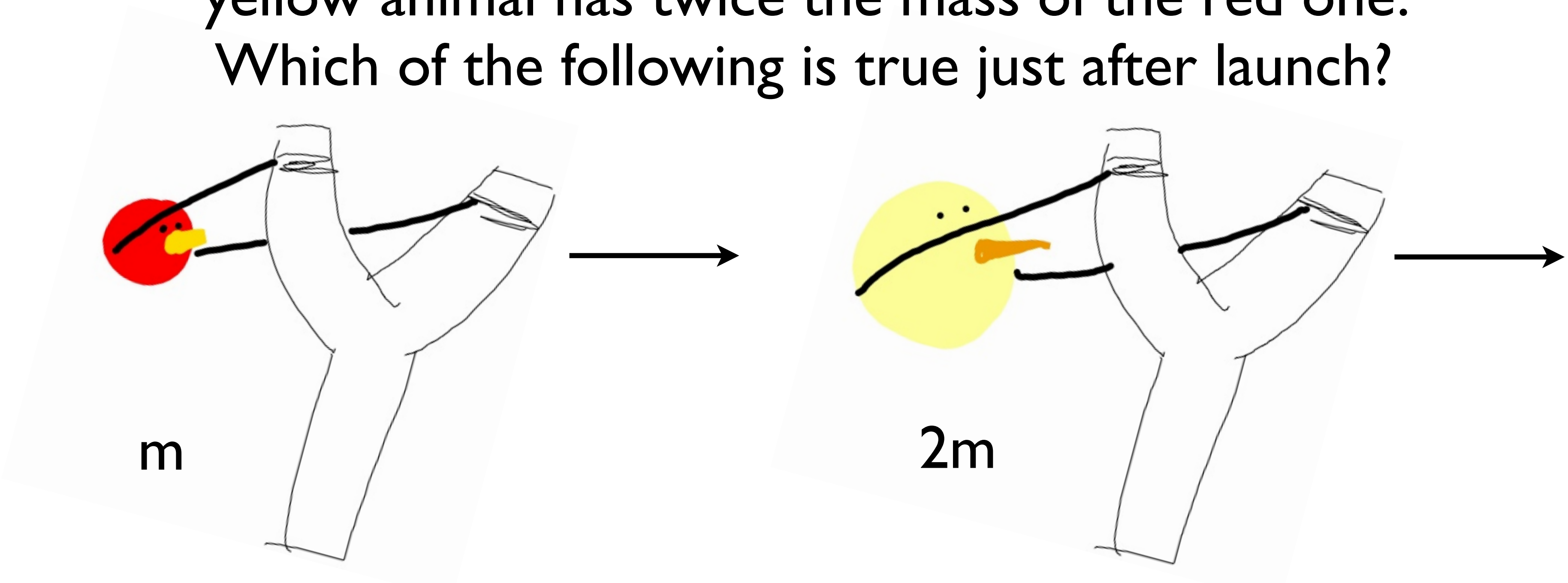
I use a slingshot to launch some stuffed animals. The slingshot acts like an ideal spring, obeying Hooke's law. It is stretched the same amount before launch. The yellow animal has twice the mass of the red one. Which of the following is true just after launch?



A. The yellow one has more kinetic energy
B. The red one has more kinetic energy
C. Both have the same kinetic energy
D. Need more information

Text 'PHYSJC' and your answer to 22333

Ch 7.2-3: Elastic Potential Energy

PHYS 1210 - Prof. Jang-Condell

Goals for Chapter 7

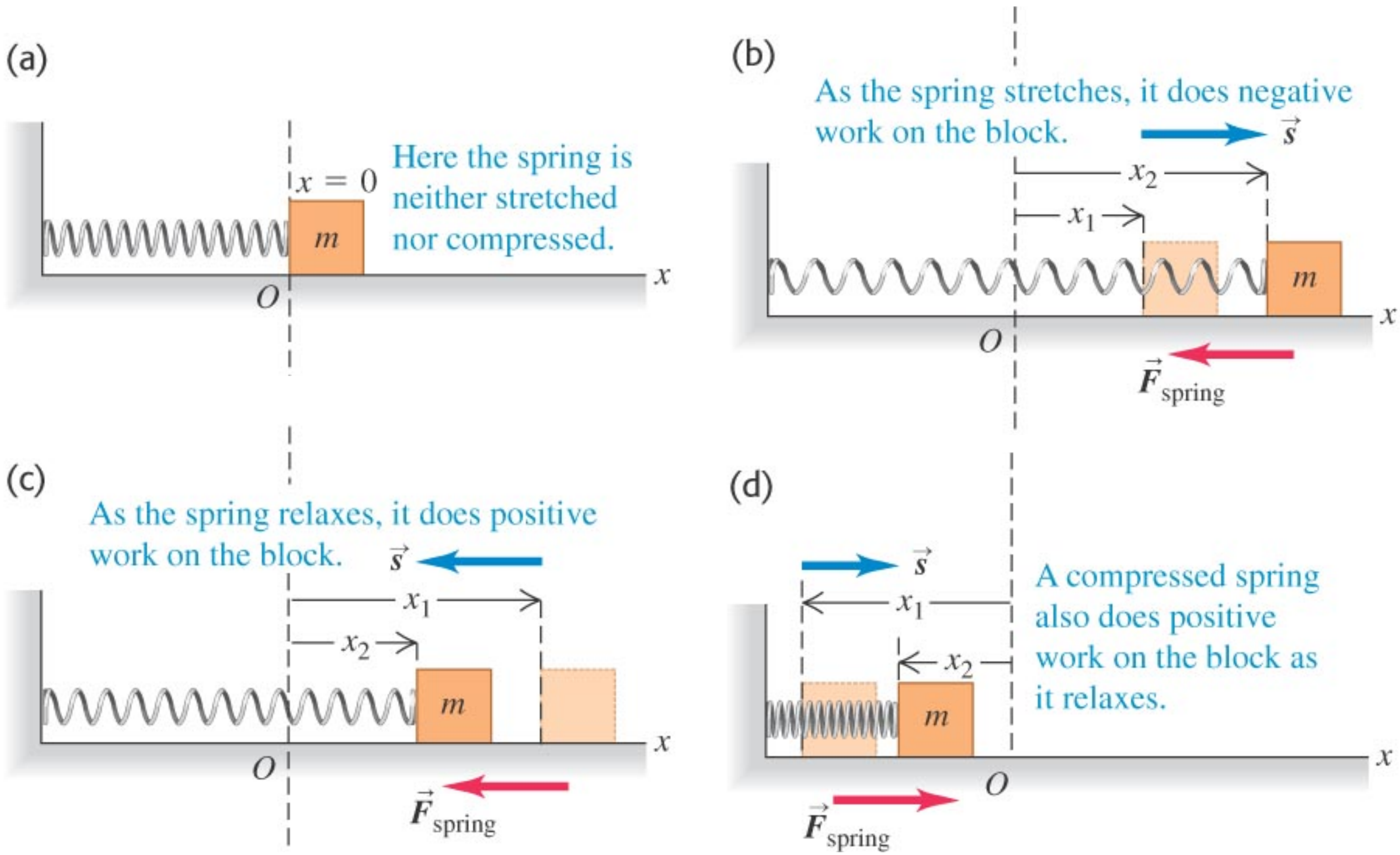
- To use gravitational potential energy in vertical motion
- To use elastic potential energy for a body attached to a spring
- To solve problems involving conservative and nonconservative forces
- To determine the properties of a conservative force from the corresponding potential-energy function
- To use energy diagrams for conservative forces

Elastic Potential Energy

$$U_{el} = \frac{1}{2}kx^2$$

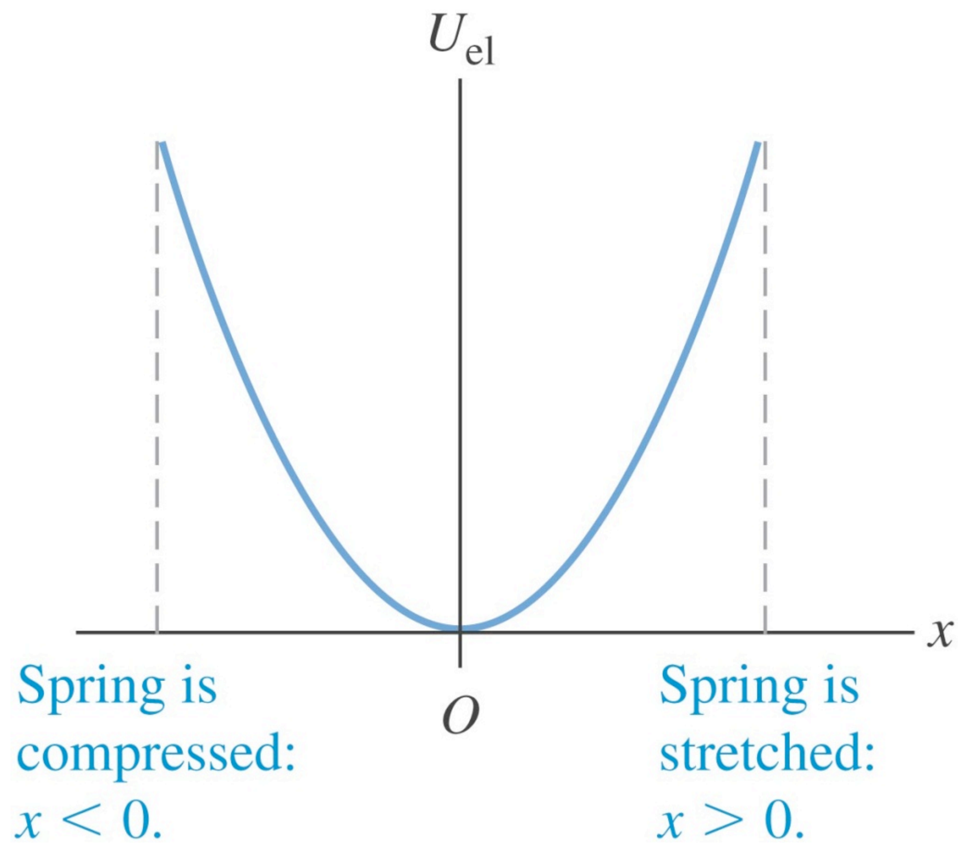
Work done by a spring

- Figure 7.13 below shows how a spring does work on a block as it is stretched and compressed.

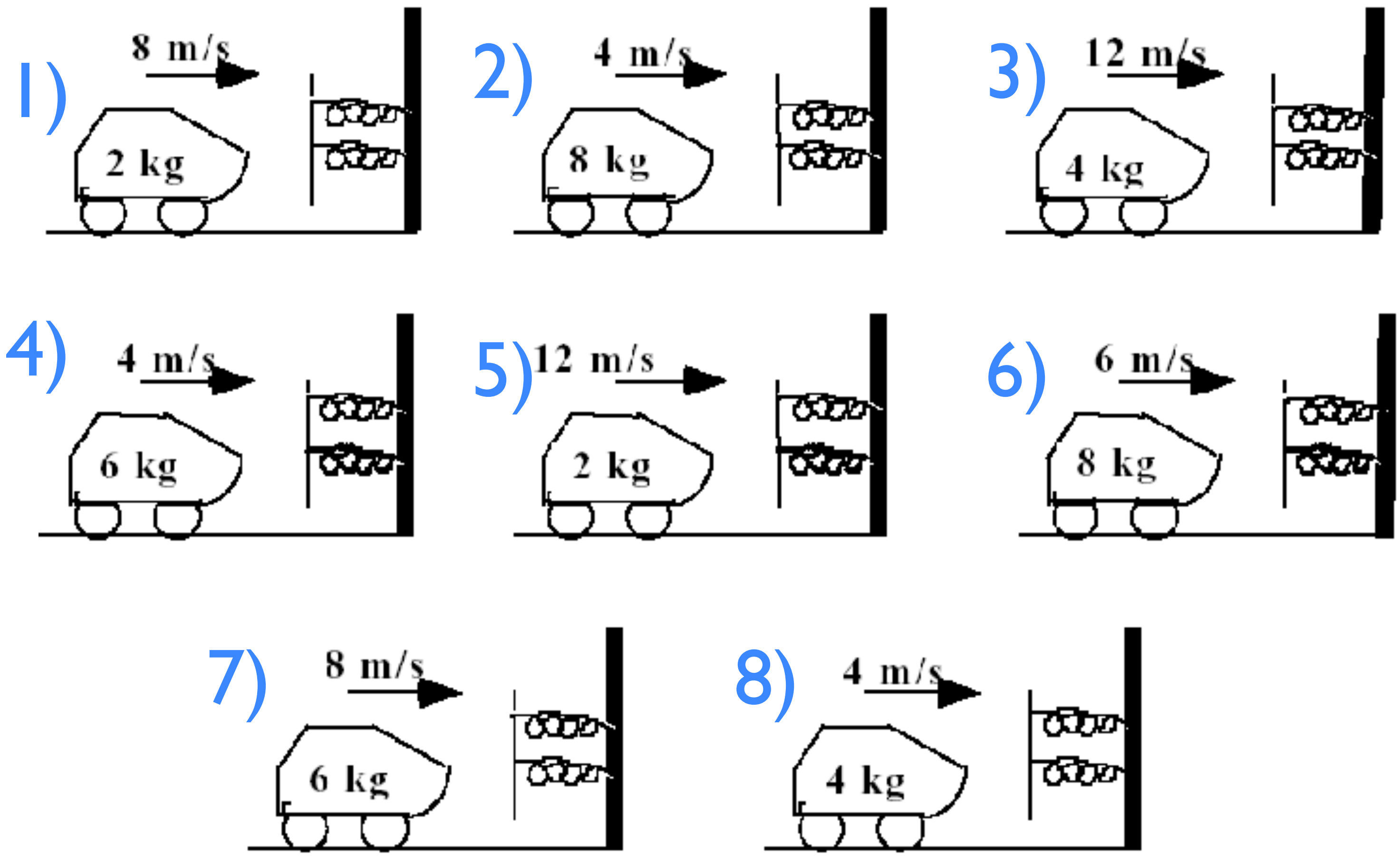


Elastic potential energy

- A body is *elastic* if it returns to its original shape after being deformed.
- *Elastic potential energy* is the energy stored in an elastic body, such as a spring.
- The elastic potential energy stored in an ideal spring is $U_{el} = 1/2\ kx^2$.
- Figure 7.14 at the right shows a graph of the elastic potential energy for an ideal spring.

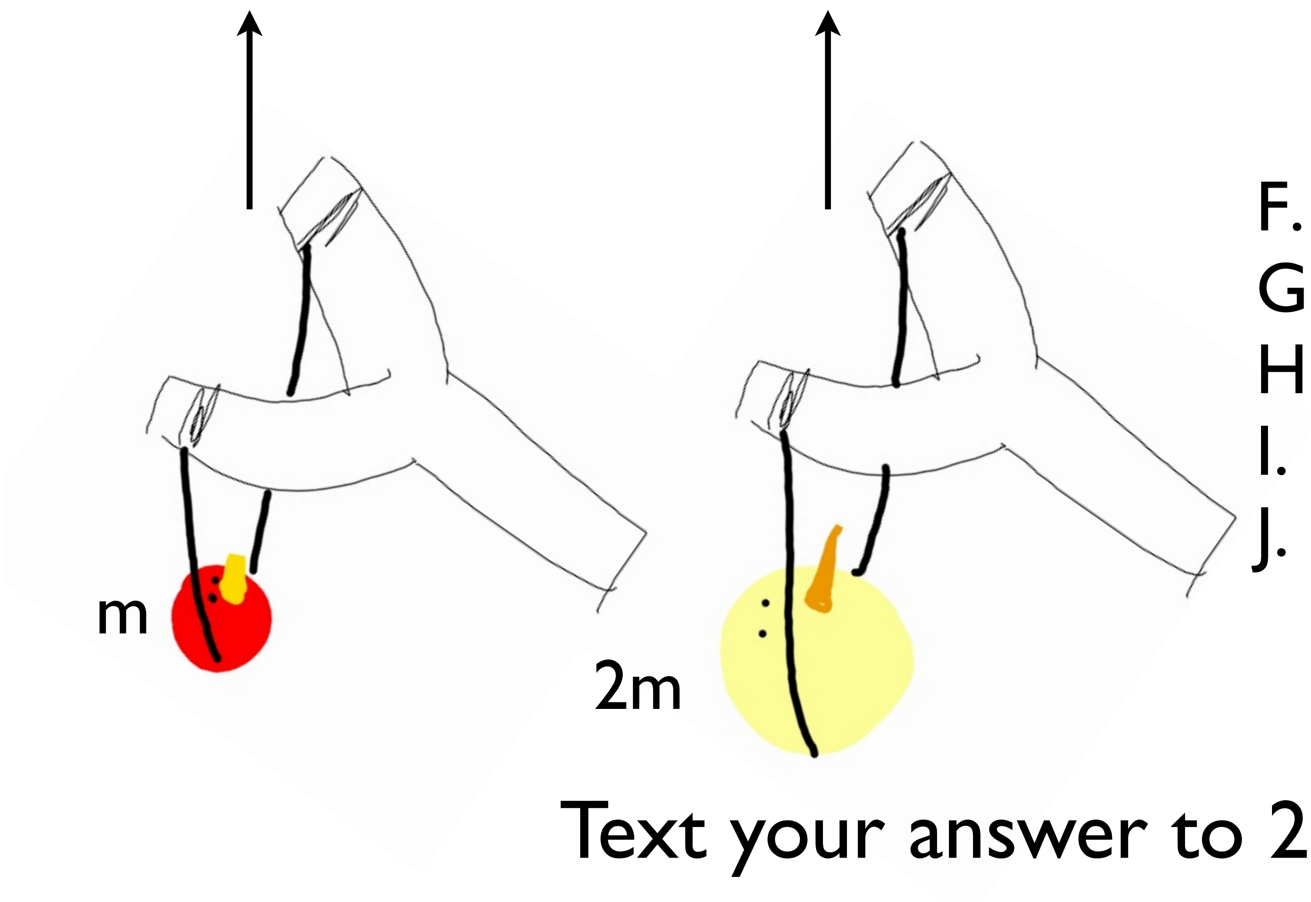


These cars are all brought to a halt by running into a barrier supported by a set of springs. The springs are all identical. Which car requires the greatest distance to stop?



Text the number of your answer to 22333

I use a slingshot to launch some stuffed animals. The slingshot acts like an ideal spring, obeying Hooke's law. It is stretched the same amount before launch. The yellow animal has twice the mass of the red one. How high does the yellow animal go compared to the red one?



F. 1/4 the height
G. half as high
H. the same height
I. twice as high
J. 4 times the height

Text your answer to 22333

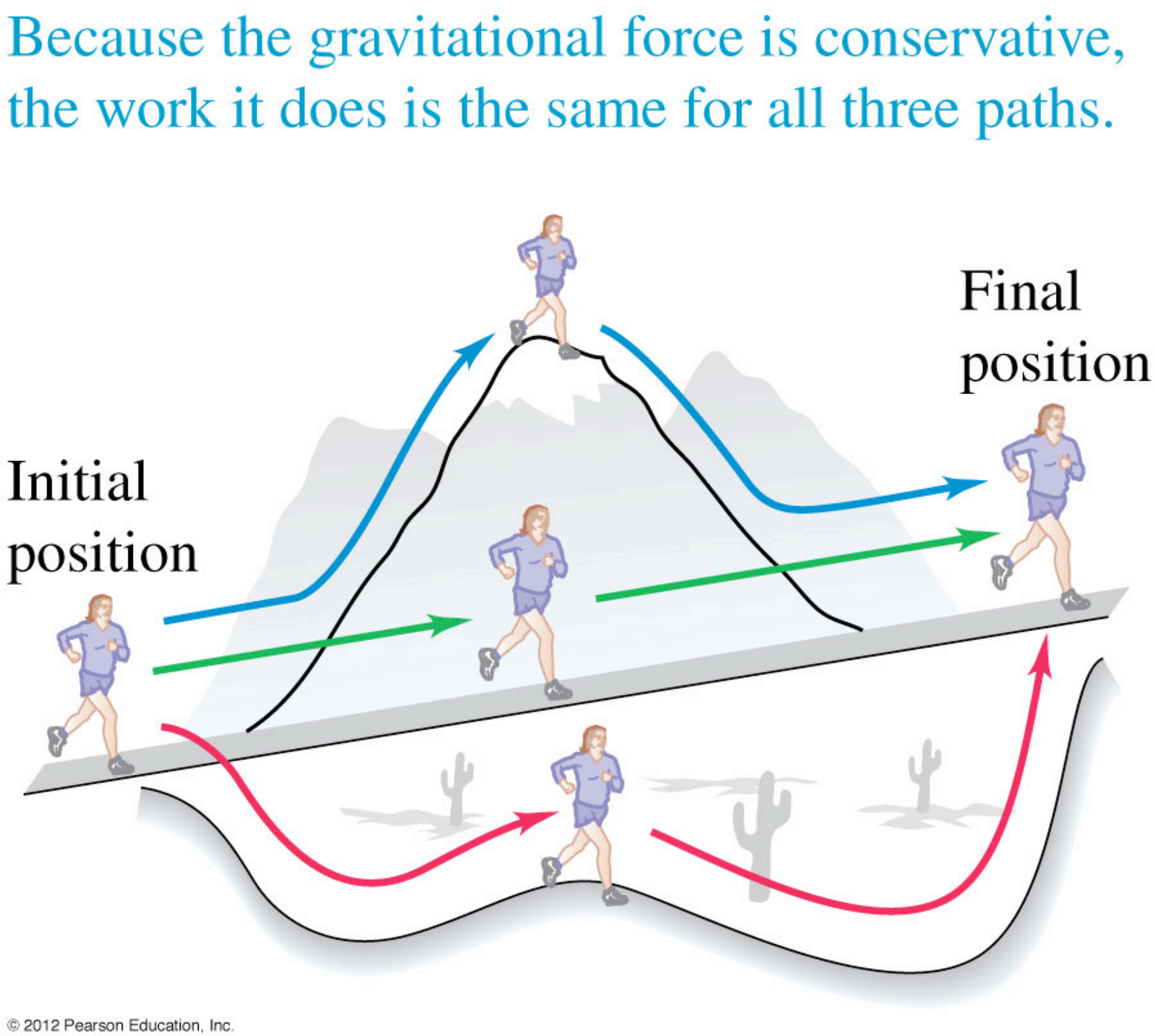
This time, I simply drop my stuffed animals straight down from the same height. How do the kinetic energies of the animals compare just before they hit the ground?

K. The yellow one has more kinetic energy
L. The red one has more kinetic energy
M. Both have the same kinetic energy
N. Need more information

Conservative Forces

- A **conservative force** allows conversion between kinetic and potential energy.
- Examples:
  - Gravity
  - Spring forces

Gravity is a conservative force



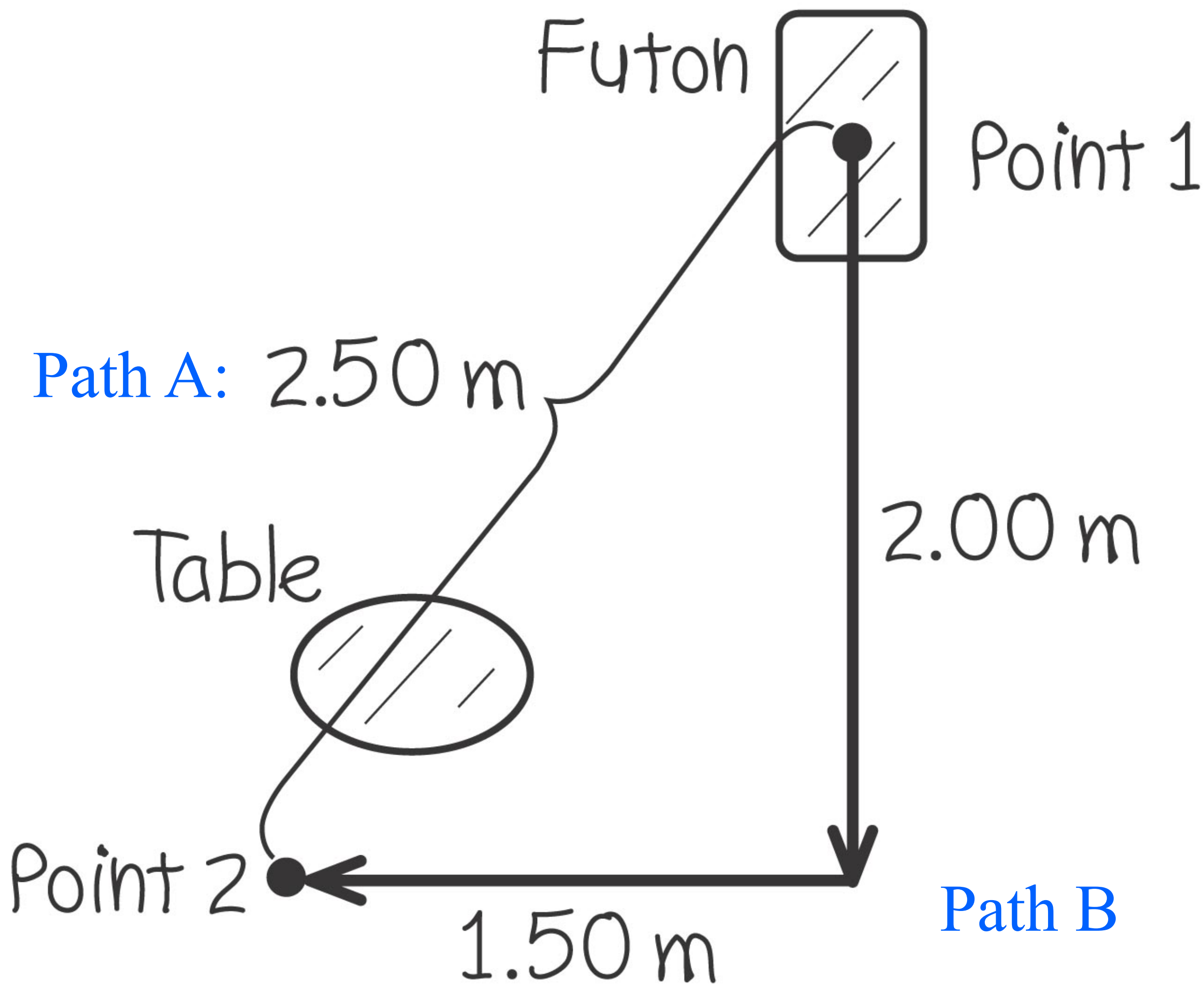
Conservative and nonconservative forces

- A *conservative force* allows conversion between kinetic and potential energy. Gravity and the spring force are conservative.
- The work done between two points by any conservative force
  - a) can be expressed in terms of a *potential energy function.*
  - b) is reversible.
  - c) is independent of the path between the two points.
  - d) is zero if the starting and ending points are the same.
- A force (such as friction) that is not conservative is called a *nonconservative force*, or a *dissipative force.*

Demo:
Skate park simulation
with friction

Frictional work depends on the path

- Which path takes more work in the absence of friction?
- When there is friction?



Conservation of energy

- Nonconservative forces do not store potential energy, but they do change the *internal energy* of a system.
- *The law of the conservation of energy* means that energy is never created or destroyed; it only changes form.
- This law can be expressed as

$$\Delta K + \Delta U + \Delta U_{\text{int}} = 0$$

kinetic energy

potential energy

$$\Delta K + \Delta U + \Delta U_{\mathrm{int}} = 0$$

internal energy (ex: heat)