Answer to Conceptual Questions of Chapter 8

1. The ease of driving a screw into a piece of wood is determined by the magnitude of the torque required to produce the necessary downward force on the screw. The torque produced is equal to the product of the radius of the screwdriver handle and the magnitude of the tangential force applied by the operator's hand. Thus, the larger diameter handle reduces the applied force required to create the necessary torque. The same amount of work is done in driving the screw, but the task is made easier.

4. Of the three axes, the book has the smallest moment of inertia about the axis along the binding of the book
(axis 1). The moments of inertia about the other two axes are larger because the mass of the book is, on average, farther from those axes.

7. The total kinetic energy of a car is found by summing the translational and rotational kinetic energies of each of the four wheels and the translational kinetic energy of the car's body. The fraction of the car's total kinetic energy due to the rotation of the wheels depends on the ratio of the mass of the car's body to the mass of the car's wheels. Thus, if two cars differ only in the mass of the body (while having wheels of the same mass), the more massive car converts a greater fraction of its gravitational potential energy into translational kinetic energy—the heavier car wins the race.

8. The force due to static friction acting on the barrel produces the torque that makes the barrel roll. If there were no friction acting on the barrel due to the floor, the applied force would make the barrel slide along the floor without rotating.

14. The center of mass of the toy lies below the wire on which is it balancing. If the toy is pushed slightly off center, the force of gravity acting at the center of mass produces a torque that tends to rotate the toy back toward the center. If the center of mass were above the wire, this situation would be reversed and the toy would be unstable.

20. When you push near the edge, you have a larger moment arm. When you push in the middle, the moment arm is half as much so you need to push with twice the force.