10.1 POTENTIAL ENERGY AND THE WORK DONE BY CONSERVATIVE FORCES

1. As an Acapulco cliff diver drops to the water from a height of 46 m, his gravitational potential energy decreases by 25,000 J. What is the diver's weight in newtons?
2. Find the gravitational potential energy of an 83-kg person standing atop Mt. Everest at an altitude of 8848 m. Use sea level as the location for y = 0.
3. A vertical spring stores 0.962 J in spring potential energy when a 3.0-kg mass is suspended from it. **(a)** By what multiplicative factor does the spring potential energy change if the mass attached to the spring is doubled? **(b)** Verify your answer to part (a) by calculating the spring potential energy when a 6.0-kg mass is attached to the spring.
4. A force of 4.7 N is required to stretch a certain spring by 1.3 cm. (a) How far must this spring be stretched for its potential energy to be 0.020 J? (b) How much stretch is required for the spring potential energy to be 0.080 J?
5. A 0.33-kg pendulum bob is attached to a string 1.2 m long. What is the change in the gravitational potential energy of the system as the bob swings from point A to point B in **Figure 8–22**?
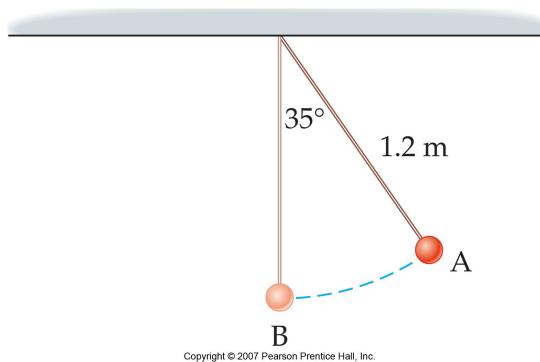
Figure 8–22

10.2 CONSERVATION OF ENERGY

6. At an amusement park, a swimmer uses a water slide to enter the main pool. If the swimmer starts at rest, slides without friction, and descends through a vertical height of 2.61 m, what is her speed at the bottom of the slide?
7. In the previous problem, find the swimmer's speed at the bottom of the slide if she starts with an initial speed of 0.840 m/s.
8. A 2.7-kg block slides with a speed of 1.4 m/s on a frictionless horizontal surface until it encounters a spring. **(a)** If the block compresses the spring 4.8 cm before coming to rest, what is the force constant of the spring? **(b)** What initial speed should the block have to compress the spring by 1.2 cm?
9. A 0.26-kg rock is thrown vertically upward from the top of a cliff that is 32 m high. When it hits the ground at the base of the cliff, the rock has a speed of 29 m/s. Assuming that air resistance can be ignored, find **(a)** the initial speed of the rock and **(b)** the greatest height of the rock as measured from the base of the cliff.

10. Suppose the pendulum bob in **Figure 8–22** (above) has a mass of 0.33 kg and is moving to the right at point B with a speed of 2.4 m/s. Air resistance is negligible. **(a)** What is the change in the system's gravitational potential energy when the bob reaches point A? **(b)** What is the speed of the bob at point A? **(c)** If the mass of the bob is increased, does your answer to part (a) increase, decrease, or stay the same? Explain. **(d)** If the mass of the bob is increased, does your answer to part (b) increase, decrease, or stay the same? Explain.

10.3 WORK DONE BY NONCONSERVATIVE FORCES

11. Catching a wave, a 72-kg surfer starts with a speed of 1.3 m/s, drops through a height of 1.75 m, and ends with a speed of 8.2 m/s. How much nonconservative work was done on the surfer?
12. At a playground, a 19-kg child plays on a slide that drops through a height of 2.1 m. The child starts at rest at the top of the slide. On the way down, the slide does a nonconservative work of -361 J on the child. What is the child's speed at the bottom of the slide?
13. A 42.0-kg seal at an amusement park slides from rest down a ramp into the pool below. The top of the ramp is 1.75 m higher than the surface of the water and the ramp is inclined at an angle of 35.0° above the horizontal. If the seal reaches the water with a speed of 4.40 m/s, what is **(a)** the work done by kinetic friction and **(b)** the coefficient of kinetic friction between the seal and the ramp?
14. A 15,800-kg truck is moving at 12.0 m/s when it starts down a 6.00° incline in the Canadian Rockies. At the start of the descent the driver notices that the altitude is 1630 m. When she reaches an altitude of 1440 m, her speed is 29.0 m/s. Find the change in **(a)** the gravitational potential energy of the system and **(b)** the truck's kinetic energy. **(c)** Is the total mechanical energy of the system conserved? Explain.
15. A 1.80-kg block slides on a rough horizontal surface. The block hits a spring with a speed of 2.00 m/s and compresses it a distance of 11.0 cm before coming to rest. If the coefficient of kinetic friction between the block and the surface is μ_k = 0.560 what is the force constant of the spring?