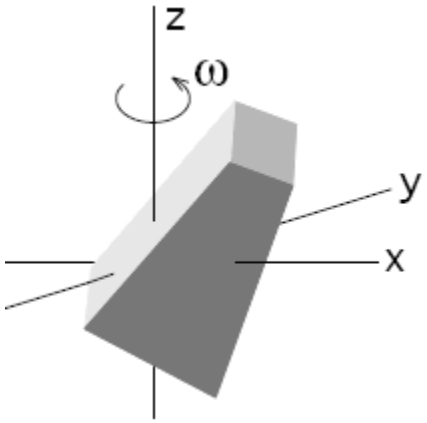
Angular Momentum System of Particles
Concept Questions

Question 1: Angular Momentum

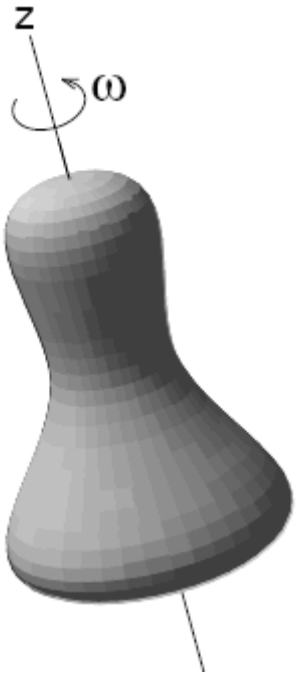
A non-symmetric body rotates with an angular speed ω about the z axis.



Relative to the origin

1. $\vec{\mathbf{L}}_0$ is constant.
2. $\left|\vec{\mathbf{L}}_0\right|$ is constant but $\vec{\mathbf{L}}_0 / \left|\vec{\mathbf{L}}_0\right|$ is not.
3. $\vec{\mathbf{L}}_0 / \left|\vec{\mathbf{L}}_0\right|$ is constant but $\left|\vec{\mathbf{L}}_0\right|$ is not.
4. $\vec{\mathbf{L}}_0$ has no z-component. .

Question 2: A rigid body with rotational symmetry rotates with an angular speed ω about its symmetry axis (z axis).



Relative to the origin

1. $\vec{\mathbf{L}}_0$ is constant.
2. $\vec{\mathbf{L}}_0$ is constant but $\vec{\mathbf{L}}_0 / \left|\vec{\mathbf{L}}_0\right|$ is not.
3. $\vec{\mathbf{L}}_0 / \left|\vec{\mathbf{L}}_0\right|$ is constant but $\vec{\mathbf{L}}_0$ is not.
4. $\vec{\mathbf{L}}_0$ has no z-component. .

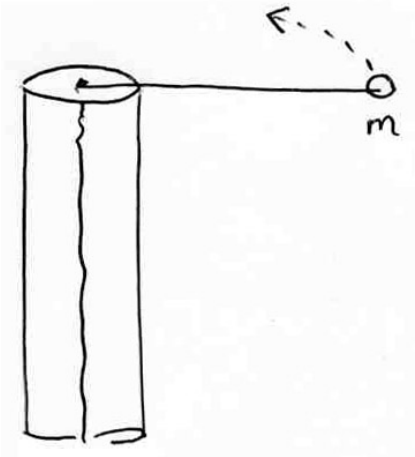
Question 3 Twirling Person A woman, holding dumbbells in her arms, spins on a rotating stool (assume that the stool has no frictional torque acting along the axis of rotation). When she pulls the dumbbells inward, her moment of inertia about the vertical axis passing through her center of mass changes and she spins faster. The z-component of the angular momentum about that axis is

1. the same.
2. larger.
3. smaller.
4. not enough information is given to decide.

Question 4 Figure Skater A figure skater stands on one spot on the ice (assumed frictionless) and spins around with her arms extended. When she pulls in her arms, she reduces her rotational moment of inertia and her angular speed increases. Assume that the z-component of her angular momentum is constant. Compared to her initial rotational kinetic energy, her rotational kinetic energy after she has pulled in her arms must be

1. the same.
2. larger.
3. smaller.
4. Not enough information is given to decide.

Question 5 A tetherball of mass m is attached to a post of radius R by a string. Initially it is a distance r_0 from the center of the post and it is moving tangentially with a speed v_0. The string passes through a hole in the center of the post at the top. The string is gradually shortened by drawing it through the hole. Ignore gravity. Until the ball hits the post,



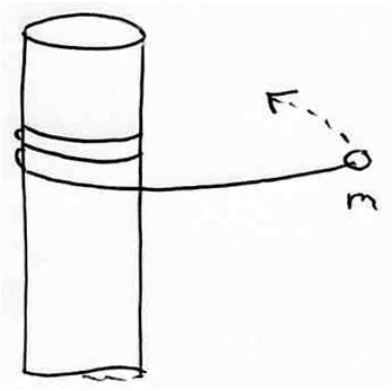
1. The energy and angular momentum about the center of the post are constant.

2. The energy of the ball is constant but the angular momentum about the center of the post changes.

3. Both the energy and the angular momentum about the center of the post, change.

4. The energy of the ball changes but the angular momentum about the center of the post is constant.

Question 6: A tetherball of mass *m* is attached to a post of radius *R* by a string. Initially it is a distance r_0 from the center of the post and it is moving tangentially with a speed v_0. The string wraps around the outside of the post. Ignore gravity. Until the ball hits the post,



1. The energy and angular momentum about the center of the post are constant.

2. The energy of the ball is constant but the angular momentum about the center of the post changes.

3. Both the energy of the ball and the angular momentum about the center of the post, change.

4. The energy of the ball changes but the angular momentum about the center of the post is constant.

8.01SC Physics I: Classical Mechanics