

ACTIVITY NO. - 4 - Let us rotate

Subject	Physics
Class	XI
Chapter/Unit	Dynamics of Rotational Motion
Topic	Conservation of Angular Momentum
Time	10 minutes
Nature of Activity	Individual

What will I learn (Learning Outcome)?

To verify the law of conservation of angular momentum experimentally.

Skills: Analyzing and Creating

What I have to do?

To demonstrate that as the moment of inertia of a rotating body increases, its angular velocity decreases, if the net external torque is zero..

What do I require?

A chair/stool with wheels and two dumbbell weights of 1 kg each.

What do I need to know?

According to the principal of conservation of momentum, in the absence of any external torque, the product of Moment of Inertia and Angular Velocity remains constant. This means to increase the angular speed of rotation, one must control the Moment of Inertia; i.e. as moment of inertia will decrease, speed of rotation will increase OR as moment of inertia will increase, speed of rotation will decrease. Further Moment of inertia is directly proportional to the mass of the body and the square of the radius of gyration.

➤ Teacher's Activity

Teacher will

1. discuss the law of conservation of angular momentum
2. guide students on how to perform the activity.

How will I proceed?

➤ Student's Activity

1. Sit on the chair/stool having wheels and hold the weights in the hands
2. Stretch the hands so that the weights are at a farthest position from the body.
3. Give yourself a rotation by pushing the ground.
4. Now slowly bring the weights closer to the body.
5. Observe - what happens to the speed of rotation of the chair as the weights are brought closer?

What have I observed?

S. No.	Position of weights	Speed of rotation (increases/decreases)
1	Closest to the body	
2	Farthest to the body	

What have I learnt?

As weights are brought closer to the chair, speed of rotation _____ and radius of gyration _____ which further _____ Moment of Inertia of the body.

What am I curious to learn?

Gyroscope is a device consisting of a wheel or disc mounted so that it can spin rapidly about an axis which is itself free to alter in direction. The orientation of the axis is not affected by tilting of the mounting, so gyroscopes can be used to provide stability or maintain a reference direction in navigation systems, automatic pilots, and stabilizers.

Let us find out if the law of conservation of angular momentum is also applicable on a gyroscope. Take a gyroscope and sit on a stool having wheels with feet not touching the ground. Then I can ask my friend to rotate the gyroscope very fast and leave. What do I observe? Can I explain my observation?

Let me evaluate myself

1. State the law of conservation of angular momentum.

2. If angular momentum of a rigid body is conserved, then what must be true about its initial and final angular momentum?
 - a) Initial angular momentum is greater than final angular momentum.
 - b) Initial angular momentum is less than final angular momentum.
 - c) Initial angular momentum is equal to final angular momentum.
 - d) Initial angular momentum is greater than zero, and final angular momentum is less than zero.
3. Derive the relation between angular momentum, moment of inertia and angular speed of a rigid body.

4. An acrobat/ballet dancer stretches her hands while dancing. What happens to her angular speed? Explain the reason for the change.

5. Why does a spring board diver, while jumping into a swimming pool, curls himself in such a way that his feet and head are driven close to each other.
