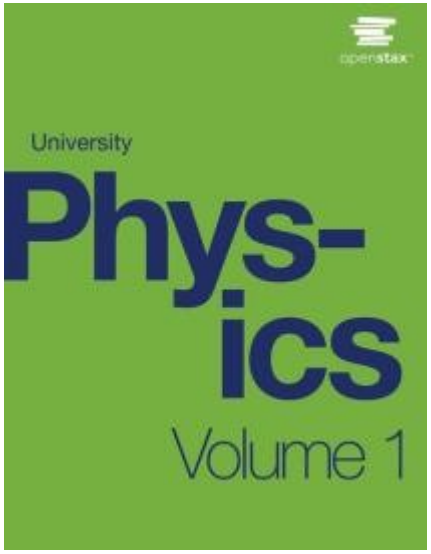
UNIVERSITY PHYSICS

Chapter 8 POTENTIAL ENERGY AND CONSERVATION OF ENERGY

PowerPoint Image Slideshow



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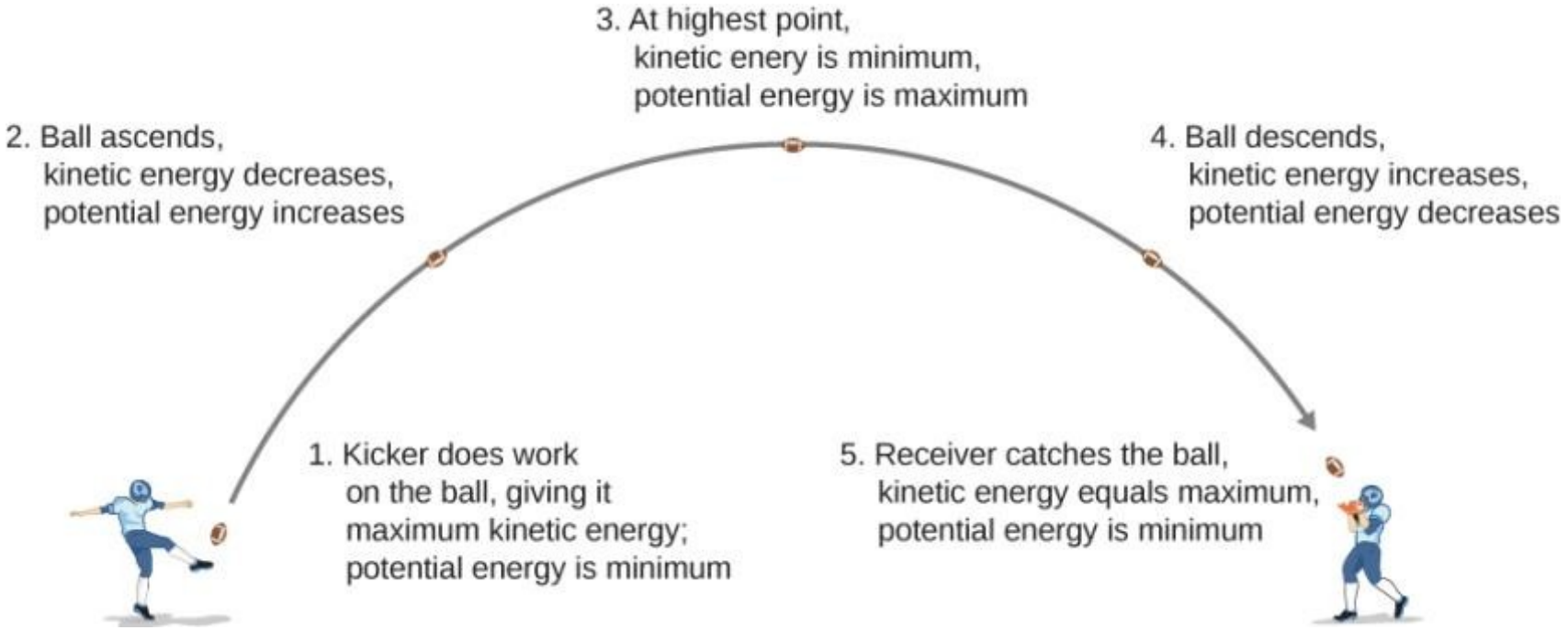
What is potential energy?

FIGURE 8.2



As a football starts its descent toward the wide receiver, gravitational potential energy is converted back into kinetic energy.

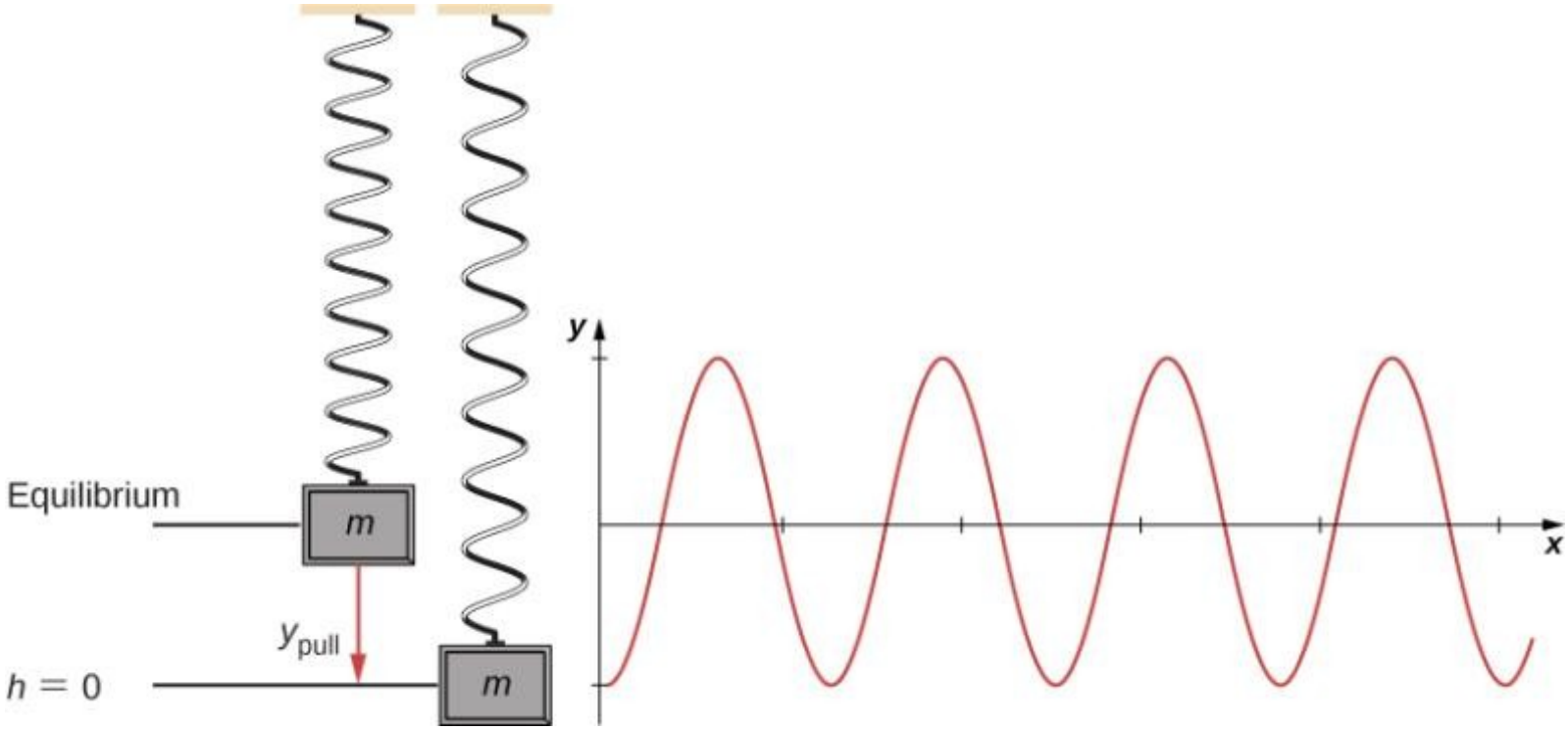
FIGURE 8.5

A bungee jumper transforms gravitational potential energy at the start of the jump into elastic potential energy at the bottom of the jump.

FIGURE 8.3

Sketch of the profile of Great Blue Hill, Milton, MA. The altitudes of the three levels are indicated.

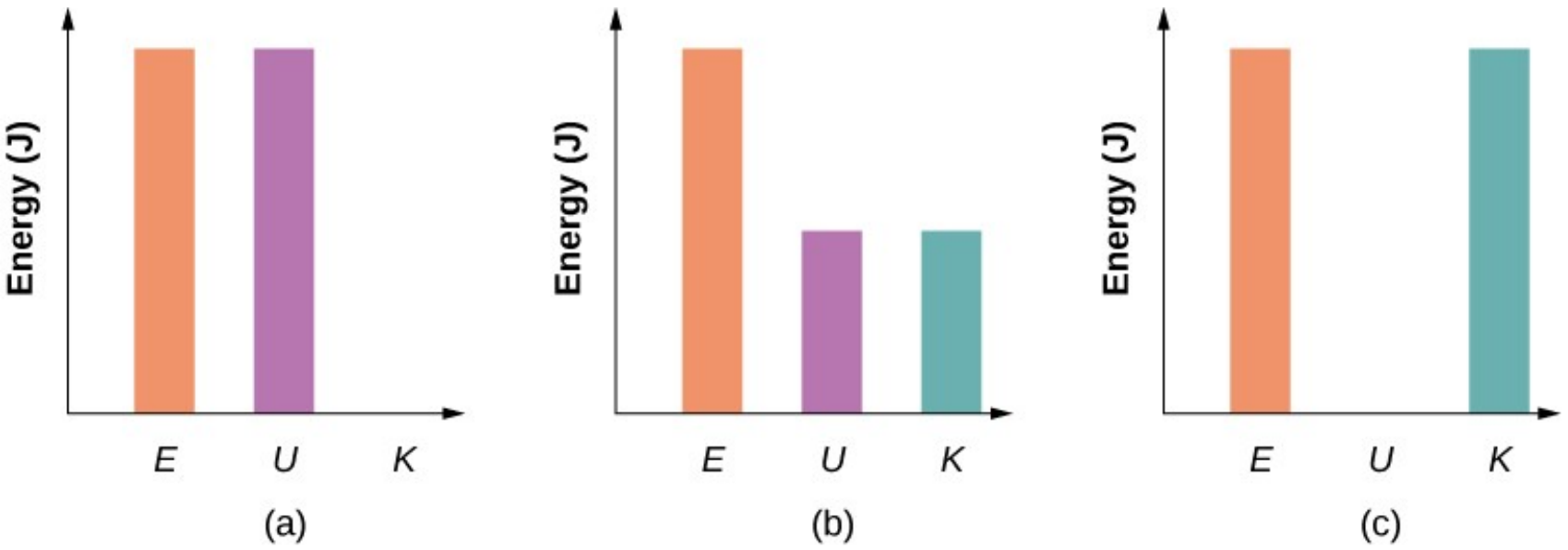
FIGURE 8.4



A vertical mass-spring system, with the *y*-axis pointing upward. The mass is initially at an equilibrium position and pulled downward to y_{pull}. An oscillation begins, centered at the equilibrium position.

Conservative vs non-conservative forces

FIGURE 8.8



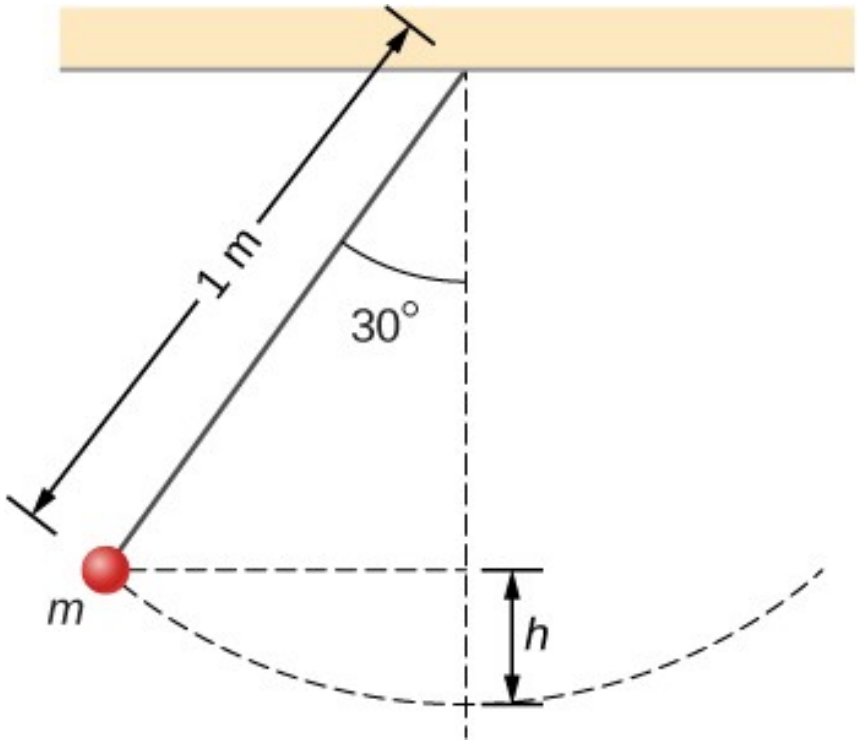
Bar graphs representing the total energy (*E*), potential energy (*U*), and kinetic energy (*K*) of the particle in different positions.

(a) The total energy of the system equals the potential energy and the kinetic energy is zero, which is found at the highest point the particle reaches.

(b) The particle is midway between the highest and lowest point, so the kinetic energy plus potential energy bar graphs equal the total energy.

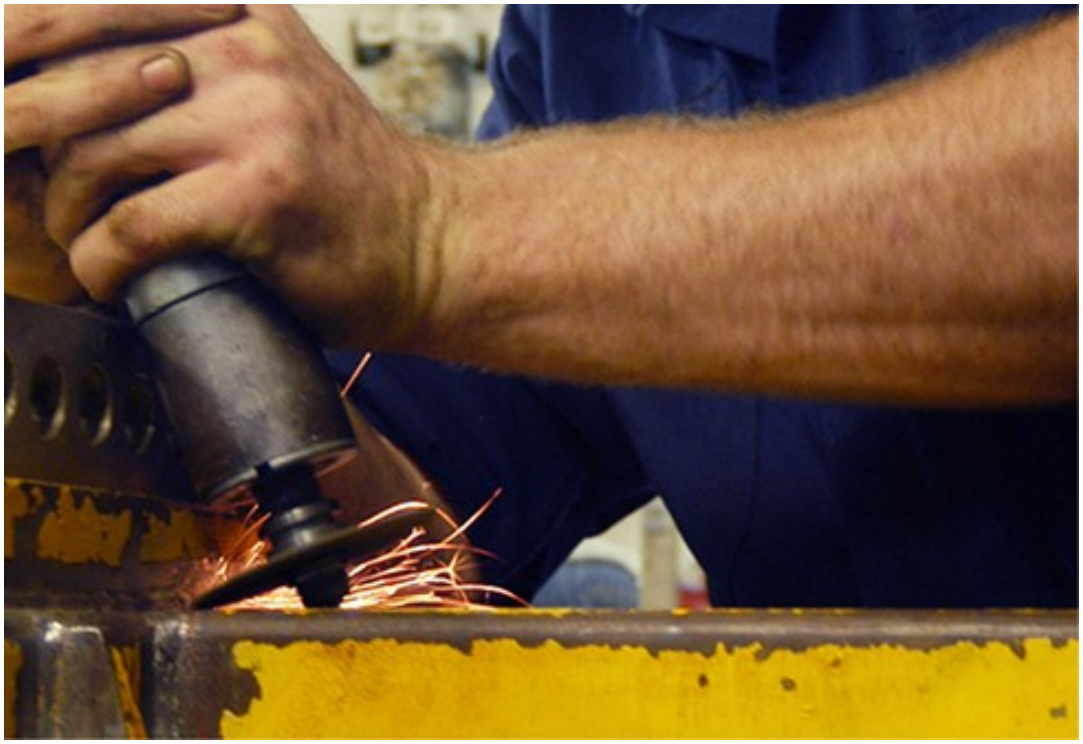
(c) The particle is at the lowest point of the swing, so the kinetic energy bar graph is the highest and equal to the total energy of the system.

FIGURE 8.7



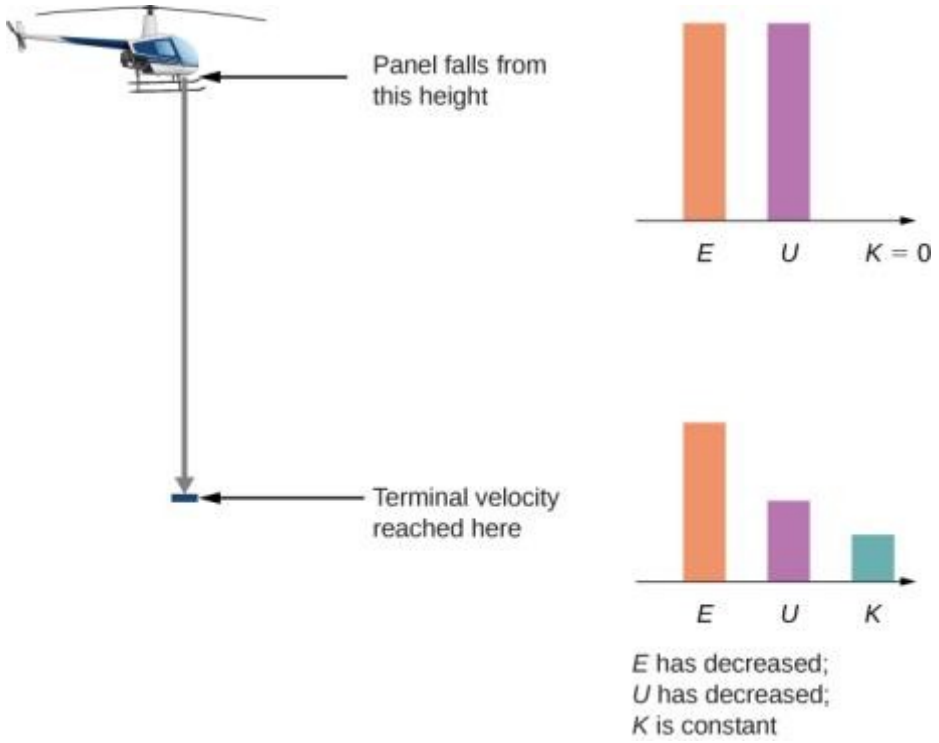
A particle hung from a string constitutes a simple pendulum. It is shown when released from rest, along with some distances used in analyzing the motion.

FIGURE 8.6



A grinding wheel applies a non-conservative force, because the work done depends on how many rotations the wheel makes, so it is path-dependent.

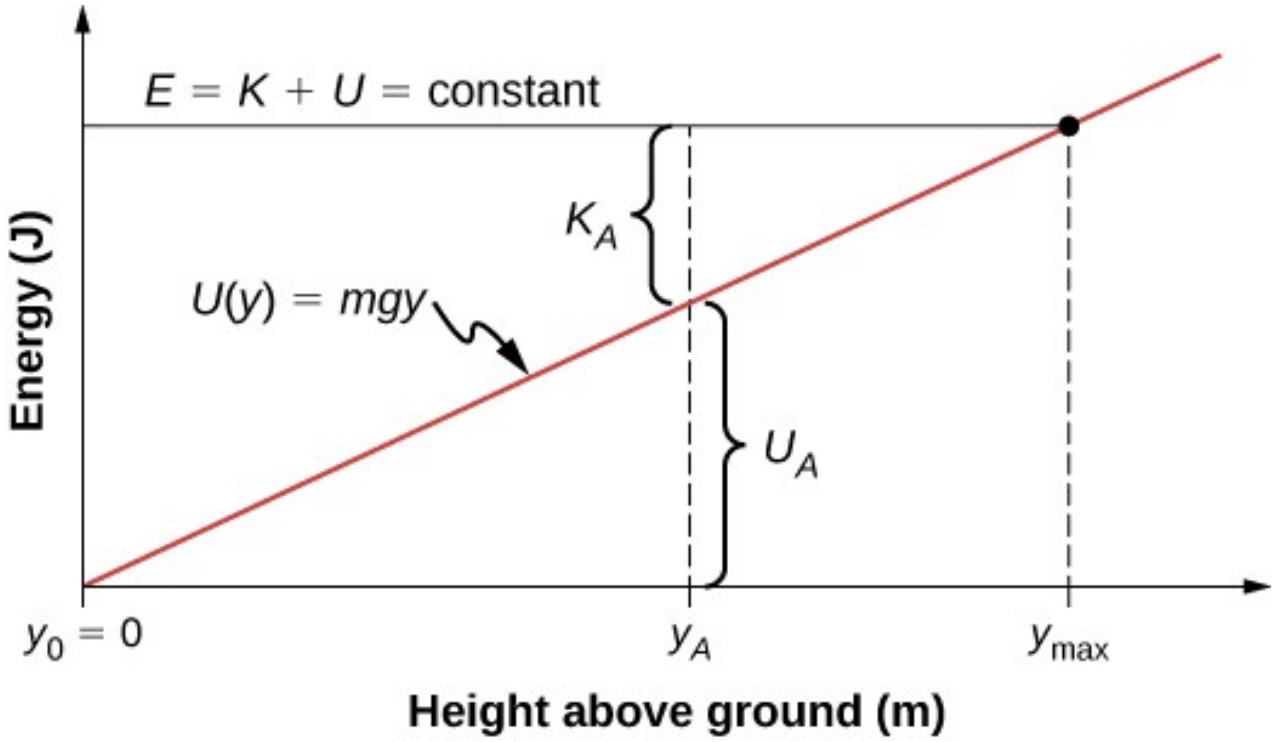
FIGURE 8.9



A helicopter loses a panel that falls until it reaches terminal velocity of 45 m/s. How much did air resistance contribute to the dissipation of energy in this problem?

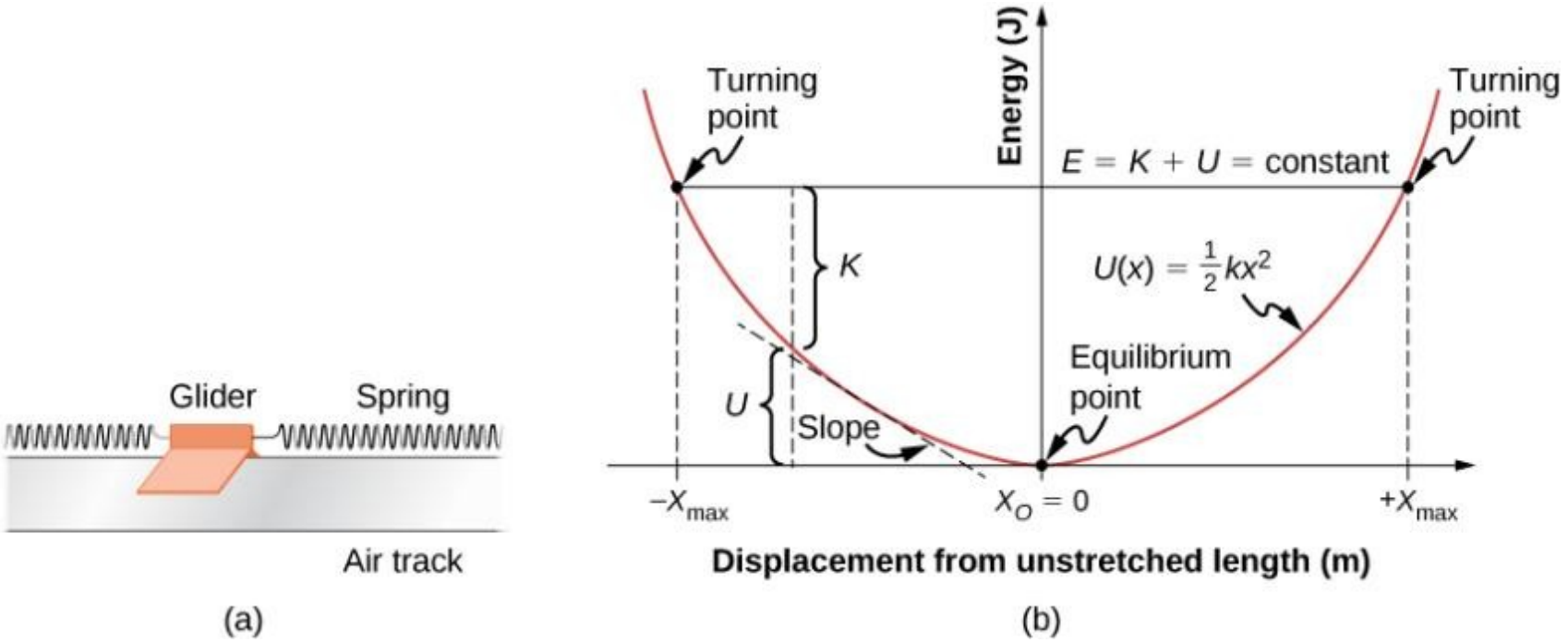
Types of potential energy

FIGURE 8.10



The potential energy graph for an object in vertical free fall, with various quantities indicated.

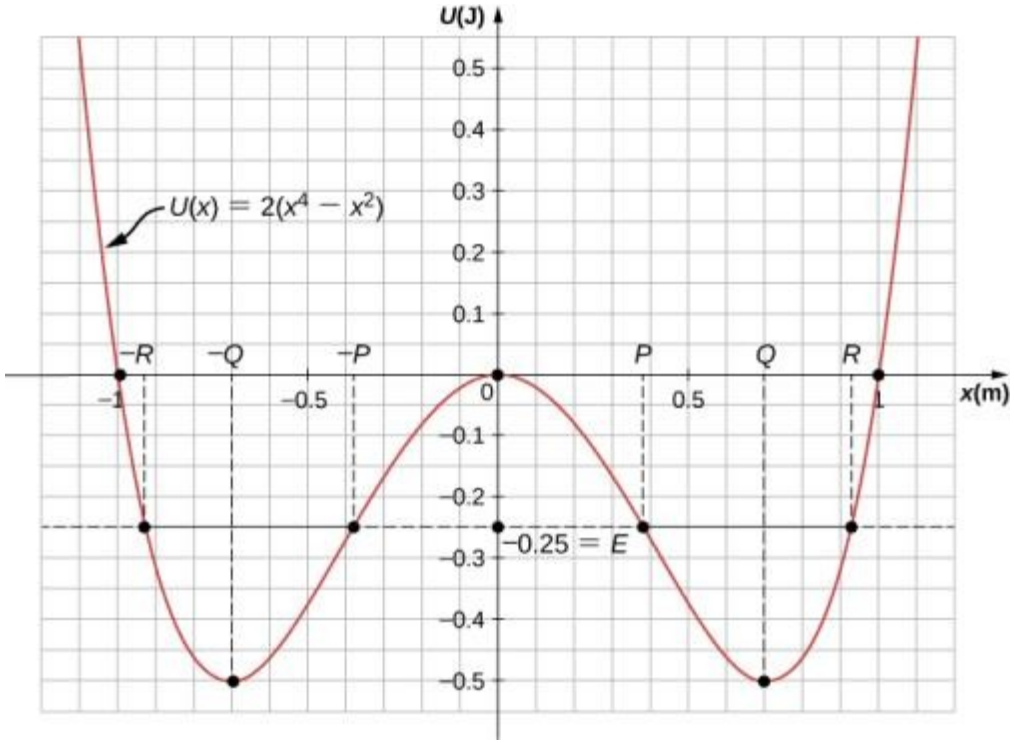
FIGURE 8.11



(a) A glider between springs on an air track is an example of a horizontal mass-spring system.

(b) The potential energy diagram for this system, with various quantities indicated.

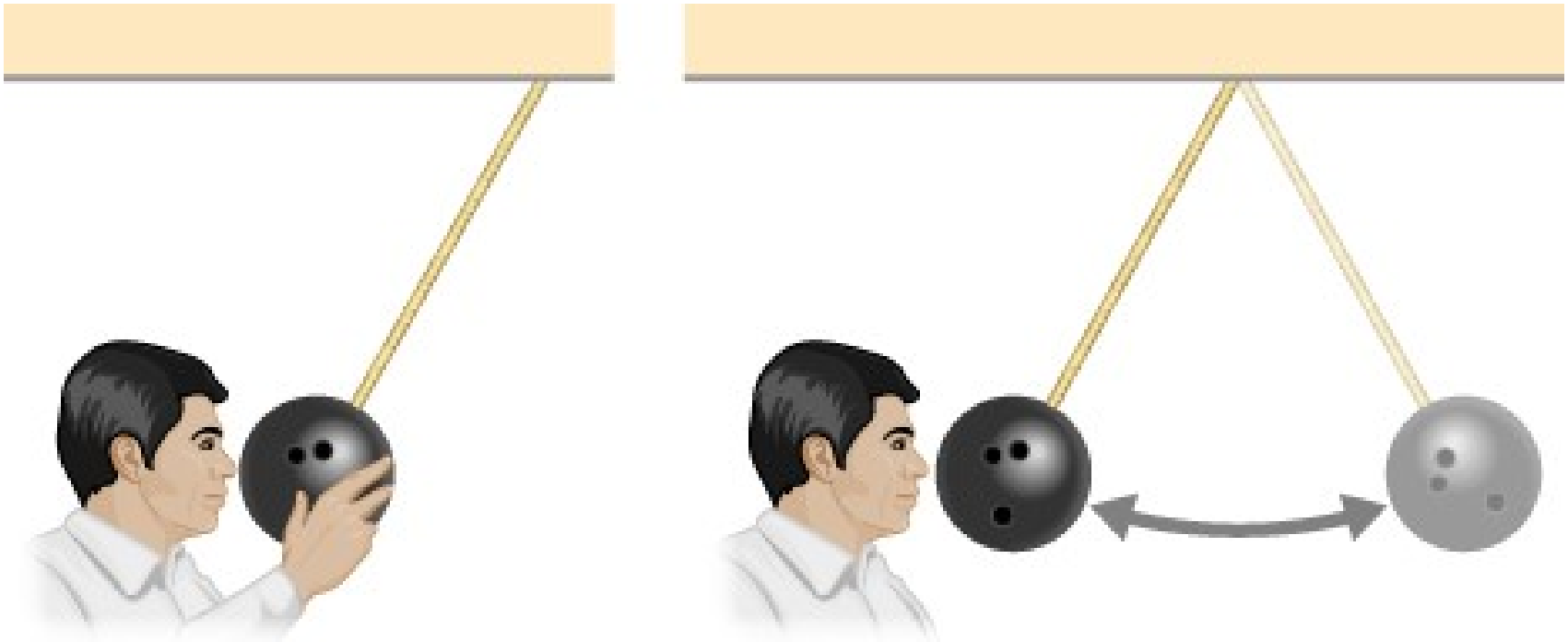
FIGURE 8.12



The potential energy graph for a one-dimensional, quartic and quadratic potential energy, with various quantities indicated.

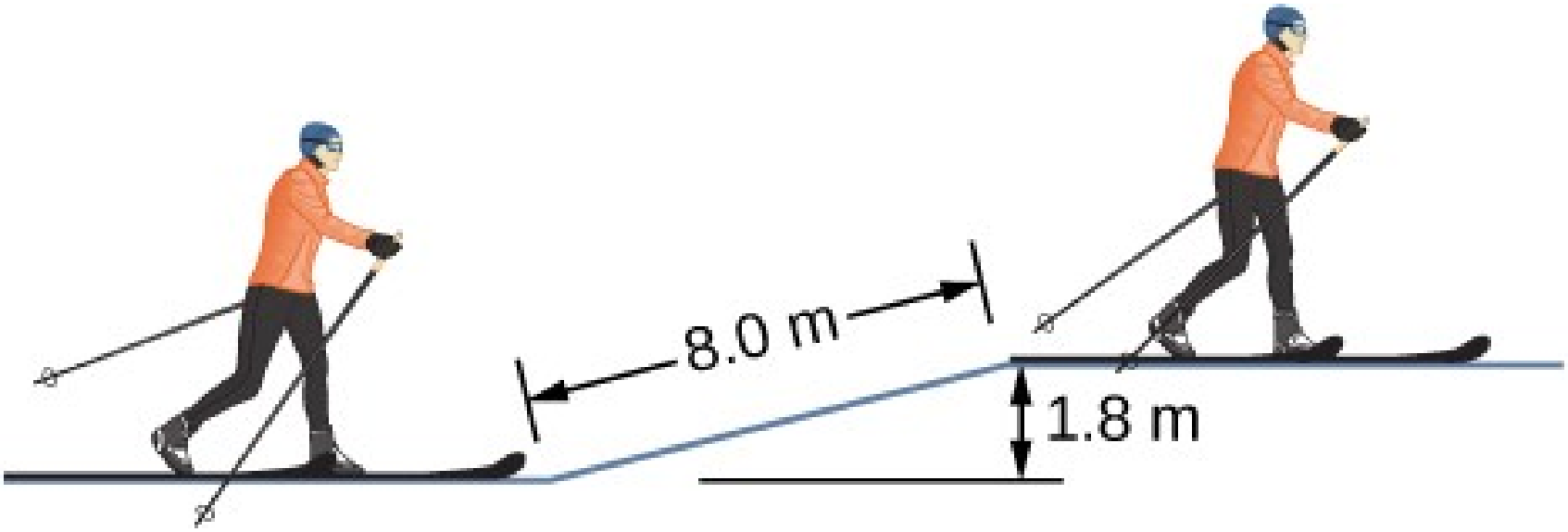
Examples

EXERCISE 14



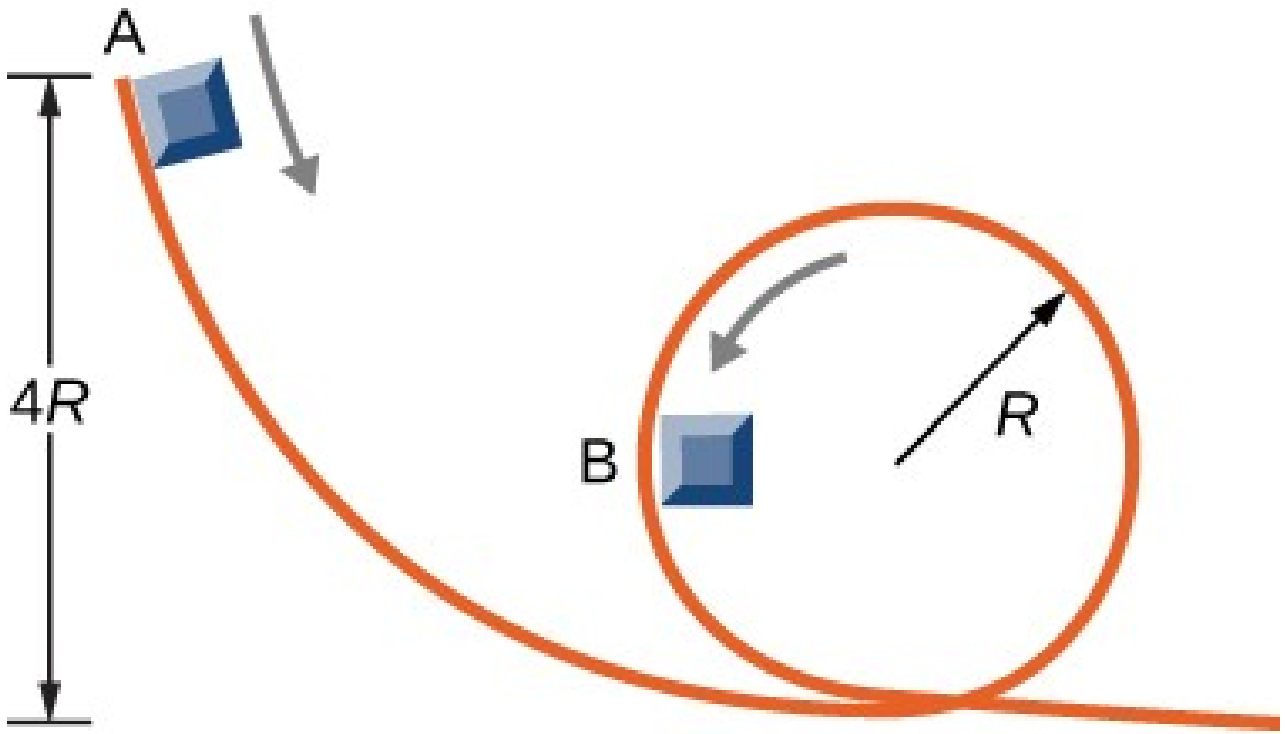
In a common physics demonstration, a bowling ball is suspended from the ceiling by a rope. The professor pulls the ball away from its equilibrium position and holds it adjacent to his nose, as shown below. He releases the ball so that it swings directly away from him. Does he get struck by the ball on its return swing? What is he trying to show in this demonstration?

EXERCISE 38



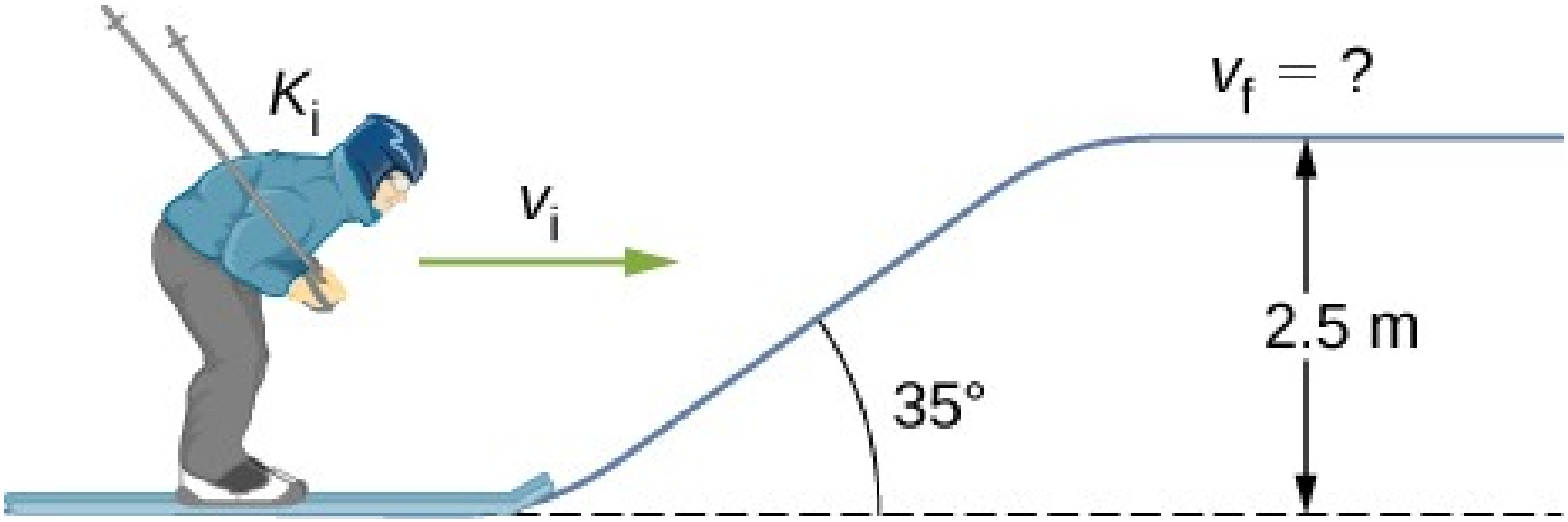
A man is skiing across level ground at a speed of when he comes to the small slope 1.8 m higher than ground level shown in the following figure. (a) If the skier coasts up the hill, what is his speed when he reaches the top plateau? Assume friction between the snow and skis is negligible. (b) What is his speed when he reaches the upper level if a frictional force acts on the skis?

EXERCISE 42



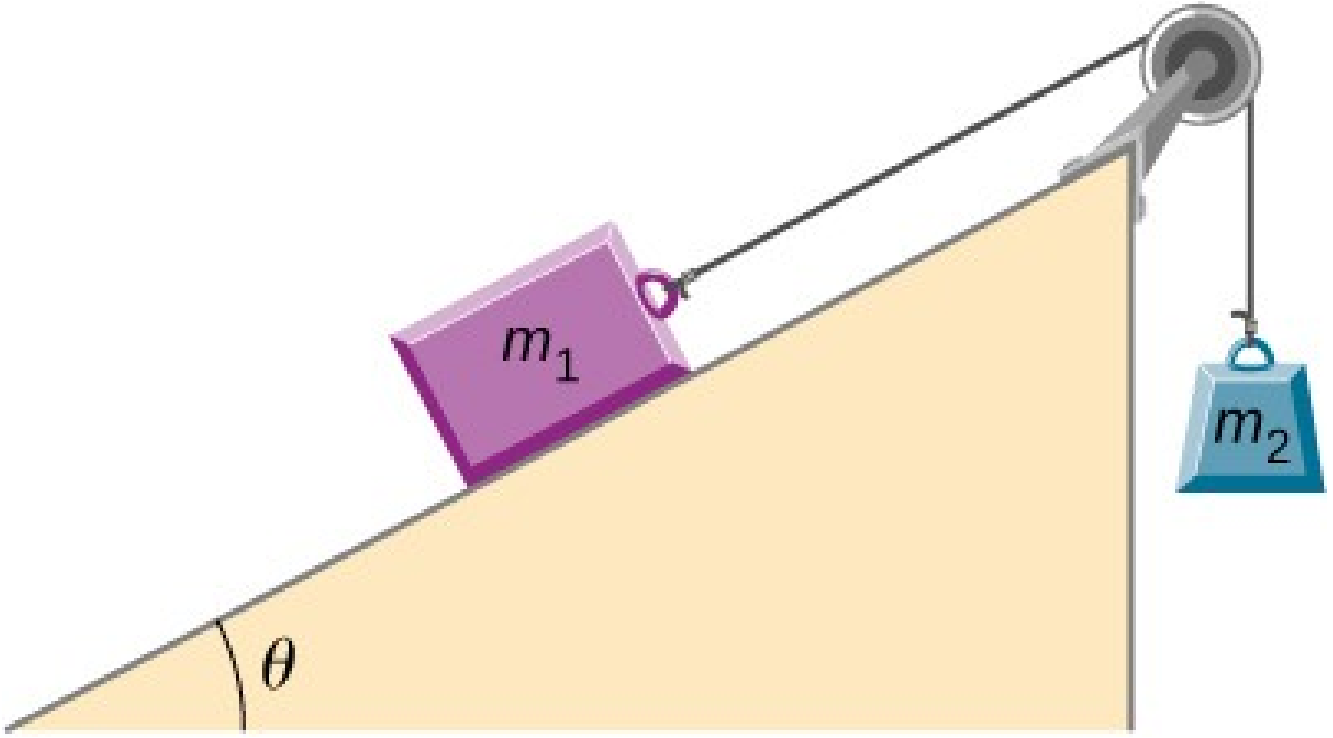
A small block of mass *m* slides without friction around the loop-the-loop apparatus shown below. (a) If the block starts from rest at *A*, what is its speed at *B*? (b) What is the force of the track on the block at *B*?

EXERCISE 60



A skier with an initial speed of v0 coasts up a h high rise as shown. Find her final speed at the top, given that the coefficient of friction between her skis and the snow is mu_k.

EXERCISE 68



(a) What is the initial gravitational potential energy of the system? (b) What is the final kinetic energy of the system?