ADVANCED PHYSICS CLUB

MARCH 22, 2020

IMPORTANT

The club will not meet physically until the next academic year. We will continue by correspondence. The discussion of old problems and new assignments will be posted on the web site on Sundays. Feel free to send your solutions, questions, comments, ideas to apc@schoolnova.org. You can always find the list of all assignments and updates on the web site:

`https://schoolnova.org/nova/classinfo?class_id=adv_phy_club&sem_id=ay2019`

We might have occasional Zoom club meetings but only if there will be a sufficient activity by correspondence.

Today's meeting

Today we continue discussing rotation of rigid bodies. You might find the following links useful in solving the problems below:

`http://hyperphysics.phy-astr.gsu.edu/hbase/circ.html`

In particular, read the articles on angular momentum, conservation of angular momentum, and rotational kinetic energy.

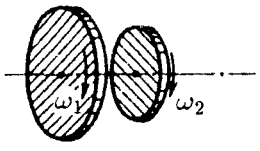
Problems

1. Two disks with moments of inertia I_1 and I_2 are rotating around the same vertical axis without friction with angular velocities ω_1 and ω_2 respectively. Disks suddenly come into contact. Because of the friction between the disks after some time there is no relative slipping between the disks. What is the angular velocity of disks then? How much heat was generated during this process?

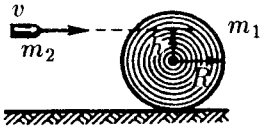
2. A cylinder of mass m_1 and radius R is at rest on a horizontal plane. A bullet of mass m_2 flying horizontally with velocity v at the height $h < R$ above the cylinder axis hits the cylinder. Assuming the collision is absolutely inelastic and $m_2 \ll m_1$, calculate the axis velocity and angular velocity of the cylinder after the collision.

3. A man of mass m stands on the edge of a disk, rotating without friction around a vertical axis with angular velocity ω. The disk has radius R and moment of inertia I. How will the angular velocity change if the man moves from the edge to the center of the disk? How will the kinetic energy of the system change? Neglect man's size compared to the disk size.

***4.** A uniform rod of length l initially stands at rest vertically on a horizontal frictionless plane. Then it starts to fall. Find the velocity of the top part of the rod just before it hits the surface.



To problem 1



To problem 2