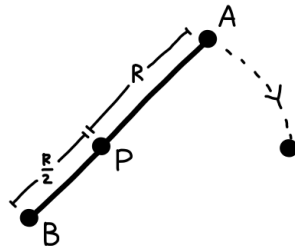


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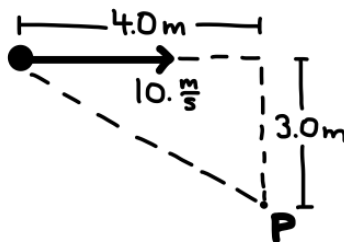
AP Physics 1
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Angular Momentum and Rotational Kinetic Energy Block:

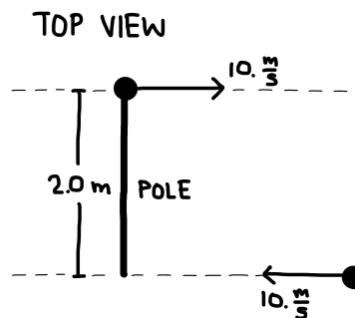
1. A 1500 kg satellite orbits a planet in a circular orbit of radius 6.2×10^6 m. What is the angular momentum of the satellite in its orbit around the planet if the satellite completes one orbit every 1.5×10^4 s?
2. A 60.0 kg skater begins a spin with an angular speed of 6.0 rad/s. By changing the position of her arms, the skater decreases her rotational inertia by 50%. What is the skater's final angular speed?
3. Two equal spheres, labelled A and B in the figure, are attached to a massless rod with a frictionless pivot at the point P. The system is made to rotate clockwise with angular speed ω on a horizontal, frictionless tabletop. Sphere A collides with and sticks to an equal sphere that is at rest on the tabletop. What is the angular speed of the system immediately after the collision?



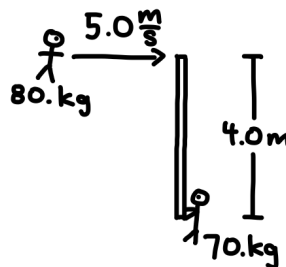
4. Planets A and B are uniform solid spheres that rotate at a constant speed about axes through their centres. Although B has twice the mass and three times the radius of A, each planet has the same rotational kinetic energy. What is the ratio $\omega_B:\omega_A$? ($I_{\text{sphere}} = \frac{2}{5} MR^2$)
5. A solid sphere of radius R rotates about a diameter with an angular speed ω . The sphere then collapses under the action of internal forces to a final radius $R/2$. What is the final angular speed of the sphere? ($I_{\text{sphere}} = \frac{2}{5} MR^2$)
6. A 3.0 kg ball moves in a straight line at 10. m/s as shown in the figure. At the instant shown, what is the angular momentum about the point P?



7. A hollow sphere of radius 0.25 m is rotation at 13 rad/s about an axis that passes through its centre. The mass of the sphere is 3.8 kg. Assuming a constant net torque is applied to the sphere, how much work is required to bring the sphere to a stop? ($I_{\text{hollow sphere}} = \frac{2}{3} MR^2$)
8. A ceiling fan has five blades, each with a mass of 0.34 kg and a length of 0.66 m. The fan is operating in its "low" setting at which the angular speed is 9.4 rad/s. If the blades can be approximated as uniform thin rods that rotate about one end, what is the total rotational kinetic energy of the five blades? ($I_{\text{rod, rotating about one end}} = \frac{1}{3} ML^2$)
9. Two skaters, each of mass 40.0 kg approach each other along parallel paths that are separated by a distance of 2.0 m. Both skaters have a speed of 10. m/s. The first skater carries a 2.0 m massless pole. As the second skater passes the pole, he catches hold of the end. The two skaters then go around in a circle around the centre of the pole.



- a) What is the forward speed of the centre of mass of the stick after the collision?
 - b) What is the angular velocity of the stick about its centre of mass after the collision?
 - c) Find the initial kinetic energy and the final kinetic energy of the system.
10. A 70. kg astronaut is in deep space. Approaching him at 5.0 m/s is a 80. kg astronaut. The 70. kg astronaut holds a 4.0 m massless rod vertically upwards such that the other astronaut can grab on to the end.



- a) What is the forward speed of the centre of mass of the stick after the collision?
 - b) What is the angular velocity of the stick about its centre of mass after the collision?
 - c) Find the initial kinetic energy and the final kinetic energy of the system.
11. A 2.0 kg hoop rolls without slipping on a horizontal surface so that its centre proceeds to the right with a constant linear speed of 6.0 m/s. What is the total kinetic energy of the hoop? ($I_{\text{hoop}} = MR^2$)
 12. A 2.7 g ping pong ball rolls down a 1.0 m high ramp. What is the speed of the ping pong ball as it reaches the bottom of the ramp? ($I_{\text{hollow sphere}} = \frac{2}{3} MR^2$)