• For material covering Ch. 10
• Due Friday, Oct. 31 at 5 pm

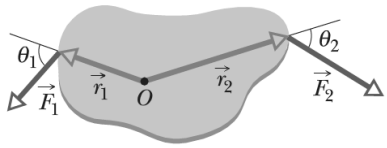
1. A flywheel turns through 28 rev as it slows from an angular speed of 6.6 rad/s to a stop. **(a)** Assuming a constant angular acceleration, find the time for it to come to rest. **(b)** What is its angular acceleration? **(c)** How much time is required for it to complete the first 14 of the 28 revolutions? [Answer: **(a)** 58 s; **(b)** -0.11 rad/s^2; **(c)** 17 s].

2. A flywheel with a diameter of 1.27 m is rotating at an angular speed of 272 rev/min. **(a)** What is the angular speed of the flywheel in radians per second? **(b)** What is the linear speed of a point on the rim of the flywheel? **(c)** What constant angular acceleration (in revolutions per minute-squared) will increase the wheel's angular speed to 793 rev/min in 98.7 s? **(d)** How many revolutions does the wheel make during that 98.7 s? [Answer: **(a)** 28.5 rad/s; **(b)** 18.1 m/s; **(c)** 317 rev/min^2; **(d)** 876 rev].

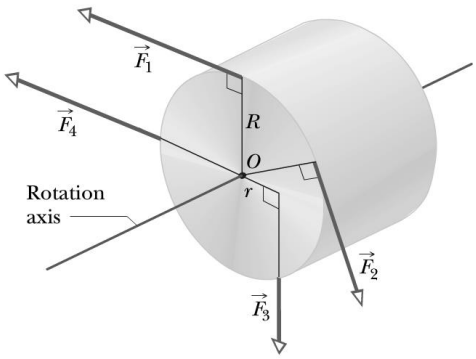
3. (a) What is the angular speed ω about the polar axis of a point on Earth's surface at a latitude of 43° N? (Earth rotates about that axis.) **(b)** What is the linear speed v of the point? What are **(c)** ω and **(d)** v for a point at the equator? (Note: Earth radius equals 6370 km and let one day be 24 hours) [Answer: **(a)** 72.7 μrad/s; **(b)** 339 m/s; **(c)** 72.7 μrad/s; **(d)** 463 m/s].

4. Some European trucks run on energy stored in a rotating flywheel, with an electric motor getting the flywheel up to its top speed of 150 π rad/s. One such flywheel is a solid, uniform cylinder with a mass of 620 kg and a radius of 1.07 m. **(a)** What is the kinetic energy of the flywheel after charging? **(b)** If the truck uses an average power of 6.8 kW, for how many minutes can it operate between chargings? [Answer: **(a)** 39.4 MJ; **(b)** 96.6 min].

5. The body in the figure is pivoted at O, and two forces act on it as shown. If r_1 = 1.40 m, r_2 = 3.95 m, F_1 = 4.91 N, F_2 = 5.18 N, θ_1 = 76.0°, and θ_2 = 68.0°, what is the net torque about the pivot? [Answer: -12.3 N·m].



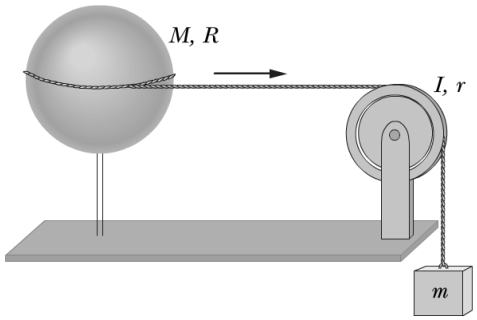
6. A cylinder having a mass of 1.9 kg can rotate about its central axis through point O. Forces are applied as shown: F_1 = 6.7 N, F_2 = 7.4 N, F_3 = 3.1 N, and F_4 = 6.1 N. Also, r = 7.8 cm and R = 11 cm. Taking the clockwise direction to be negative, find the angular acceleration of the cylinder. (During the rotation, the forces maintain their same angles relative to the cylinder.) [Answer: -28 rad/s^2].



7. A 44.0 kg wheel, essentially a thin hoop with radius 1.10 m, is rotating at 175 rev/min. It must be brought to a stop in 17.0 s. **(a)** How much work must be done to stop it? **(b)** What is the required average power? Give absolute values for both parts. [Answer: **(a)** 8940 J; **(b)** 526 W].

8. A meter stick is held vertically with one end on the floor and is then allowed to fall. Find the speed of the other end just before it hits the floor, assuming that the end on the floor does not slip. (Hint: Consider the stick to be a thin rod and use the conservation of energy principle.) [Answer: 5.42 m/s].

9. A uniform spherical shell of mass M and radius R can rotate about a vertical axis on frictionless bearings. A massless cord passes around the equator of the shell, over a pulley of rotational inertia I and radius r, and is attached to a small object of mass m. There is no friction on the pulley's axle; the cord does not slip on the pulley. What is the speed of the object when it has fallen a distance d after being released from rest? Use energy considerations. Express you answer in terms of the variables given and g. [Answer: $\sqrt{\frac{2mgd}{m+I/r^2+2M/3}}$].



10. A solid cylinder of radius 18 cm and mass 16 kg starts from rest and rolls without slipping a distance L = 4.2 m down a roof that is inclined at angle θ = 34°. **(a)** What is the angular speed of the cylinder about its center as it leaves the roof? **(b)** The roof's edge is at height H = 5.0 m. How far horizontally from the roof's edge does the cylinder hit the level ground? [Answer: **(a)** 31 rad/s; **(b)** 3.4 m].