

Chapter 11 Rotational Mechanics

Rotational Mechanics

Pre-Test - Post-Test

- Which has more rotational inertia, a bicycle wheel or a solid disk of the same mass and diameter?
 - A) The wheel.
 - B) The disk.
 - C) Both have the same rotational inertia.
 - D) Not enough information.
- The rotational inertia of your leg is greater when your leg is _____.
 - A) straight.
 - B) bent.
 - C) ...same either way.
 - D) not enough information.
- A disk and a ring of same diameter and mass roll down an incline starting at the same time. The one to reach the bottom first will be _____.
 - A) the ring.
 - B) the disk.
 - C) ...both reach the bottom together.
 - D) not enough information.
- Which rolls to the bottom of a hill sooner, an empty car tire or the same tire mounted on a rim?
 - A) The mounted tire, regardless of its weight.
 - B) The mounted tire, provided the tire is lighter in weight than the rim.
 - C) The empty tire, regardless of its weight.
 - D) The empty tire, provided it is as heavy as the rim.
 - E) The mounted tire, provided the tire is more massive than the rim.
- When an ice skater pulls in his hands to turn faster _____.
 - A) angular momentum must be conserved.
 - B) his moment of inertia changes.
 - C) his rotational speed changes.
 - D) all of the above.
- Suppose a huge rotating cloud of particles in space gravitates together to form a dense ball. As the cloud shrinks in size it rotates _____.
 - A) rotates faster.
 - B) rotates slower.
 - C) rotates at the same speed.
- If the polar icecaps melted, the resulting water would spread over the entire earth. This new mass distribution would tend to make the length of a day _____.
 - A) longer.
 - B) shorter.
 - C) stay the same.
 - D) not enough information.

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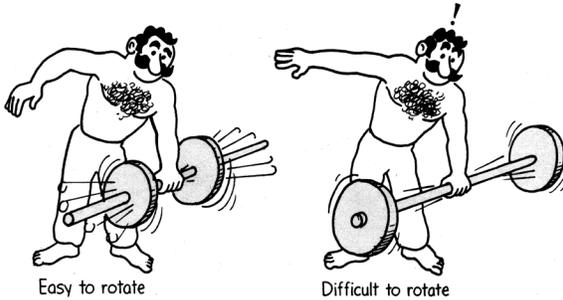
Rotational Inertia

1. What is rotational acceleration?

2. What is torque?

3. What is rotational inertia?

4. What are the variables that rotational inertia depends on?

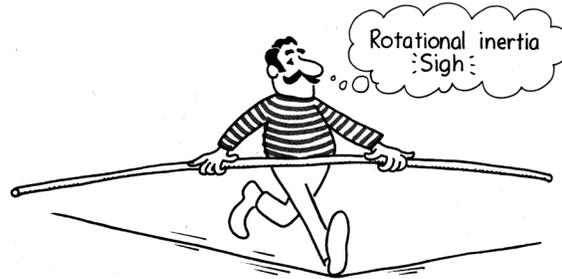


5. What is a flywheel and how is it used in a car?

6. Why is a stick with a wad of clay at the top easier to balance on the palm of your hand than an empty stick?

7. If you walked along the top of a fence, why would holding your arms out help you to balance?

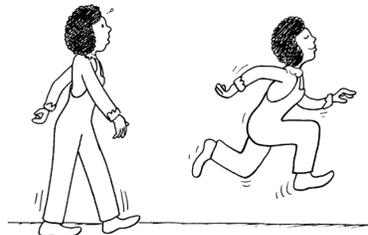
8. Why do tightrope walker uses a long pole.



9. Which will swing to and fro more often, a short pendulum or a long pendulum? Explain

10. Why do people with long legs generally walk with a slower stride than people with short legs?

11. Why do you bend your legs to run faster?



12. How does a skater change his or her rotational inertia while spinning?

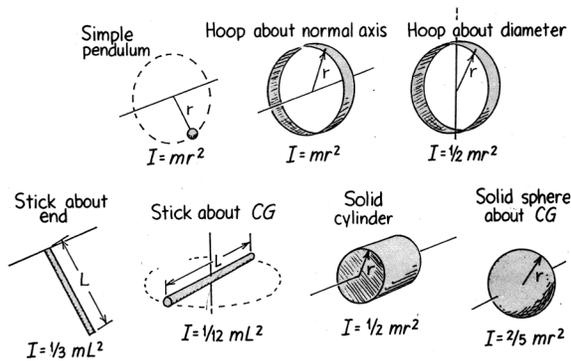
13. What is the basic formula for rotational inertia.

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14. What is the rotational inertia of a disc and a hoop?



20. What is the formula for angular momentum?

Conservation of Angular Momentum

21. What does it mean to say that angular momentum is conserved?

22. Linear momentum is conserved when there is no net external force. When is angular momentum conserved?

Rotational Inertia and Rolling

15. Which will have the greater acceleration rolling down an incline—a hoop or a solid disk?

23. Write the formula for conservation of angular momentum.

16. Which will have a greater acceleration on a horizontal surface from rest, a hoop or disk. They each have the same mass and diameter?

24. Why do ice skaters pull their arms into their body as they spin?

17. Consider two rotating bicycle wheels, one filled with air and the other filled with sand. Which would be more difficult to stop rotating? Explain.

25. If you are in the center of a large, freely rotating turntable at an amusement park and you crawl toward the outer rim, does the rate of the rotation increase, decrease, or remain unchanged? Explain

Angular Momentum

18. What is angular momentum?

26. If the world's populations move to the North and South Poles, would the length of a day increase, decrease, or stay the same?

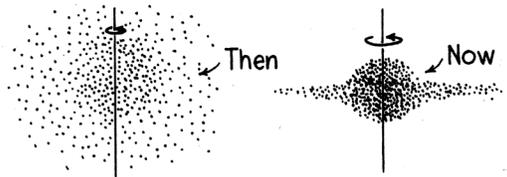
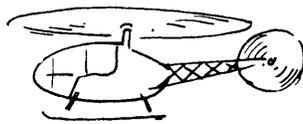
19. Distinguish between linear momentum and angular momentum.

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- 27. A sizable quantity of earth is washed down the Mississippi River and deposited in the Gulf of Mexico. What effect does this tend to have on the length of a day?
- 28. If the polar ice caps melted, how would this affect the length of the day?
- 29. As more and more skyscrapers are built on the surface of the earth, does the length of the day become longer or shorter? Explain
- 30. A basketball player wishes to balance a ball on his fingertip. Will he be more successful with a spinning ball or a stationary ball? Explain
- 31. Why does a typical small helicopter with a single main rotor have a second small rotor on its tail?
- 32. Describe the consequence if the small rotor fails in flight on a helicopter.
- 33. How do you keep your balance on a bicycle?
- 34. If you are on a bike and going fast into a turn do you tend to lean the bike into the turn or point the handle bars in the direction you want to go? Explain
- 35. Why are bullets given a spin as they travel down the rifle barrel?
- 36. In times of doubt, you can distinguish a hard boiled egg from a raw one by spinning them. A cooked egg will spin on its end, but a raw egg will fall over. Explain
- 37. We believe our galaxy was formed from a huge cloud of gas and particles. The original cloud was far larger than the present size of the galaxy, was more or less spherical, and was rotating very much more slowly than the galaxy is now. Explain how gravitation and the conservation of angular momentum contribute to the galaxy's present shape and why it rotates faster now than when it was a larger, spherical cloud.



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