- For material covering Ch. 7 (skipping Sect. 7-4 thru 7-6) and Ch. 8 (skipping Sect. 8-3 thru 8-4)
- Due Friday, Oct. 10 at 5 pm

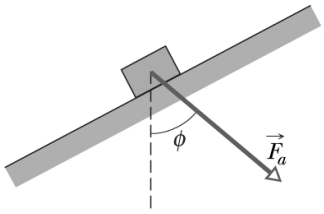
Ch. 7

1. A father racing his son has 1/2 the kinetic energy of the son, who has 1/2 the mass of the father. The father speeds up by 1.4 m/s and then has the same kinetic energy as the son. What are the original speeds of **(a)** the father and **(b)** the son? [Answer: **(a)** 3.4 m/s; **(b)** 6.8 m/s].

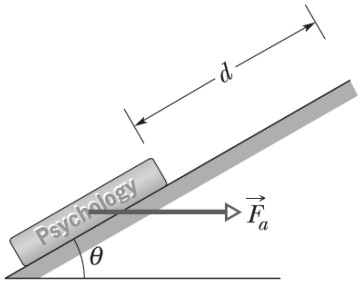
2. A helicopter lifts a 81-kg astronaut 18 m vertically from the ocean by means of a cable. The acceleration of the astronaut is g/14. How much work is done on the astronaut by **(a)** the force from the helicopter and **(b)** the gravitational force on her? Just before she reaches the helicopter, what are her **(c)** kinetic energy and **(d)** speed? [Answer: **(a)** 15 kJ; **(b)** -14 kJ; **(c)** 1.0 kJ; **(d)** 5.0 m/s].

3. A cave rescue team lifts an injured spelunker directly upward and out of a sinkhole by means of a motor-driven cable. The lift is performed in three stages, each requiring a vertical distance of 12.0 m: **(a)** the initially stationary spelunker is accelerated to a speed of 2.00 m/s; **(b)** he is then lifted at the constant speed of 2.00 m/s; **(c)** finally he is decelerated to zero speed. How much work is done on the 57.0 kg rescue by the force lifting him during each stage? [Answer: **(a)** 6.82 kJ; **(b)** 6.70 kJ; **(c)** 6.59 kJ].

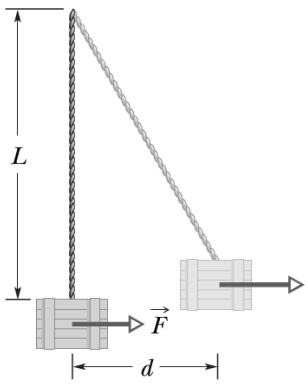
4. A constant force $\vec{F}_a$ of magnitude 83.0 N is applied to a 3.0 kg shoe box at angle φ = 56.0°, causing the box to move up a frictionless ramp at constant speed. How much work is done on the box by $\vec{F}_a$ when the box has moved through vertical distance h = 0.35 m? [Answer: 10.3 J].



5. A horizontal force $\vec{F}_a$ of magnitude 21.0 N is applied to a 3.12 kg book as the book slides a distance d = 0.64 m up a frictionless ramp at angle θ = 30°. **(a)** During the displacement, what is the net work done on the book by $\vec{F}_a$, the gravitational force on the book, and the normal force on the book? **(b)** If the book has zero kinetic energy at the start of the displacement, what is its speed at the end of the displacement? [Answer: **(a)** 1.86 J; **(b)** 1.09 m/s].

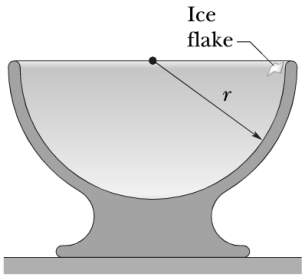


6. A 233 kg crate hangs from the end of a rope of length L = 14.5 m. You push horizontally on the crate with a varying force $\vec{F}$ to move it distance d = 4.95 m to the side. **(a)** What is the magnitude of $\vec{F}$ when the crate is in this final position? During the crate's displacement, what are **(b)** the total work done on it, **(c)** the work done by the gravitational force on the crate, and **(d)** the work done by the pull on the crate from the rope? **(e)** Knowing that the crate is motionless before and after its displacement, use the answers to **(b)**, **(c)**, and **(d)** to find the work your force $\vec{F}$ does on the crate. [Answer: **(a)** 829 N; **(b)** 0 J; **(c)** -1.99 kJ; **(d)** 0 J; **(d)** 1.99 kJ].

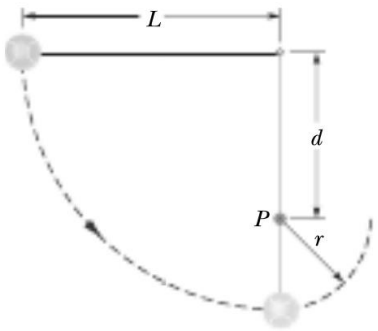


Ch. 8

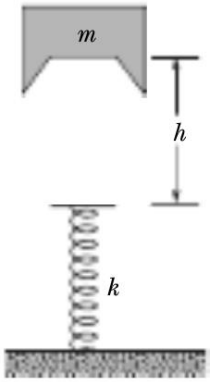
7. A 1.50 g ice flake is released from the edge of a hemispherical bowl whose radius r is 34.7 cm. The flake-bowl contact is frictionless. **(a)** How much work is done on the flake by the gravitational force during the flake's descent to the bottom of the bowl? **(b)** What is the change in the potential energy of the flake-Earth system during that descent? **(c)** If that potential energy is taken to be zero at the bottom of the bowl, what is its value when the flake is released? **(d)** If, instead, the potential energy is taken to be zero at the release point, what is its value when the flake reaches the bottom of the bowl? [Answer: **(a)** 5.10 mJ; **(b)** -5.10 mJ; **(c)** 5.10 mJ; **(d)** -5.10 mJ].



8. The string in the figure is L = 118 cm long, has a ball attached to one end, and is fixed at its other end. The distance d from the fixed end to a fixed peg at point P is 71 cm. When the initially stationary ball is released with the string horizontal as shown, it will swing along the dashed arc. What is its speed when it reaches **(a)** its lowest point and **(b)** its highest point after the string catches on the peg? [Answer: **(a)** 4.81 m/s; **(b)** 2.17 m/s].



9. A block of mass m = 2.7 kg is dropped from height h = 91 cm onto a spring of spring constant k = 2080 N/m. Find the maximum distance the spring is compressed. [Answer: 16.5 cm].



10. In the figure below, a block slides along a track from one level to a higher level after passing through an intermediate valley. The track is frictionless until the block reaches the higher level. There a frictional force stops the block in a distance d. The block's initial speed is v_0; the height difference is h and the coefficient of kinetic friction is μ_k. Find d in terms of the given variables (use g where applicable). [Answer: $\frac{v_0^2}{2g\mu_k} - \frac{h}{\mu_k}$].