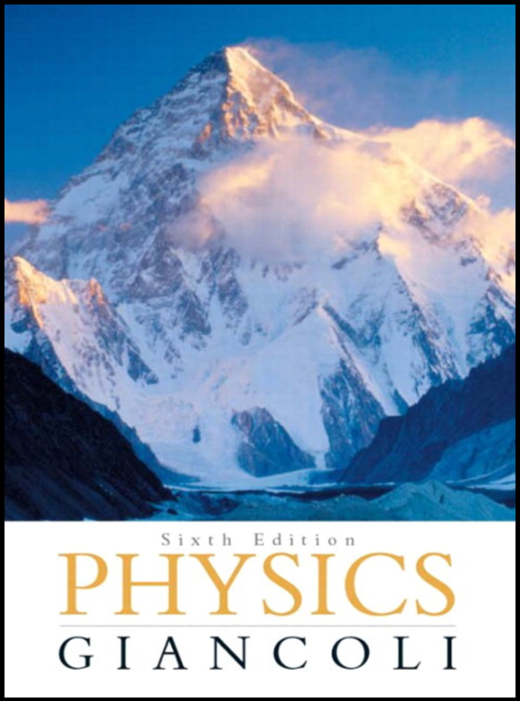


ConcepTest PowerPoints

Chapter 8

Physics: Principles with Applications, 6th edition

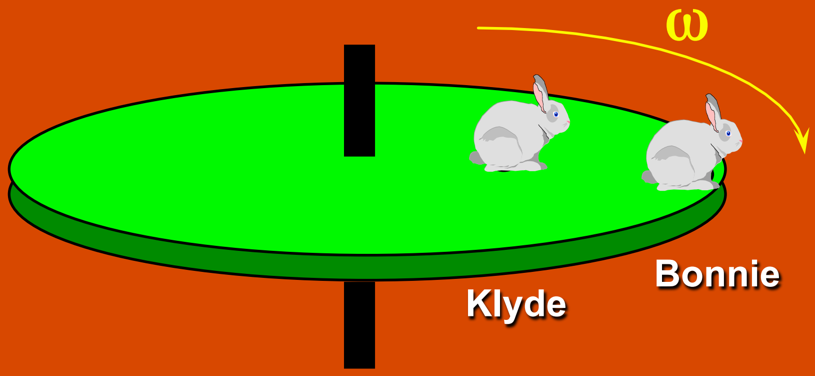
Giancoli

ConcepTest 8.1a Bonnie and Klyde I

Bonnie sits on the outer rim of a merry-go-round, and **Klyde** sits midway between the center and the rim. The merry-go-round makes one complete revolution every two seconds.

Klyde's angular velocity is:

1) same as Bonnie's
2) twice Bonnie's
3) half of Bonnie's
4) 1/4 of Bonnie's
5) four times Bonnie's



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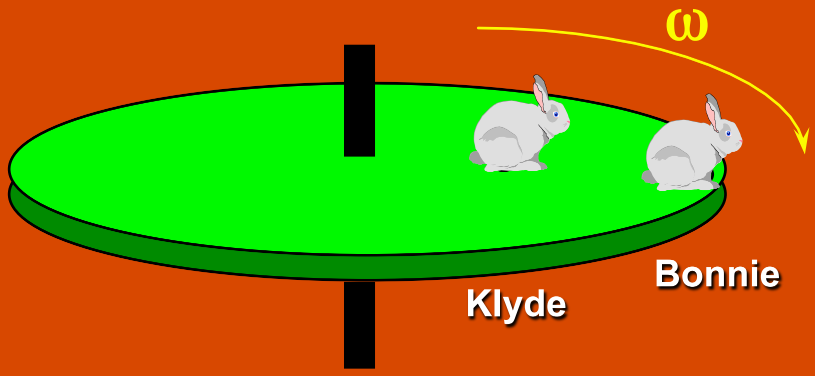
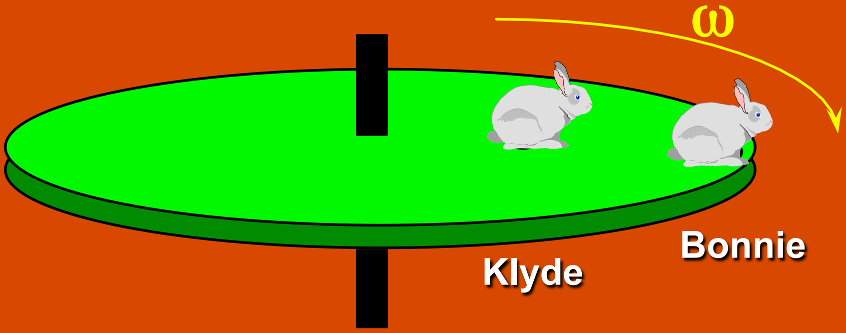
The **angular velocity ω** of any point on a solid object rotating about a fixed axis ***is the same***. Both Bonnie & Klyde go around one revolution (2π radians) every two seconds.



ConcepTest 8.1b Bonnie and Klyde II

Bonnie sits on the outer rim of a merry-go-round, and Klyde sits midway between the center and the rim. The merry-go-round makes one revolution every two seconds. Who has the larger linear (tangential) velocity?

1) Klyde
2) Bonnie
3) both the same
4) linear velocity is zero for both of them



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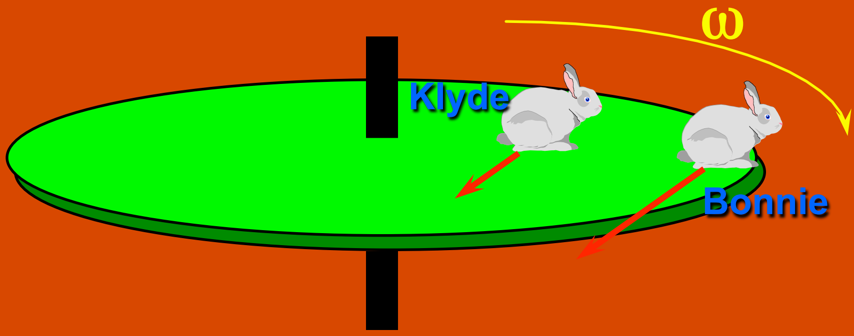
Bonnie sits on the outer rim of a merry-go-round, and **Klyde** sits midway between the center and the rim. The merry-go-round makes one revolution every two seconds. **Who has the larger linear (tangential) velocity?**

1) Klyde
2) Bonnie
3) both the same
4) linear velocity is zero for both of them

Their **linear speeds *v*** will be different since ***v* = *R*ω** and **Bonnie is located further out** (larger radius *R*) than Klyde.

[redacted]



Follow-up: Who has the larger centripetal acceleration?

ConcepTest 8.2 Truck Speedometer

Suppose that the speedometer of a truck is set to read the linear speed of the truck, but uses a device that actually measures the angular speed of the tires. If larger diameter tires are mounted on the truck instead, how will that affect the speedometer reading as compared to the true linear speed of the truck?

1) speedometer reads a higher speed than the true linear speed
2) speedometer reads a lower speed than the true linear speed
3) speedometer still reads the true linear speed

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1) speedometer reads a higher speed than the true linear speed
2) speedometer reads a lower speed than the true linear speed
3) speedometer still reads the true linear speed

The linear speed is $v = \omega R$. So when the speedometer measures the same angular speed ω as before, the linear speed v is actually higher, because the tire radius is larger than before.

ConcepTest 8.3a Angular Displacement I

An object at rest begins to rotate with a constant angular acceleration. If this object rotates through an angle θ in the time *t*, through what angle did it rotate in the time 1/2 *t*?

1) 1/2 θ
2) 1/4 θ
3) 3/4 θ
4) 2 θ
5) 4 θ

ConcepTest 8.3a Angular Displacement I

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3) 3/4 θ
4) 2 θ
5) 4 θ

The angular displacement is $\theta = 1/2\ \alpha t^2$ (starting from rest), and there is a quadratic dependence on time. Therefore, in **half the time**, the object has rotated through **one-quarter the angle**.

ConcepTest 8.3b Angular Displacement II

An object at rest begins to rotate with a constant angular acceleration. If this object has angular velocity ω at time *t*, what was its angular velocity at the time 1/2 *t*?

1) 1/2 ω
2) 1/4 ω
3) 3/4 ω
4) 2 ω
5) 4 ω

ConcepTest 8.3b Angular Displacement II

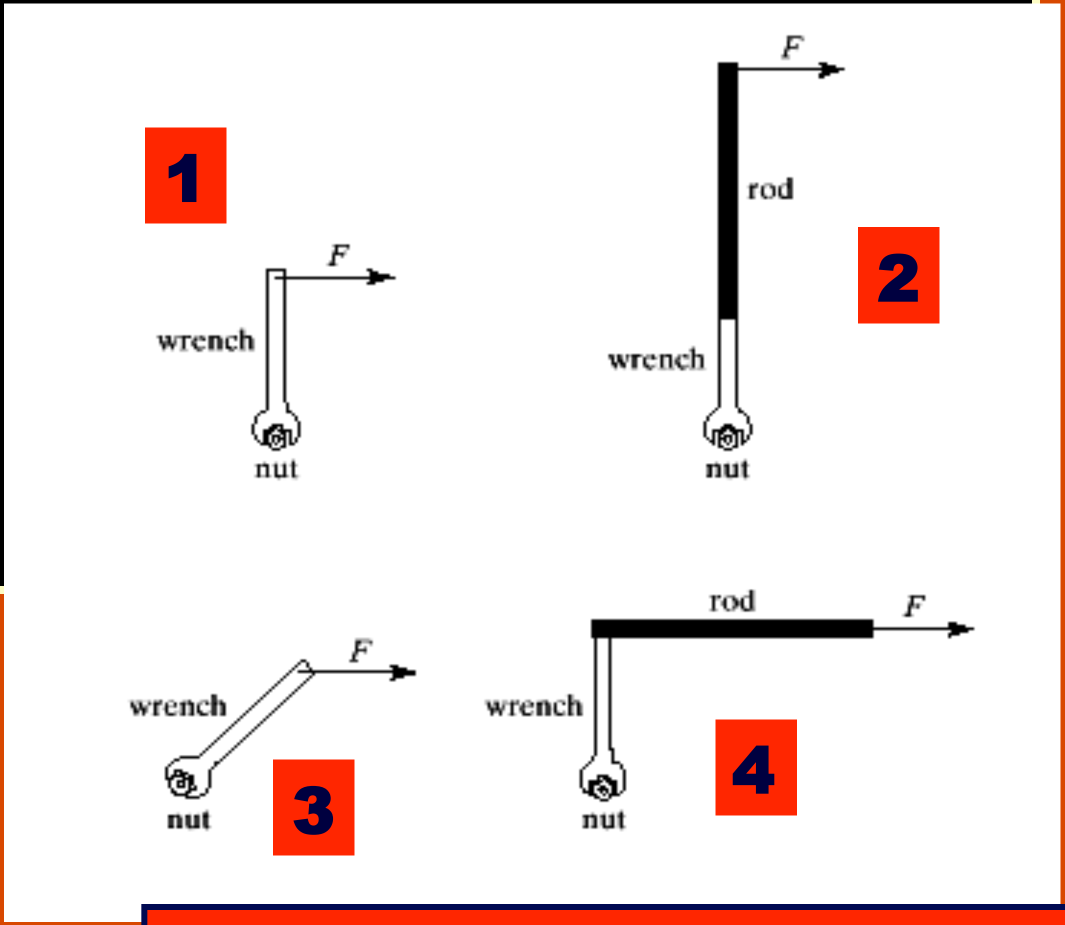
An object at rest begins to rotate with a constant angular acceleration. If this object has angular velocity ω at time t, what was its angular velocity at the time $1/2t$?

1) $1/2\ \omega$
2) $1/4\ \omega$
3) $3/4\ \omega$
4) $2\ \omega$
5) $4\ \omega$

The angular velocity is $\omega = \alpha t$ (starting from rest), and there is a linear dependence on time. Therefore, in **half the time**, the object has accelerated up to only **half the speed**.

ConcepTest 8.4 Using a Wrench

You are using a wrench to loosen a rusty nut. Which arrangement will be the most effective in loosening the nut?



5) all are equally effective

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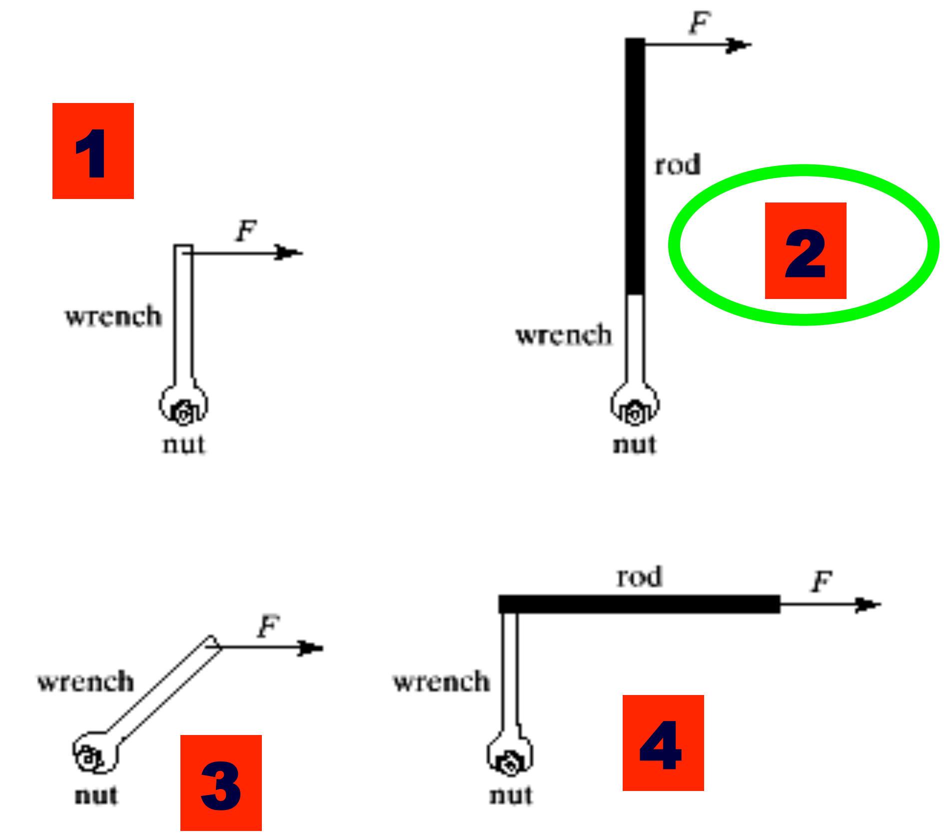

5) all are equally effective

Since the forces are all the same, the only difference is the lever arm. The arrangement with the largest lever arm (case #2) will provide the largest torque.

Follow-up: What is the difference between arrangement 1 and 4?

ConcepTest 8.5 Two Forces

Two forces produce the same torque. Does it follow that they have the same magnitude?

1) yes
2) no
3) depends

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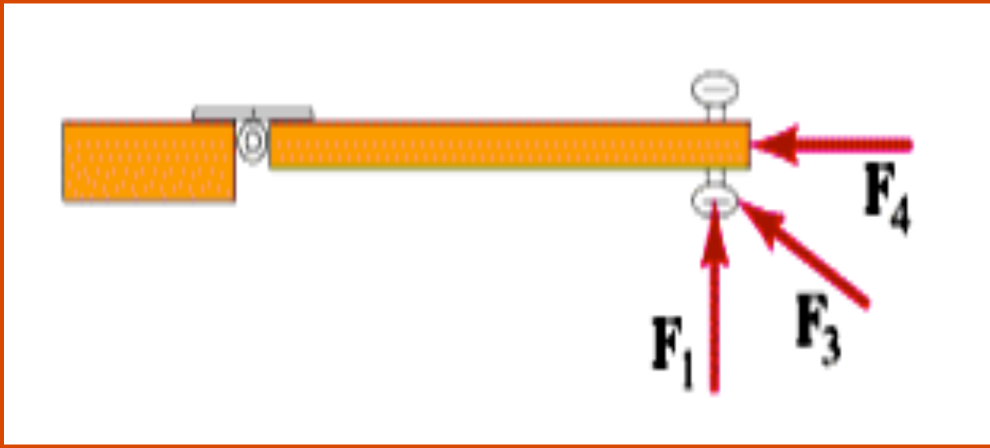
1) yes
2) no
3) depends

Because torque is the product of force times distance, two different forces that act at different distances could still give the same torque.

ConcepTest 8.6 Closing a Door

In which of the cases shown below is the torque provided by the applied force about the rotation axis biggest? For all cases the magnitude of the applied force is the same.

1) F_1
2) F_3
3) F_4
4) all of them
5) none of them



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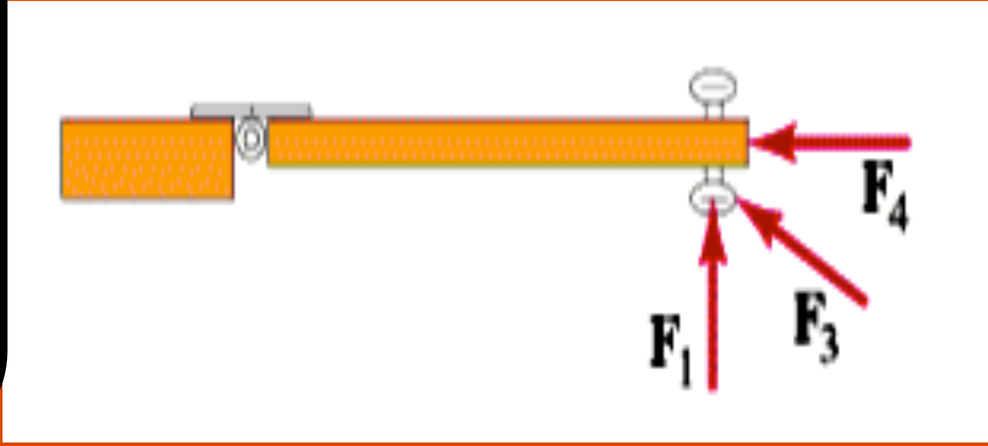
2) F_3
3) F_4
4) all of them
5) none of them

The torque is: $\tau = F\ d \sin\theta$ and so the force that is at 90° to the lever arm is the one that will have the **largest torque**. Clearly, to close the door, you want to push **perpendicular**!!



Follow-up: How large would the force have to be for F_4?

ConcepTest 8.7 Cassette Player

When a tape is played on a cassette deck, there is a tension in the tape that applies a torque to the supply reel. Assuming the tension remains constant during playback, how does this applied torque vary as the supply reel becomes empty?

1) torque increases
2) torque decreases
3) torque remains constant

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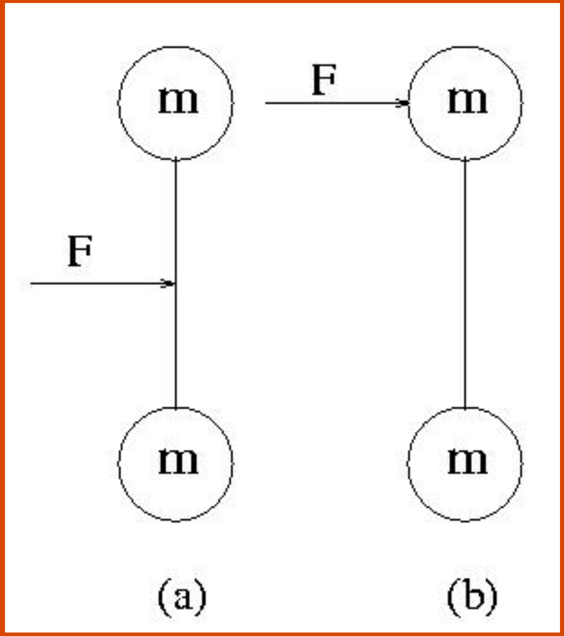
1) torque increases
2) torque decreases
3) torque remains constant

As the supply reel empties, the lever arm decreases because the radius of the reel (with tape on it) is decreasing. Thus, as the playback continues, the applied torque diminishes.

ConcepTest 8.8a Dumbbell I

A force is applied to a dumbbell for a certain period of time, first as in (a) and then as in (b). In which case does the dumbbell acquire the greater center-of-mass speed?

1) case (a)
2) case (b)
3) no difference
4) It depends on the rotational inertia of the dumbbell.



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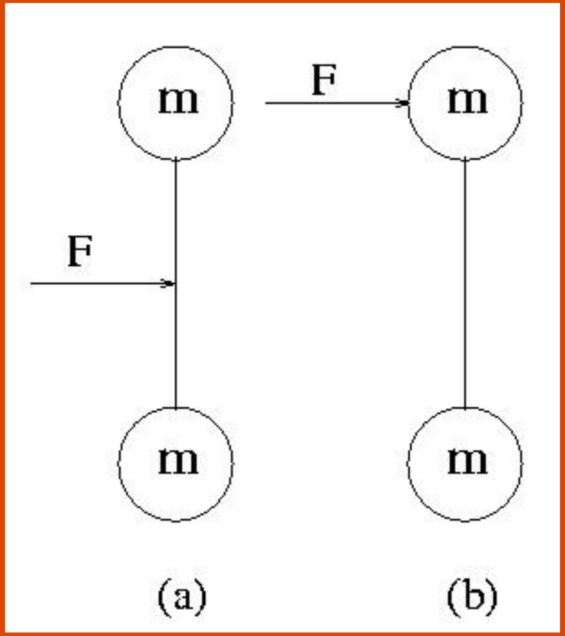
2) case (b)
3) no difference
4) It depends on the rotational inertia of the dumbbell.

Because the same force acts for the same time interval in both cases, the change in momentum must be the same, thus the CM velocity must be the same.



ConcepTest 8.8b Dumbbell II

A force is applied to a dumbbell for a certain period of time, first as in (a) and then as in (b). In which case does the dumbbell acquire the greater energy?

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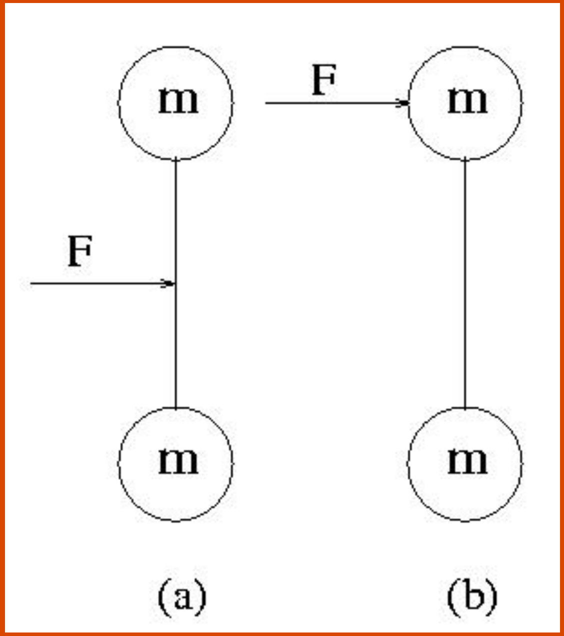
2) case (b)
3) no difference
4) It depends on the rotational inertia of the dumbbell.



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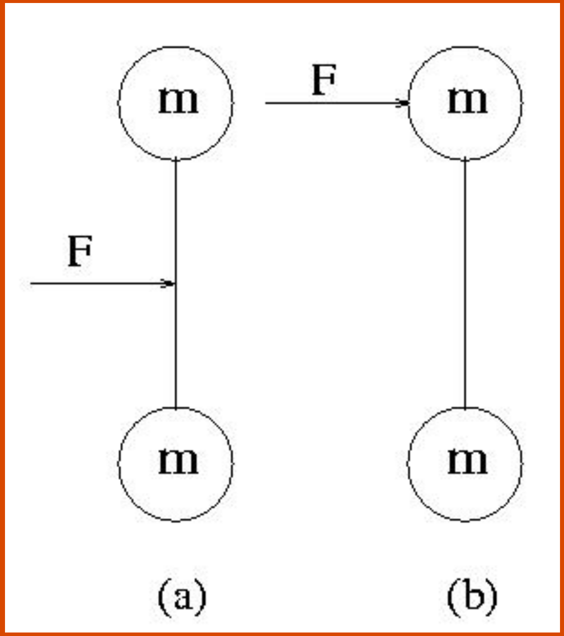
1) case (a)
2) case (b)
3) no difference
4) It depends on the rotational inertia of the dumbbell.

If the CM velocities are the same, the translational kinetic energies must be the same. Because dumbbell (b) is also rotating, it has rotational kinetic energy in addition.



ConcepTest 8.9 Moment of Inertia

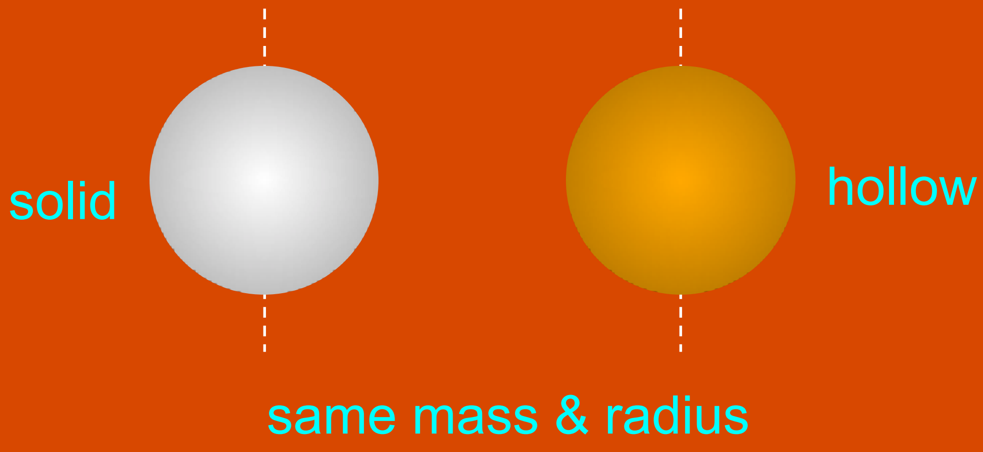
Two spheres have the same radius and equal masses. One is made of solid aluminum, and the other is made from a hollow shell of gold.

Which one has the bigger moment of inertia about an axis through its center?

a) solid aluminum

b) hollow gold

c) same



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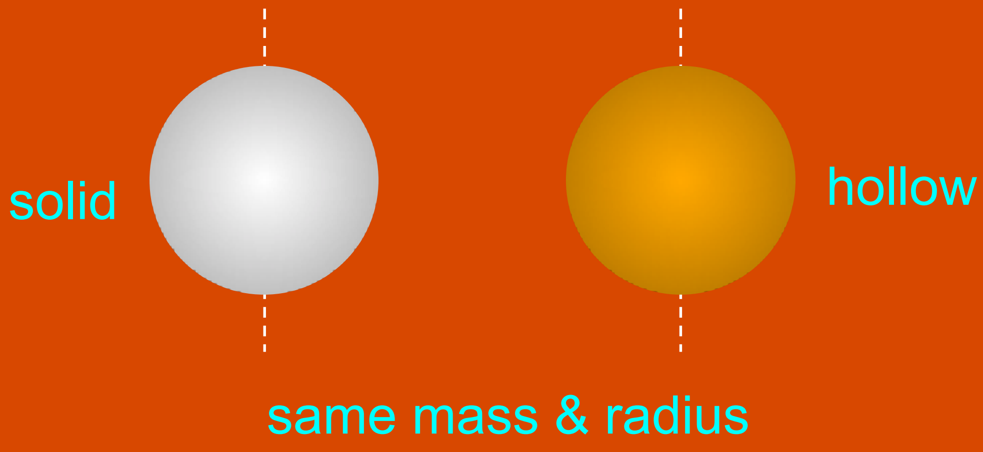
Which one has the bigger moment of inertia about an axis through its center?

a) solid aluminum

b) hollow gold

c) same

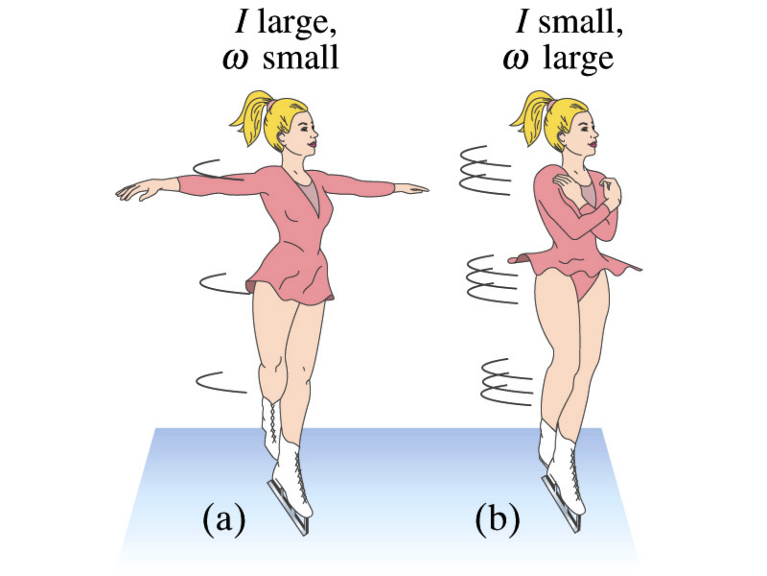
Moment of inertia depends on mass and distance from axis squared. It is bigger for the shell since its mass is located farther from the center.



ConcepTest 8.10 Figure Skater

A figure skater spins with her arms extended. When she pulls in her arms, she reduces her rotational inertia and spins faster so that her angular momentum is conserved. Compared to her initial rotational kinetic energy, her rotational kinetic energy after she pulls in her arms must be

1) the same
2) larger because she's rotating faster
3) smaller because her rotational inertia is smaller



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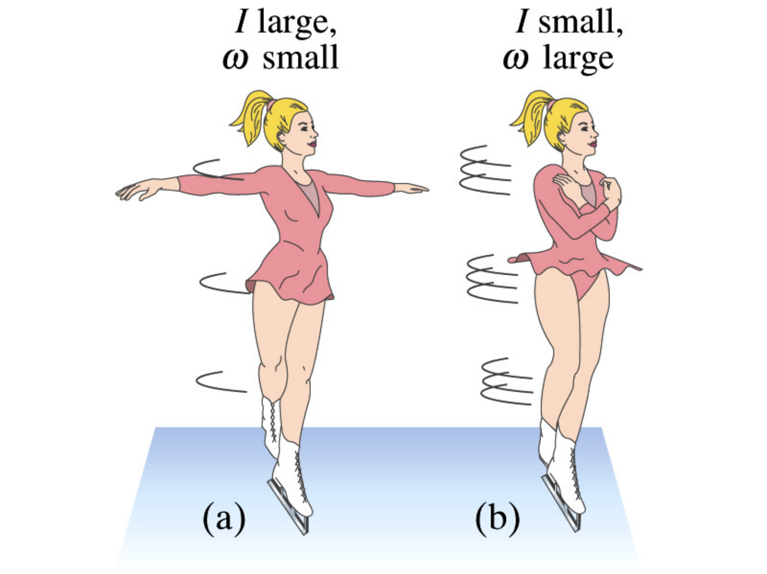
$KE_{rot} = 1/2\, I\, \omega^2 = 1/2\, L\, \omega$ (used $L = I\omega$). Since L is conserved, larger ω means larger KE_{rot}. The "extra" energy comes from the work she does on her arms.



ConcepTest 8.11 Two Disks

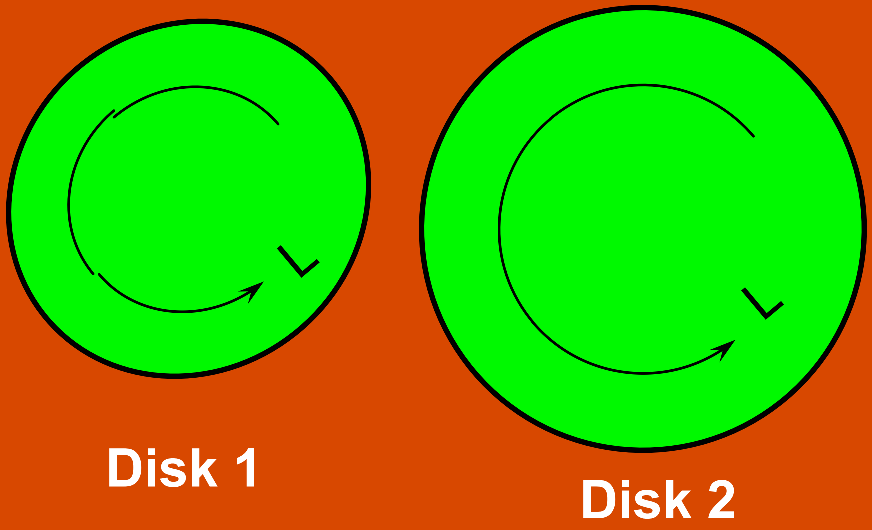
Two different spinning disks have the same angular momentum, but disk 1 has more kinetic energy than disk 2.

Which one has the bigger moment of inertia?

1) disk 1

2) disk 2

3) not enough info



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Two different spinning disks have the **same angular momentum**, but **disk 1** has more kinetic energy than **disk 2**.

Which one has the bigger moment of inertia?

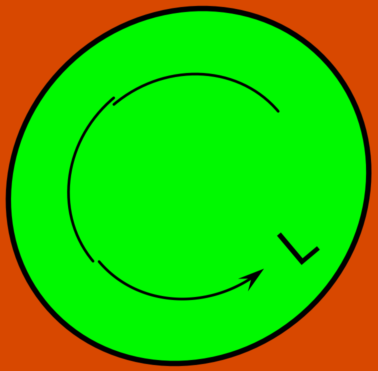
1) disk 1

2) disk 2

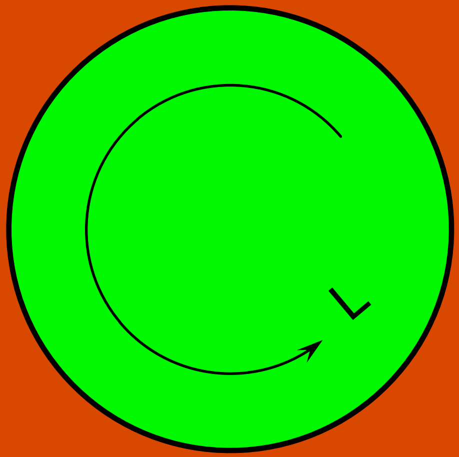
3) not enough info

$KE = 1/2\ I\ \omega^2 = L^2/(2\ I)$
(used $L = I\ \omega$).

Since L is the same, bigger I means smaller KE.



Disk 1

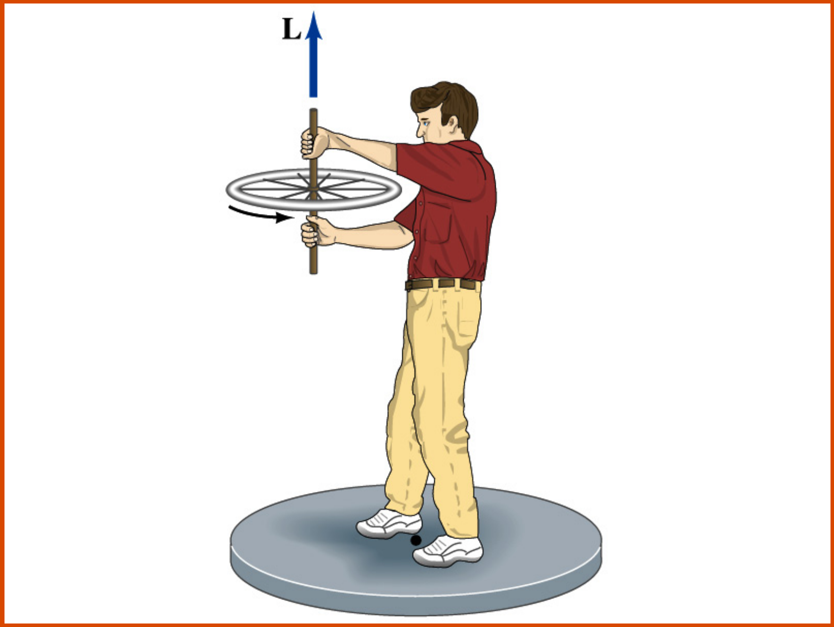


Disk 2

ConcepTest 8.12 Spinning Bicycle Wheel

You are holding a spinning bicycle wheel while standing on a stationary turntable. If you suddenly flip the wheel over so that it is spinning in the opposite direction, the turntable will

1) remain magically stationary
2) start to spin in the same direction as the wheel before flipping
3) start to spin in the opposite direction as the wheel before flipping



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The total angular momentum of the system is *L* upward, and it is conserved. So if the wheel has -*L* downward, you and the table must have +2*L* upward.