• **10–48** A small block of mass 0.400 kg is attached to a cord passing through a hole in a frictionless horizontal surface (see Fig. 10–35). The block is originally revolving in a circle with a radius of 0.500 m about the hole with a tangential speed of 4.00 m/s. The cord is then pulled slowly from below, shortening the radius of the circle in which the block revolves. The breaking strength of the cord is 60.0 N. What is the radius of the circle when the cord breaks?

10–27 A solid wood door 1.00 m wide and 2.00 m high is hinged along one side and has a total mass of 50.0 kg. Initially open and at rest, the door is struck at its center by a handful of sticky mud of mass 0.500 kg, traveling 8.00 m/s just before impact. Find the final angular velocity of the door. Is the moment of inertia of the mud significant?

51E. A man stands on a frictionless platform that is rotating with an angular speed of 1.2 rev/s; his arms are outstretched and he holds a weight in each hand. With his hands in this position the rotational inertia of the system of man, weights, and platform is 6.0 kg·m². If by moving the weights the man decreases the rotational inertia of the system to 2.0 kg·m², (a) what is the resulting angular speed of the platform and (~~b) what is the ratio of the new kinetic energy of the system to the original kinetic energy?~~ (c) ~~What provided the added kinetic energy~~?

• 55E. Suppose that the sun runs out of nuclear fuel and suddenly collapses to form a so-called white dwarf star, with a diameter equal to that of the Earth. Assuming no mass loss, what would then be the sun's new rotation period (time for one rotation), which currently is about 25 days? Assume that the sun and the white dwarf are uniform, solid spheres.

• 63P. If the polar ice caps of the Earth melted and the water returned to the oceans, the oceans would be made deeper by about 30 m. What effect would this have on the Earth's rotation? Make an estimate of the resulting change in the length of the day. (Concern has been expressed that warming of the atmosphere resulting from industrial pollution could cause the ice caps to melt.)

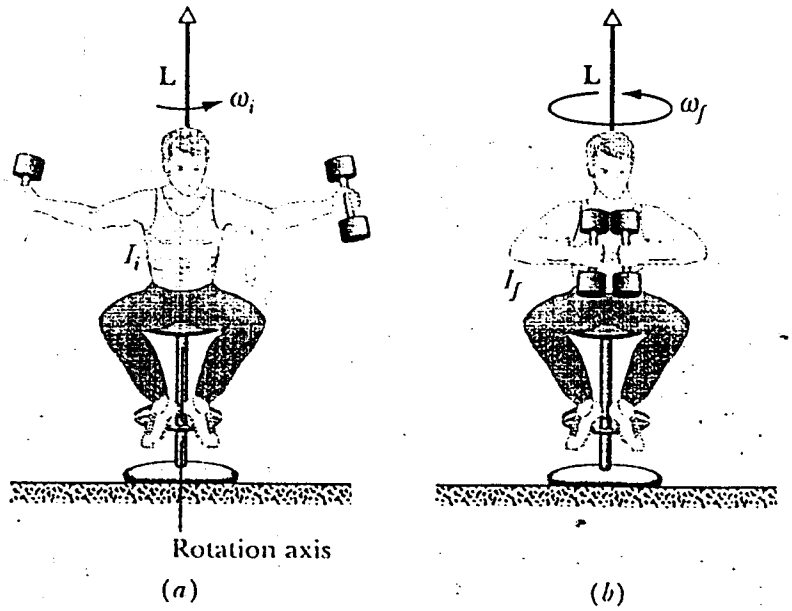
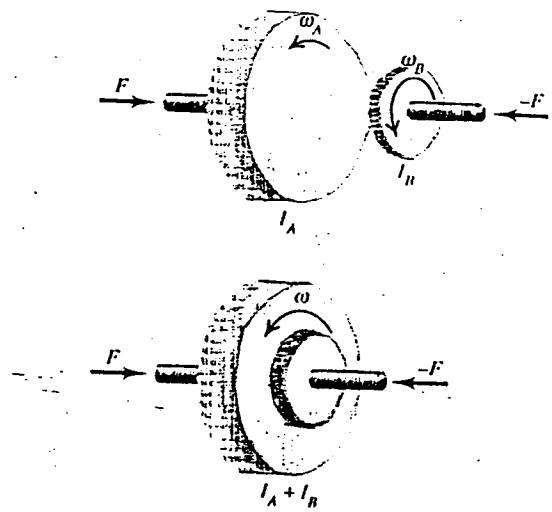
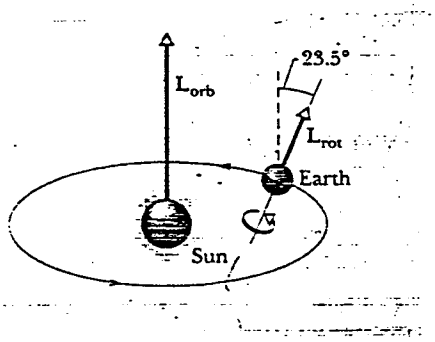


FIGURE 12-16 (*a*) The student has a relatively large rotational inertia and a relatively small angular speed. (*b*) By decreasing his rotational inertia, the student automatically increases his angular speed. The angular momentum L of the rotating system remains unchanged.

Figure 10–21 shows two disks, one an engine flywheel, the other a clutch plate attached to a transmission shaft. Their moments of inertia are I_A and I_B; initially, they are rotating with constant angular velocities ω_A and ω_B, respectively. We then push the disks together with forces acting along the axis, so as not to apply any torque on either disk. The disks rub against each other and eventually reach a common final angular velocity ω. Derive an expression for ω.



12–46 As the earth orbits the sun in its elliptical orbit, its distance of closest approach to the center of the sun (at the perihelion) is 1.471×10^{11} m, and its maximum distance from the center of the sun (at aphelion) is 1.521×10^{11} m. If the earth's orbital speed at perihelion is 3.027×10^4 m/s, what is its orbital speed at aphelion? (Neglect the effect of the moon and other planets.)



10–49 Hitting a Bull's-eye. A target in a shooting gallery consists of a vertical square wooden board, 0.200 m on a side and of mass 2.20 kg, that is pivoted on an axis along its top edge. It is struck at the center by a bullet of mass 5.00 g that is traveling at 300 m/s. a) What is the angular velocity of the board just after the bullet's impact? b) What maximum height above the equilibrium position does the center of the board reach before starting to swing down again? c) What bullet speed would be required for the board to swing all the way over after impact?

radius 6.96×10^8 m 6.37×10^6

55E. Suppose that the sun runs out of nuclear fuel and suddenly collapses to form a so-called white dwarf star, with a diameter equal to that of the Earth. Assuming no mass loss, what would then be the sun's new rotation period (time for one rotation), which currently is about 25 days? Assume that the sun and the white dwarf are uniform, solid spheres.

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