You and your friend both solve a problem involving a skier going down a slope, starting from rest. The two of you have chosen different levels for \( y = 0 \) in this problem. Which of the following quantities will you and your friend agree on?

A) skier’s PE  
B) skier’s change in PE  
C) skier’s final KE

a) only B  
b) only C  
c) A, B, and C  
d) only A and C  
e) only B and C
Question 8.3  Up the Hill

Two paths lead to the top of a big hill. One is steep and direct, while the other is twice as long but less steep. How much more potential energy would you gain if you take the longer path?

a) the same  
b) twice as much  
c) four times as much  
d) half as much  
e) you gain no PE in either case
Question 8.4  Elastic Potential Energy

How does the work required to stretch a spring 2 cm compare with the work required to stretch it 1 cm?

a) same amount of work
b) twice the work
c) four times the work
d) eight times the work
A mass attached to a vertical spring causes the spring to stretch and the mass to move downwards. What can you say about the spring’s potential energy (PE$_s$) and the gravitational potential energy (PE$_g$) of the mass?

a) both PE$_s$ and PE$_g$ decrease
b) PE$_s$ increases and PE$_g$ decreases
c) both PE$_s$ and PE$_g$ increase
d) PE$_s$ decreases and PE$_g$ increases
e) PE$_s$ increases and PE$_g$ is constant
Three balls of equal mass start from rest and roll down different ramps. All ramps have the same height. Which ball has the greater speed at the bottom of its ramp?

- a)
- b)
- c)
- d) same speed for all balls
A truck, initially at rest, rolls down a frictionless hill and attains a speed of 20 m/s at the bottom. To achieve a speed of 40 m/s at the bottom, how many times higher must the hill be?

- a) half the height
- b) the same height
- c) \(\sqrt{2}\) times the height
- d) twice the height
- e) four times the height
A box sliding on a frictionless flat surface runs into a fixed spring, which compresses a distance $x$ to stop the box. If the initial speed of the box were doubled, how much would the spring compress in this case?

- a) half as much
- b) the same amount
- c) $\sqrt{2}$ times as much
- d) twice as much
- e) four times as much
Question 8.8a  Water Slide I

Paul and Kathleen start from rest at the same time on frictionless water slides with different shapes. At the bottom, whose velocity is greater?

a) Paul  
b) Kathleen  
c) both the same
Question 8.8b  Water Slide II

Paul and Kathleen start from rest at the same time on frictionless water slides with different shapes. Who makes it to the bottom first?

a) Paul  
b) Kathleen  
c) both the same
A cart starting from rest rolls down a hill and at the bottom has a speed of 4 m/s. If the cart were given an initial push, so its initial speed at the top of the hill was 3 m/s, what would be its speed at the bottom?

a) 4 m/s  
b) 5 m/s  
c) 6 m/s  
d) 7 m/s  
e) 25 m/s
Question 8.10a  Falling Leaves

You see a leaf falling to the ground with constant speed. When you first notice it, the leaf has initial total energy $\text{PE}_i + \text{KE}_i$. You watch the leaf until just before it hits the ground, at which point it has final total energy $\text{PE}_f + \text{KE}_f$. How do these total energies compare?

a) $\text{PE}_i + \text{KE}_i > \text{PE}_f + \text{KE}_f$
b) $\text{PE}_i + \text{KE}_i = \text{PE}_f + \text{KE}_f$
c) $\text{PE}_i + \text{KE}_i < \text{PE}_f + \text{KE}_f$
d) impossible to tell from the information provided
You throw a ball straight up into the air. In addition to *gravity*, the ball feels a force due to *air resistance*. Compared to the time it takes the ball to go up, the time it takes to come back down is:

- a) smaller
- b) the same
- c) greater